TM 55-1520-210-23-1

TECHNICAL MANUAL

AVIATION UNIT AND INTERMEDIATE MAINTENANCE INSTRUCTIONS ARMY MODEL UH-1H/V/EH-1H/X HELICOPTERS

This manual supersedes TM 55-1520-210-23-1, 20 February 1979, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY
30 SEPTEMBER 1987

CHANGE
NO. 42

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 14 April 2003

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X HELICOPTERS

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Remove pages	Insert pages
A through H	A through H
P-1 and P-2	P-1 and P-2
i and ii	i and ii
1-21 and 1-22	1-21 and 1-22
1-30.3 and 1-30.4	1-30.3 and 1-30.4
1-37 and 1-38	1-37 and 1-38
1-105 and 1-106	1-105 and 1-106
1-111 and 1-112	1-111 and 1-112
2-119 and 2-120	2-119 and 2-120
2-154.5/(2-154.6 blank)	2-154.5 and 2-154.6
3-14.1 and 3-14.2	3-14.1 and 3-14.2
4-42.3 and 4-42.4	4-42.3 and 4-42.4
4-43 through 4-46	4-43 through 4-46
4-57 and 4-58	4-57 and 4-58
4-73 and 4-74	4-73 and 4-74
4-93 and 4-94	4-93 and 4-94
5-9 and 5-10	5-9 and 5-10
5-15 and 5-16	5-15 and 5-16
5-25 through 5-28	5-25 through 5-28
5-33 and 5-34	5-33 and 5-34
5-67 and 5-68	5-67 and 5-68
5-68.1 and 5-68.2	5-68.1 and 5-68.2
5-69 and 5-70	5-69 and 5-70
5-85 and 5-86	5-85 and 5-86
5-91 and 5-92	5-91 and 5-92
5-103 and 5-104	5-103 and 5-104
5-109 and 5-110	5-109 and 5-110
6-23 and 6-24	6-23 and 6-24

Remove pages	Insert pages
6-43 and 6-44	6-43 and 6-44
6-44.1 through 6-44.4	6-44.1 through 6-44.4
6-49 and 6-50	6-49 and 6-50
6-60.1/(6.60.2 blank)	6-60.1/(6.60.2 blank)
6-89 through 6-92	6-89 through 6-92
6-101 and 6-102	6-101 and 6-102
6-116.5 and 6-116.6	6-116.5 and 6-116.6
6-137 and 6-138	6-137 and 6-138
6-138.1 through 6-138.3/(6-138.4 blank)	6-138.1 through 6-138.3/(6-138.4 blank)
6-139 and 6-140	6-139 and 6-140
6-147 and 6-148	6-147 and 6-148
6-165 and 6-166	6-165 and 6-166
6-166.5/(6-166.6 blank)	6-166.5/(6-166.6 blank)
Index-13 and Index-14	Index-13 and Index-14

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

ERIC K. SHINSEKI
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Chief of Staff

Official:

JOEL B. HUDSON
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TM 55-1520-210-23-1
C41

CHANGE
NO. 41

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 1 July 2002

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X HELICOPTERS

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Remove pages	Insert pages
A through H	A through H
1-109 through 1-114	1-109 through 1-114
6-137 through 6-140	6-137 through 6-140
6-146.1 and 6-146.2	6-146.1 and 6-146.2
6-147/(6-148 blank)	6-147 and 6-148
6-151 and 6-152	6-151 and 6-152
6-165 and 6-166	6-165 and 6-166
6-166.3 through 6-166.5/(6-166.6 blank)	6-166.3 through 6-166.5/(6-166.6 blank)

2. Pages 1-111 through 1-114 correct errors associated with urgent change 40.
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TM 55-1520-210-23-1
C 40

CHANGE
NO. 40

HEADQUARTERS
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Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH–1H/V/EH–1H/X HELICOPTERS

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Remove pages	Insert pages
A through H	A through H
1--113 and 1–114	1--113 and 1–114
6--137 and 6–138	6--137 and 6–138
6--147/(6–148 blank)	6--147/(6–148 blank)

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TM 55-1520-210-23-1
C39

CHANGE
NO. 39

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 15 October 2001

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X HELICOPTERS

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Remove pages	Insert pages
A through H	A through H
1-111 through 1-114	1-111 through 1-114
5-54.45 and 5-54.46	5-54.45 and 5-54.46
5-65 and 5-66	5-65 and 5-66
5-72.5 and 5-72.6	5-72.5 and 5-72.6
5-87 and 5-88	5-87 and 5-88
5-101 through 5-104	5-101 through 5-104
6-105 and 6-106	6-105 and 6-106
– – – – – –	6-106.1/(6-106.2 blank)

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C 38

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NO. 38

HEADQUARTERS
DEPARTMENT OF THE ARMY
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Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH–1H/V/EH–1H/X HELICOPTERS

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Remove pages	Insert pages
A through H	A through H
P–1 and P–2	P–1 and P–2
1–113 and 1–114	1–113 and 1–114
2–153 and 2–154	2–153 through 2–154.5/(2–154.6 blank)

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CHANGE

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HEADQUARTERS
DEPARTMENT OF THE ARMY
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Aviation Unit And Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

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Remove pages	Insert pages
A through G / (H blank)	A through H
i and ii	i and ii
1-1 and 1-2	1-1 and 1-2
1-5 through 1-8	1-5 through 1-8
1-15 through 1-18	1-15 through 1-18
1-30.1 through 1-30.4	1-30.1 through 1-30.4
1-95 and 1-96	1-95 and 1-96
1-105 through 1-110	1-105 through 1-110
2-1 and 2-2	2-1 and 2-2
2-31 and 2-32	2-31 and 2-32
2-53 and 2-54	2-53 and 2-54
2-59 and 2-60	2-59 and 2-60
2-63 through 2-68	2-63 through 2-68
2-73 and 2-74	2-73 and 2-74
2-79 and 2-80	2-79 and 2-80
2-83 through 2-88.2	2-83 through 2-88.2
2-91 through 2-94	2-91 through 2-94
2-103 and 2-104	2-103 and 2-104
2-107 and 2-108	2-107 and 2-108
2-115 and 2-116	2-115 and 2-116
2-119 and 2-120	2-119 and 2-120
2-130.1 / (2-130.2 blank)	2-130.1 / (2-130.2 blank)
2-147 through 2-150	2-147 through 2-150
2-153 and 2-154	2-153 and 2-154
2-157 and 2-158	2-157 and 2-158
2-181 and 2-182	2-181 and 2-182
2-183 through 2-188	2-183 through 2-188
2-197 and 2-198	2-197 and 2-198

Remove pages	Insert pages
2-207 and 2-208	2-207 and 2-208
2-227 through 2-230	2-227 through 2-230
2-247 and 2-248	2-247 and 2-248
2-255 and 2-256	2-255 and 2-256
3-1 through 3-4	3-1 through 3-4
3-7 and 3-8	3-7 and 3-8
3-14.1 and 3-14.2	3-14.1 and 3-14.2
3-15 and 3-16	3-15 and 3-16
4-13 and 4-14	4-13 and 4-14
4-17 and 4-18	4-17 and 4-18
4-23 and 4-24	4-23 and 4-24
4-29 and 4-30	4-29 and 4-30
4-35 and 4-36	4-35 and 4-36
4-42.1 through 4-42.4	4-42.1 through 4-42.4
4-42.5 through / (4-42.8 blank)	4-42.5 through / (4-42.8 blank)
4-43 through 4-46	4-43 through 4-46
4-47 and 4-48	4-47 and 4-48
4-53 and 4-54	4-53 and 4-54
4-57 through 4-60.4	4-57 through 4-60.4
———	4-60.4.1 / (4-60.4.2 blank)
4-60.5 through 4-60.8	4-60.5 through 4-60.12
4-67 and 4-68	4-67 and 4-68
4-71 through 4-74	4-71 through 4-74
4-79 and 4-80	4-79 and 4-80
4-87 and 4-88	4-87 and 4-88
4-107 and 4-108	4-107 and 4-108
5-21 and 5-22	5-21 and 5-22
5-29 and 5-30	5-29 and 5-30
5-32.1 and 5-32.2	5-32.1 and 5-32.2
5-39 and 5-40	5-39 and 5-40
5-40.1 / (5-40.2 blank)	5-40.1 / (5-40.2 blank)
5-41 through 5-44	5-41 through 5-44
5-54.45 and 5-54.46	5-54.45 and 5-54.46
5-54.49 / (5-54.50 blank)	5-54.49 / (5-54.50 blank)
5-68.1 and 5-68.2	5-68.1 and 5-68.2
5-71 and 5-72	5-71 and 5-72
5-73 and 5-74	5-73 and 5-74
5-79 and 5-80	5-79 and 5-80
5-83 and 5-84	5-83 and 5-84
5-93 and 5-94	5-93 and 5-94
5-99 through 5-102	5-99 through 5-102
5-107 through 5-110	5-107 through 5-110
5-121 and 5-122	5-121 and 5-122

Remove pages	Insert pages
5-124.1 / (5-124.2 blank)	5-124.1 / (5-124.2 blank)
5-131 and 5-132	5-131 and 5-132
6-7 through 6-10	6-7 through 6-10
6-13 and 6-14	6-13 and 6-14
6-21 and 6-22	6-21 and 6-22
6-25 and 6-26	6-25 and 6-26
6-39 and 6-44	6-39 and 6-44
6-44.1 and 6-44.2	6-44.1 and 6-44.2
6-47 and 6-48	6-47 and 6-48
6-60.1 / (6-60.2 blank)	6-60.1 / (6-60.2 blank)
6-61 and 6-62	6-61 and 6-62
6-65 and 6-66	6-65 and 6-66
6-71 and 6-72	6-71 and 6-72
6-79 through 6-84	6-79 through 6-84
6-87 and 6-88	6-87 and 6-88
6-93 through 6-98	6-93 through 6-98
6-113 through 6-116.4	6-113 through 6-116.4
6-127 and 6-128	6-127 and 6-128
6-129 and 6-130	6-129 and 6-130
6-133 and 6-134	6-133 and 6-134
6-137 and 6-138	6-137 and 6-138
6-138.1 / (6-138.2 blank)	6-138.1 / (6-138.2 blank)
6-141 and 6-142	6-141 and 6-142
6-146.1 and 6-146.2	6-146.1 and 6-146.2
6-147 / (6-148 blank)	6-147 / (6-148 blank)
6-149 and 6-150	6-149 and 6-150
6-153 and 6-154	6-153 and 6-154
6-161 and 6-162	6-161 and 6-162
6-165 through 6-166.2	6-165 through 6-166.2
6-171 through 6-172.2	6-171 through 6-172.2
Index-5 and Index-6	Index-5 and Index-6

2. Retain these sheets in front of manual for reference purposes.

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

OFFICIAL:

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TM 55-1520-210-23-1
C36

CHANGE
NO. 36

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 19 Nov 1999

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1 H/V/EH-1 H/X HELICOPTERS

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Remove pages	Insert pages
– – – – – – –	A through G
P-l and P-2	P-1 and P-2
1-115 and 1-116	1-115 and 1-116
1-123 and 1-124	1-123 and 1-124
4-45 and 4-46	4-45 and 4-46
– – – – – – –	4-46.1/(4-46.2 blank)

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TM 55-1520-210-23-1
C35

CHANGE

NO. 35

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 22 January 1998

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X HELICOPTERS

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Remove pages	Insert pages
i and ii	i and ii
1-111 and 1-112	1-111 and 1-112

2. Retain this sheet in front of manual for reference purposes.

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TM 55-1520-210-23-1
C 34

CHANGE

NO. 34

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 7 October 1996

Aviation Unit and Intermediate Maintenance Instructions

ARMY MODEL UH-1HNIEH-1H/X HELICOPTERS

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Remove pages	Insert pages
1-109 and 1-110	1-109 and 1-110
5-135 and 5-136	5-135 and 5-136
	5-136.1/(5-136.2 blank)
6-39 and 6-40	6-39 and 6-40

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

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NO. 33

HEADQUARTERS
DEPARTMENT OF THE ARMY
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Aviation Unit and Intermediate
Maintenance Instructions

**ARMY MODEL UH-1HNIEH-1HIX
HELICOPTERS**

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Remove pages	**Insert pages**
i and ii	i and ii
1-5 and 1-6	1-5 and 1-6
1-15 and 1-16	1-15 and 1-16
1-25 and 1-26	1-25 and 1-26
1-30.3 and 1-30.4	1-30.3 and 1-30.4
1-51 and 1-52	1-51 and 1-52
1-67 and 1-68	1-67 and 1-68
	1-68.1 and 1-68.2
~~1-97 and 1-98~~	1-97 and 1-98
1-107 and 1-108	1-107 and 1-108
1-111 and 1-112	1-111 and 1-112
2-33 and 2-34	2-33 and 2-34
2-43 and 2-44	2-43 and 2-44
	2-44.1/(2-44.2 blank)
2-45 and 2-~~4~~6	2-45 and 2-46
2-67 through 2-70	2-67 through 2-70
2-91 and 2-92	2-91 and 2-92
2-101	2-101/(2-102 blank)
2-109	2-109/(2-110 blank)
2-115 and 2-116	2-115 and 2-116
2-119 and 2-120	2-119 and 2-120
2-120.1 and 2-120.2	2-120.1 and 2-120.2
2-121 through 2-124	2-121 through 2-124
2-131 and 2-132	2-131 and 2-132
2-151 through 2-154	2-151 through 2-154
2-185 and 2-186	2-185 and 2-186
2-197 and 2-198	2-197 and 2-198
2-207 through 2-210	2-207 through 2-210
2-255 and 2-256	2-255 and 2-256
3-14.1 and 3-14.2	3-14.1 and 3-14.2
4-9 and 4-10	4-9 and 4-10
4-13 and 4-14	4-13 and 4-14
4-42.3 and 4-42.4	4-42.3 and 4-42.4

Remove pages	Insert pages
4-49 and 4-50	4-49 and 4-50
4-73 and 4-74	4-73 and 4-74
4-78.1/(4-78.2 blank)	4-78.1/(4-78.2 blank)
4-85 and 4-86	4-85 and 4-86
4-93 and 4-94	4-93 and 4-94
4-97 and 4-98	4-97 and 4-98
5-9 and 5-10	5-9 and 5-10
5-40.1/(5-40.2 blank)	5-40.1/(5-40.2 blank)
5-41 and 5-42	5-41 and 5-42
5-51 and 5-52	5-51 and 5-52
5-57 through 5-60	5-57 through 5-60
	5-60.1/(5-60.2 blank)
5-65 and 5-66	5-65 and 5-66
5-83 and 5-84	5-83 and 5-84
5-103 and 5-104	5-103 and 5-104
5-121 and 5-122	5-121 and 5-122
5-124.1/(5-124.2 blank)	5-124.1/(5-124.2 blank)
5-147 through 5-150	5-147 through 5-150
5-158.1 and 5-158.2	5-158.1 and 5-158.2
5-159 and 5-160	5-159 and 5-160
6-1 and 6-2	6-1 and 6-2
6-37 and 6-38	6-37 and 6-38
6-51 and 6-52	6-51 and 6-52
6-59 and 6-60	6-59 and 6-60
6-93 and 6-94	6-93 and 6-94
6-99 through 6-102	6-99 through 6-102
6-115 and 6-116	6-115 and 6-116
6-116.3 and 6-116.4	6-116.3 and 6-116.4
6-121 and 6-122	6-121 and 6-122
6-128.11/(6-128.2 blank)	
6-129 and 6-130	6-129 and 6-130
6-141 and 6-142	6-141 and 6-142
6-147 and 6-148	6-147/(6-148 blank)
6-149 through 6-152	6-149 through 6-152
6-159 and 6-160	6-159 and 6-160
6-165 and 6-166	6-165 and 6-166
6-166.1 and 6-166.2	6-166.1 and 6-166.2
	Electronic 2028 Instructions

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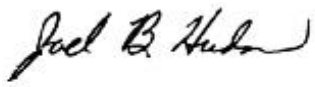
General, United States Army
Chief of Staff

Official: 

JOEL B. HUDSON
Administrative Assistant to the
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C32

CHANGE

NO. 32

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 12 August 1996

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1HNIEH-1H/X
HELICOPTERS

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Remove pages	**Insert pages**
1-99 and 1-100	1-99 and 1-100
5-109 and 5-110	5-109 and 5-110
5-135 and 5-136	5-135 and 5-136

2. Retain this sheet in front of manual for reference purposes.

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U R G E N T

CHANGE

NO. 31

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 1 January 1996

Aviation Unit and Intermediate Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X HELICOPTERS

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Remove pages	Insert pages
i and ii	i and ii
1-105 through 1-110	1-105 through 1-110
	1-115 through 1-125/(1-126 blank)
4-13 and 4-14	4-13 and 4-14
4-43 and 4-44	4-43 and 4-44
	4-44.1/(4-44.2 blank)
4-60.1 through 4-60.7/(4-60.8 blank)	4-60.1 through 4-60.8
4-97 and 4-98	4-97 and 4-98
5-91 and 5-92	5-91 and 5-92
5-103 and 5-104	5-103 and 5-104
6-29 and 6-30	6-29 and 6-30
6-41 through 6-44	6-41 through 6-44
6-44.1 through 6-44.4	6-44.1 through 6-44.5/(6-44.6 blank)
6-167 and 6-168	6-167 and 6-168
6-171 and 6-172	6-171 and 6-172
Index-5 and Index-6	Index-5 and Index-6

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TM 55-1520-210-23-1

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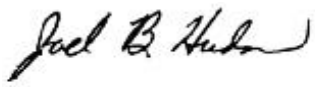
Official: 

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CHANGE

NO. 30

HEADQUARTERS
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Aviation Unit and Intermediate Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X HELICOPTERS

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1-33 and 1-34	1-33 and 1-34
Index 5 and Index 6	Index 5 and Index 6

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TM 55-1520-210-23-1
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CHANGE
NO. 29

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 12 December 1994

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X HELICOPTERS

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Remove pages	Insert pages
1-109 and 1-110	1-109 and 1-110

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TM 55-1520-210-23-1
C 28

CHANGE

NO. 28

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 23 September 1994

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

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Remove pages	Insert pages
1-109 and 1-110	1-109 and 1-110
4-83 through 4-66	4-83 through 4-86
5-13 and 5-14	5-13 and 5-14
5-21 and 5-22	5-21 and 5-22
5-32.1 and 5-32.2	5-32.1 through 5-32.3/(5-32.4 blank)
5-33 and 5-34	5-33 and 5-34
5-37 and 5-38	5-37 and 5-38
5-85 and 5-86	5-85 and 5-86

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TM 55-1520-210-23-1
C 27

CHANGE
NO. 27

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 2 June 1993

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

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1-99 and 1-100	1-99 and 1-100

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TM 55-1520-210-23-1
C 26

CHANGE
NO. 26

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 15 January 1993

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

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Remove pages	Insert pages
P-1 and P-2	P-1 and P-2
i and ii	i and ii
1-111 through 1-114	1-111 through 1-114

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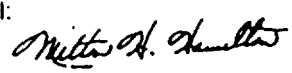

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NO. 25

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 15 December 1992

Aviation Unit and Intermediate
Maintenance Instructions

Army Model UH-1H/V/EH-1H/X Helicopters

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Remove pages	Insert pages
1-109 and 1-110	1-109 and 1-110
1-111 and 1-112	1-111 and 1-112
1-113 and 1-114	1-113 and 1-114
- - -	4-78.1/(4-78.2 Blank)
4-79 and 4-80	4-79 and 4-80
2028's and Envelopes	2028's and Envelopes

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CHANGE
NO. 24

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 NOVEMBER 1992

Aviation Unit and Intermediate Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X HELICOPTERS

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Remove pages	Insert pages
1-5 through 1-10	1-5 through 1-10
----	1-10.1/(1-10.2 blank)
1-11 through 1-14	1-11 through 1-14
1-17 and 1-18	1-17 and 1-18
1-21 and 1-22	1-21 and 1-22
1-27 through 1-30	1-27 through 1-30
1-30.1 through 1-30.4	1-30.1 through 1-30.4
1-31 through 1-36	1-31 through 1-36
1-81 and 1-82	1-81 and 1-82
1-82.1 and 1-82.2	1-82.1 and 1-82.2
1-103 and 1-104	1-103 and 1-104
1-107 and 1-108	1-107 and 1-108
2-53 and 2-54	2-53 and 2-54
2-115 and 2-116	2-115 and 2-116
2-185 and 2-186	2-185 and 2-186
2-233 and 2-234	2-233 and 2-234
2-255 and 2-256	2-255 and 2-256
3-14.1/(3-14.2 blank)	3-14.1 and 3-14.2
3-15 and 3-16	3-15 and 3-16
4-42.1 and 4-42.2	4-42.1 and 4-42.2
4-42.4.1 and 4-42.4.2	4-42.4.1 and 4-42.4.2
4-42.5 and 4-42.6	4-42.5 and 4-42.6
4-53 through 4-56	4-53 through 4-56
4-57 through 4-60	4-57 through 4-60
4-60.1 through 4-60.6	4-60.1 through 4-60.6
4-71 and 4-72	4-71 and 4-72
~~4-85 and 4-86~~	4-85 and 4-86
4-97 and 4-98	4-97 and 4-98
5-38.1 and 5-38.2	5-38.1 and 5-38.2
5-53 and 5-54	5-53 and 5-54

Remove pages	Insert pages
5-65 and 5-66	5-65 and 5-66
5-81 and 5-82	5-81 and 5-82
5-121 and 5-122	5-121 and 5-122
5-127 and 5-128	5-127 and 5-128
5-130.1/(5-130.2 blank)	5-130.1/(5-130.2 blank)
6-47 and 6-48	6-47 and 6-48
6-51 and 6-52	6-51 and 6-52
6-55 through 6-58	6-55 through 6-58
6-83 and 6-84	6-83 and 6-84
6-84.1 and 6-84.2	6-84.1 and 6-84.2
6-85 and 6-86	6-85 and 6-86
6-93 and 6-94	6-93 and 6-94
6-103 through 6-106	6-103 through 6-106
6-115 and 6-116	6-115 and 6-116
6-116.1 and 6-116.2	6-116.1 and 6-116.2
6-127 and 6-128	6-127 and 6-128
6-141 and 6-142	6-141 and 6-142
6-149 through 6-152	6-149 through 6-152
----	6-158.1/(6-158.2 blank)
6-159 and 6-160	6-159 and 6-160
6-163 and 6-164	6-163 and 6-164
6-167 and 6-168	6-167 and 6-168
6-171 and 6-172	6-171 and 6-172
6-172.1 through 6-172.3/ (6-172.4 blank)	6-172.1 through 6-172.3/ (6-172.4 blank)

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General, United States Army
Chief of Staff

Official:

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TM 55-1520-210-23-1
C 23

CHANGE NO. 23

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 15 October 1992

AVIATION UNIT AND INTERMEDIATE
MAINTENANCE INSTRUCTIONS

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

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Remove pages	Insert pages
2-233 and 2-234	2-233 and 2-234
- - - -	2-234.1/2-234.2
2-255 and 2-256	2-255 and 2-256
4-53 and 4-54	4-53 and 4-54
5-81 and 5-82	5-81 and 5-82
6-127 and 6-128	6-127 and 6-128
- - - -	6-128.1/6-128.2
6-141 and 6-142	6-141 and 6-142
6-165 and 6-166	6-165 and 6-166

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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 31 MARCH 1993

AVIATION UNIT AND INTERMEDIATE MAINTENANCE INSTRUCTIONS

ARMY MODEL UH-1H/V/EH-1H/X HELICOPTERS

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Remove pages	Insert pages
1-5 through 1-10	1-5 through 1-10
1-15 through 1-18	1-15 through 1-18
1-23 and 1-24	1-23 and 1-24
1-29 and 1-30	1-29 and 1-30
1-30.1 through 1-30.4	1-30.1 through 1-30.4
1-41 and 1-42	1-41 and 1-42
1-51 and 1-52	1-51 and 1-52
1-65 and 1-66	1-65 and 1-66
1-95 and 1-96	1-95 and 1-96
1-99 and 1-100	1-99 and 1-100
1-105 and 1-106	1-105 and 1-106
2-15 through 2-20	2-15 through 2-20
2-23 and 2-24	2-23 and 2-24
2-33 and 2-34	2-33 and 2-34
2-53 and 2-54	2-53 and 2-54
2-69 and 2-70	2-69 and 2-70
2-99 and 2-100	2-99 and 2-100
2-103 and 2-104	2-103 and 2-104
2-143 and 2-144	2-143 and 2-144
2-149 through 2-152	2-149 through 2-152
2-195 and 2-196	2-195 and 2-196
2-213 and 2-214	2-213 and 2-214
2-253 and 2-254	2-253 and 2-254
3-3 and 3-4	3-3 and 3-4
3-4.1/(3–4.2 blank)	3-4.1/(3-4.2 blank)
3-5 and 3-6	3–5 and 3-6
4-27 and 4-28	4-27 and 4-28
4-42.5 and 4-42.6	4-42.5 and 4-42.6
4-49 and 4-50	4-49 and 4-50
4-53 through 4-56	4-53 through 4-56
4-57 and 4-58	4-57 and 4-58
4-61 and 4-62	4-61 and 4-62
4-71 through 4-74	4-71 through 4-74

Remove pages	Insert pages
4-77 and 4-78	4-77 and 4-78
4-85 and 4-86	4-85 and 4-86
4-97 and 4-98	4-97 and 4-98
5-5 and 5-6	5-5 and 5-6
5-19 through 5-22	5-19 through 5-22
5-29 and 5-30	5-29 and 5-30
5-30.1/(5-30.2 blank)	5-30.1/(5-30.2 blank)
5-31 and 5-32	5-31 and 5-32
5-54.13 and 5-54.14	5-54.13 and 5-54.14
5-67 and 5-68	5-67 and 5-68
5-69 through 5-72	5-69 through 5-72
5-75 and 5-76	5-75 and 5-76
5-83 and 5-84	5-83 and 5-84
5-101 and 5-102	5-101 and 5-102
5-109 and 5-110	5-109 and 5-110
5-113 and 5-114	5-113 and 5-114
5-117 and 5-118	5-117 and 5-118
5-123 and 5-124	5-123 and 5-124
5-125 through 5-130	5-125 through 5-130
5-131 and 5-132	5-131 and 5-132
5-153 and 5-154	5-153 and 5-154
5-158.1 and 5-158.2	5-158.1 and 5-158.2
5-159 and 5-160	5-159 and 5-160
6-9 and 6-10	6-9 and 6-10
6-13 and 6-14	6-13 and 6-14
6-17 through 6-22	6-17 through 6-22
6-29 and 6-30	6-29 and 6-30
—---	6-34.1/(6-34.2 blank)
6-35 through 6-38	6-35 through 6-38
6-41 and 6-42	6-41 and 6-42
6-44.3/(6-44.4 blank)	6-44.3 and 6-44.4
6-47 and 6-48	6-47 and 6-48
6-55 through 6-58	6-55 through 6-58
6-65 and 6-66	6-65 and 6-66
6-73 through 6-84	6-73 through 6-84
----	6-84.1 and 6-84.2
6-85 through 6-90	6-85 through 6-90
6-93 through 6-104	6-93 through 6-104
6-115 and 6-116	6-115 and 6-116
6-116.1 and 6-116.2	6-116.1 and 6-116.2
6-116.5 and 6-116.6	6-116.5 and 6-116.6
6-123 and 6-124	6-123 and 6-124
6-139 and 6-140	6-139 and 6-140
6-145 and 6-146	6-145 and 6-146
6-147 and 6-148	6-147 and 6-148
6-148.1/(6-148.2 blank)	----
6-149 through 6-156	6-149 through 6-156
6-161 through 6-164	6-161 through 6-164
6-166.1 and 6-166.2	6-166.1 and 6-166.2
6-169 and 6-170	6-169 and 6-170

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General, United States Army
Chief of Staff

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TM 55-1520-210-23-1
C21

CHANGE
NO. 21

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 15 JANUARY 1992

AVIATION UNIT AND INTERMEDIATE
MAINTENANCE INSTRUCTIONS

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert Pages
1-35 and 1-36	1-35 and 1-36
6-97 and 6-98	6-97 and 6-98
6-129 and 6-130	6-129 and 6-130
6-133 and 6-134	6-133 and 6-134
6-137 and 6-138	6-137 and 6-138
- - - -	6-138.1/6-138.2
6-141 and 6-142	6-141 and 6-142
6-147 and 6-148	6-147 and 6-148
- - - -	6-148.1/6-148.2
6-161 and 6-162	6-161 and 6-162
6-165/6-166	6-165 and 6-166
- - - -	6-166.1 through 6-166.3/ 6-166.4

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TM 55-1520-210-23-1
C21

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TM 55-1520-210-23-1
C 20

CHANGE NO. 20

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 1 July 1991

AVIATION UNIT AND INTERMEDIATE
MAINTENANCE INSTRUCTIONS

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

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Remove pages	Insert pages
4-85 and 4-86	4-85 and 4-86
5-4.1 and 5-4.2	5-4.1 and 5-4.2

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General, United States Army
Chief of Staff

Official:

PATRICIA P. HICKERSON
Colonel, United States Army
The Adjutant General

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URGENT

CHANGE
NO. 19

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 14 June 1991

AVIATION UNIT AND INTERMEDIATE MAINTENANCE INSTRUCTIONS

ARMY MODEL UH-1H/V/EH-1H/X HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
1-3 and 1-4	1-3 and 1-4
1-15 through 1-18	1-15 through 1-18
1-30.3 and 1-30.4	1-30.3 and 1-30.4
1-33 and 1-34	1-33 and 1-34
1-55 and 1-56	1-55 and 1-56
1-60.1 and 1-60.2	1-60.1 and 1-60.2
1-61 and 1-62	1-61 and 1-62
1-75 through 1-82	1-75 through 1-82
1-82.1 and 1-82.2	1-82.1 and 1-82.2
1-87 and 1-88	1-87 and 1-88
1-99 and 1-100	1-99 and 1-100
1-105 through 1-108	1-105 through 1-108
2-9 and 2-10	2-9 and 2-10
2-107 and 2-108	2-107 and 2-108
2-120.1/2-120.2	2-120.1 and 2-120.2
2-121 and 2-122	2-121 and 2-122
2-129 and 2-130	2-129 and 2-130
- - - -	2-130.1/2-130.2
2-145 and 2-146	2-145 and 2-146
2-151 and 2-152	2-151 and 2-152
2-179 and 2-180	2-179 and 2-180
2-197 and 2-198	2-197 and 2-198
2-209 through 2-212	2-209 through 2-212
3-4.1/3-4.2	3-4.1/3-4.2
4-3 through 4-6	4-3 through 4-6
4-13 and 4-14	4-13 and 4-14
4-41 and 4-42	4-41 and 4-42
4-42.3 and 4-42.4	4-42.3 and 4-42.4
4-43 through 4-46	4-43 through 4-46
4-57 through 4-60	4-57 through 4-60
- - - -	4-60.1 through 4-60.7/4-60.8
4-73 and 4-74	4-73 and 4-74
4-77 and 4-78	4-77 and 4-78
4-97 through 4-100	4-97 through 4-100
4-111 and 4-112	4-111 and 4-112

Remove pages	Insert pages
5-15 and 5-16	5-15 and 5-16
5-32.1 and 5-32.2	5-32.1 and 5-32.2
5-33 and 5-34	5-33 and 5-34
5-43 and 5-44	5-43 and 5-44
5-79 through 5-82	5-79 through 5-82
5-101 through 5-104	5-101 through 5-104
5-115 through 5-118	5-115 through 5-118
5-155 and 5-156	5-155 and 5-156
5-158.1/5-158.2	5-158.1 and 5-158.2
6-29 and 6-30	6-29 and 6-30
6-37 through 6-44	6-37 through 6-44
--- -	6-44.1 through 6-44.3/6-44.4
6-45 through 6-48	6-45 through 6-48
6-55 through 6-58	6-55 through 6-58
6-59 and 6-60	6-59 and 6-60
--- --	6-60.1/6-60.2
6-67 and 6-68	6-67 and 6-68
6-71 through 6-74	6-71 through 6-74
6-79 through 6-86	6-79 through 6-86
6-97 through 6-100	6-97 through 6-100
6-103 through 6-108	6-103 through 6-108
6-115 and 6-116	6-115 and 6-116
6-116.3 and 6-116.4	6-116.3 and 6-116.4
6-137 and 6-138	6-138 and 6-138
6-138.1/6-138.2	6-138.1 through 6-138.3/ 6-138.4
6-139 through 6-142	6-139 through 6-142
6-145 and 6-146	6-145 and 6-146
- - - -	6-146.1 and 6-146.2
6-147 and 6-148	6-147 and 6-148
6-149 through 6-154	6-149 through 6-154
6-163 and 6-164	6-163 and 6-164
6-167 through 6-172	6-167 through 6-172
- - - -	6-172.1 through 6-172.3/ 6-172.4
6-173/6-174	6-173 and 6-174
Index 1 through Index 14	Index 1 through Index 14

2. Retain these sheets in front of manual for reference purposes.

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army

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TM 55-1520-210-23-1
C 18

CHANGE NO. 18

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 14 May 1991

AVIATION UNIT AND INTERMEDIATE
MAINTENANCE INSTRUCTIONS

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
1-109 through 1-114	1-109 through 1-114
5-147 and 5-148	5-147 and 5-148
5-159 and 5-160	5-159 and 5-160

2. Retain this sheet in front of manual for reference purposes.

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PATRICIA P. HICKERSON
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TM 55-1520-210-23-1
C 17

CHANGE NO. 17

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 28 February 1991

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

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1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
4-41 and 4-42	4-41 and 4-42
4-42.3 and 4-42.4	4.42.3 and 4-42.4
4-42.4.1 and 4-42.4.2	4-42.4.1 and 4-42.4.2
4-42.5 and 4-42.6	4-42.5 and 4-42.6

2. Retain this sheet in front of manual for reference purposes.

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TM 55-1520-210-23-1
C 16

CHANGE NO. 16

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 11 December 1990

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
4-42.3 and 4-42.4	4-42.3 and 4-42.4
4-42.4.1 and 4-42.4.2	4-42.4.1 and 4-42.4.2

2. Retain this sheet in front of manual for reference purposes.

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TM 55-1520-210-23-1
C 15

CHANGE
NO. 15

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 1 SEPTEMBER 1990

AVIATION UNIT AND INTERMEDIATE
MAINTENANCE INSTRUCTIONS

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
5-91 and 5-92	5-91 and 5-92
5-103 and 5-104	5-103 and 5-104

2. Retain this sheet in front of manual for reference purposes.

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TM 55-1520-210-23-1
C 14

CHANGE
No. 14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 1 August 1990

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
1-113 and 1-114	1-113 and 1-114
4-42.1 through 4-42.4	4-42.1 through 4-42.4
--- -	4-42.4.1 through 4-42.4.4

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

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Brigadier General, United States Army
The Adjutant General

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URGENT

TM 55-1520-210-23-1
C 13

CHANGE NO. 13

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 1 August 1990

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
P-1 and P-2	P-1 and P-2
1-11 through 1-22	1-11 through 1-22
1-25 through 1-30	1-25 through 1-30
1-30.1 through 1-30.5	1-30.1 through 1-30.5/
1-30.6	1-30.6
1-35 through 1-38	1-35 through 1-38
1-53 through 1-56	1-53 through 1-56
1-63 through 166	1-63 through 1-66
1-75 and 1-76	1-75 and 1-76
1-79 and 1-80	1-79 and 1-80
1-83 through 1-86	1-83 through 1-86
1-91 through 1-94	1-91 through 1-94
1-95 and 1-96	1-95 and 1-96
1-99 through 1-110	1-99 through 1-110
2-1 and 2-2	2-1 and 2-2
2-17 through 2-20	2-17 through 2-20
2-31 through 2-36	2-31 through 2-36
2-45 and 2-46	2-45 and 2-46
2-53 through 2-56	2-53 through 2-56
2-69 and 2-70	2-69 and 2-70
2-83 through 2-88	2-83 through 2-88
2-88.1 and 2-88.2	2-88.1 and 2-88.2
2-89 and 2-90	2-89 and 2-90
2-115 and 2-116	2-115 and 2-116
2-119 and 2-120	2-119 and 2-120
2-121 and 2-122	2-121 and 2-122
2-135 and 2-136	2-135 and 2-136
2-139 and 2-140	2-139 and 2-140
2-143 and 2-144	2-143 and 2-144
- - - - - -	2-144.1/2-144.2
2-151 through 2-154	2-151 through 2-154
- - - -	2-182.1/2-182.2
2-185 and 2-186	2-185 and 2-186
2-193 through 2-198	2-193 through 2-198
2-205 through 2-218	2-205 through 2-218

URGENT

Remove pages	Insert pages
2-229 and 2-230	2-229 and 2-230
2-233 and 2-234	2-233 and 2-234
2-247 and 2-248	2-247 and 2-248
2-255 and 2-256	2-255 and 2-256
2-261 and 2-262	2-261 and 2-262
2-269 through 2-272	2-269 through 2-272
3-1 through 3-4	3-1 through 3-4
	3-4.1/3-4.2
3-5 through 3-8	3-5 through 3-8
3-13 and 3-14	3-13 and 3-14
	3-14.1/3-14.2
3-17 and 3-18	3-17 and 3-18
3-23 and 3-24	3-23 and 3-24
4-1 through 4-6	4-1 through 4-6
4-13 and 4-14	4-13 and 4-14
4-17 and 4-18	4-17 and 4-18
4-45 and 4-46	4-45 and 4-46
4-53 through 4-56	4-53 through 4-56
	4-56.1/4-56.2
4-57 through 4-62	4-57 through 4-62
4-67 and 4-68	4-67 and 4-68
4-71 through 4-82	4-71 through 4-82
4-85 and 4-86	4-85 and 4-86
4-89 and 4-90	4-89 and 4-90
4-93 through 4-98	4-93 through 4-98
4-107 through 4-112	4-107 through 4-112
5-1 and 5-2	5-1 and 5-2
5-3 and 5-4	5-3 and 5-4
5-4.1 and 5-4.2	5-4.1 and 5-4.2
5-5 and 5-6	5-5 and 5-6
5-6.1/5-6.2	5-6.1 and 5-6.2
5-18.1/5-18.2	5-18.1/5-18.2
5-21 and 5-22	5-21 and 5-22
5-32.1 and 5-32.2	5-32.1 and 5-32.2
5-33 and 5-34	5-33 and 5-34
5-38.1 through 548.3/ 5-38.4	5-38.1 through 5-38.3/ 5-38.4
5-39 and 5-40	5-39 and 5-40
5-40.1/5-40.2	5-40.1/5-40.2
5-41 and 5-42	5-41 and 5-42
5-45 through 5-48	5-45 through 5-48
5-51 through 5-54	5-51 through 5-54
5-54.1 through 5-54.48	5-54.1 through 5-54.49/5-54.50
5-57 and 5-58	5-57 and 5-58
5-61 and 5-62	5-61 and 5-62
5-62.1	5-62.1 and 5-62.2
5-63 and 5-64	5-63 and 5-64
5-64.1/5-64.2	5-64.1 and 5-64.2
5-65 and 5-66	5-65 and 5-66
5-68.1 and 5-68/2	5-68.1 and 5-68.2
5-71 and 5-72	5-71 and 5-72
5-85 and 5-86	5-85 and 5-86
5-103 and 5-104	5-103 and 5-104

Remove pages	Insert pages
5-107 through 5-110	5-107 through 5-110
5-113 through 5-116	5-113 through 5-116
5-121 through 5-124	5-121 through 5-124
	5-124.1/5-124.2
5-125 and 5-126	5-125 and 5-126
5-130.1/5-130.2	5-130.1/5-130.2
5-141 and 5-142	5-141/5-142
5-147 and 5-148	5-147 and 5-148
5-151 and 5-152	5-151 and 5-152
	5-152.1 and 5-152.2
5-153 and 5-154	5-153 and 5-154
	5-154.1 and 5-154.2
5-155 through 5-158	5-155 through 5-158
5-158.1 and 5-158.2	5-158.1/5-158.2
	5-164.1/5-164.2
5-173 and 5-174	5-173 and 5-174
5-183 and 5-184	5-183 and 5-184
5-184.1 through 5-184.3/ 5-184.4	5-184.1 through 5-184.3/ 5-184.4
6-23 through 6-26	6-23 through 6-26
6-29 and 6-30	6-29 and 6-30
	6-30.1/6-30.2
6-31 and 6-32	6-31 and 6-32
6-35 through 6-44	6-35 through 6-44
6-47 through 6-58	6-47 through 6-58
	6-58.1/6-58.2
6-59 through 6-62	6-59 through 6-62
6-71 and 6-72	6-71 and 6-72
6-75 and 6-76	6-75 and 6-76
6-79 through 6-82	6-79 through 6-82
6-85 through 6-88	6-85 through 6-88
6-91 through 6-100	6-91 through 6-100
6-103 and 6-104	6-103 and 6-104
6-111 through 6-116	6-111 through 6-116
6-116.1 through 6-116.5/ 6-116.6	6-116.1 through 6-116.6
6-127 through 6-130	6-127 through 6-130
6-133 through 6-138	6-133 through 6-138
6-141 through 6-156	6-141 through 6-156
6-159 through 6-165/6-166	6-159 through 6-165/6-166
	Index 1 through Index 14

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

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Brigadier General, United States Army
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TM 55-1520-210-23-1
C 12

CHANGE
NO. 12

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 12 April 1990

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

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Remove pages	Insert pages
1-99 and 1-100	1-99 and 1-100
1-103 and 1-104	1-103 and 1-104
1-111 through 1-114	1-111 through 1-114
- - - - -	5-18.1/5-18.2

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Chief of Staff

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Brigadier General, United States Army
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TM 55-1520-210-23-1
C 11

CHANGE NO. 11

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 1 March 1990

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

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Remove pages	Insert pages
5-17 through 5-20	5-17 through 5-20
5-31 and 5-32	5-31 and 5-32

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TM 55-1520-210-23-1
C 10

CHANGE
NO. 10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 31 January 1990

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
5-72.5 and 5-72.6	5-72.5 and 5-72.6
5-73 and 5-74	5-73 and 5-74
5-103 through 5-106	5-103 through 5-106

2. Retain this sheet in front of manual for reference purposes.

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TM 55-1520-210-23-1
C 9

CHANGE

NO. 9

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 31 January 1990

Aviation Unit and intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
5-21 and 5-22	5-21 and 5-22
5-31 and 5-32	5-31 and 5-32
5-32.1 and 5-32.2	5-32.1 and 5-32.2
5-33 and 5-34	5-33 and 5-34
-----	5-34.1/5-34.2
5-63 and 5-64	5-63 and 5-64
5-65 and 5-66	5-64 and 5-66

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By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

WILLIAM J. MEEHAN II
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, AVUM and AVIM Maintenance requirements for UH-1H, UH-1V Helicopter? Utility and EH-1H Helicopter, Electronic Countermeasure and EH-1X Helicopter, Electronic Countermeasure and Intercept.

URGENT

CHANGE NO. 8

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 2 January 1990

Aviation Unit and Intermediate Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
i through iii iv	i through iii/iv
P-1 and P-2	P-1 and P-2
1-9 and 1-10	1-9 and 1-10
1-13 through 1-30	1-13 through 1-30
- - - -	1-30.1 through 1-30.5/1-30.6
1-37 through 1-40	1-37 through 1-40
- - - -	1-42.1/1-42.2
1-51 and 1-52	1-51 and 1-52
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- - - -	1-60.1 and 1-60.2
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1-109 and 1-110	1-109 and 1-110
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5-3 and 5-4	5-3 and 5-4
5-4.1 and 5-4 2	5-4.1 and 5-4.2
5-5 and 5-6	5-5 and 5-6
- - - -	5-6.1/5-6.2
5-9 through 5-12	5-9 through 5-12
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5-22.1 and 5-22.2	5-22.1 and 5-22.2
5-23 through 5-28	5-23 through 5-28
5-28.3/5-28.4	5-28.3/5-28.4
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5-30.1/5-30.2	5-30.1 and 5-30.2
5-35 and 5-36	5-35 and 5-36
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Remove pages	Insert pages
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5-107 and 5-108	5-107 and 5-108
5-113 through 5-118	5-113 through 5-118
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5-127 through 5-130 ‘	5-127 through 5-130
5-130.1/5-130.2	5-130.1/5-130.2
5-135 through 5-138	5-135 through 5-138
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5-183 and 5-184	5-183 and 5-184
	5-184.1 through 5-184.3/5-184.4

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

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Chief of Staff

Official:

WILLIAM J. MEEHAN 11
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The Adjutant General

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TM 55-1520-210-23-1
C 7

CHANGE NO. 7

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 November 1989

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
5-85 and 5-86	5-85 and 5-86

2. Retain this sheet in front of manual for reference purposes.

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Official:

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TM 55-1520-210-23-1
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CHANGE NO. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 17 November 1989

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
5-83 and 5-84	5-83 and 5-84
----	5-84.1/5-84.2

2. Retain this sheet in front of manual for reference purposes.

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General, United States Army
Chief of Staff

Official:

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The Adjutant General

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TM 55-1520-210-23-1
c 5

CHANGE NO. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 06 October 1989

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
1-97 through 1-100	1-97 through 1-100
1-103 and 1-104	1-103 and 1-104
1-107 through 1-110	1-107 through 1-110
1-113 and 1-114	1-113 and 1-114

2. Retain this sheet in front of manual for reference purposes.

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TM 55-1520-210-23-1
C 4

CHANGE NO. 4

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 28 July 1989

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
1-97 through 1-100	1-97 through 1-100
1-103 and 1-104	1-103 and 1-104
1-107 through 1-114	1-107 through 1-114

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

Official:

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The Adjutant General

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TM 55-1520-210-23-1
C 3

CHANGE NO. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 23 June 1989

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
1-82.1 and 1-82.2	1-82.1 and 1-82.2
5-17 and 5-18	5-17 and 5-18

2. Retain this sheet in front of manual for reference purposes.

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CARL E. VUONO
General, United States Army
Chief of Staff

Official:

WILLIAM J. MEEHAN II
Brigadier General, United States Army
The Adjutant General

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TM 55-1520-210-23-1
C 2

CHANGE
NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 15 May 1989

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TM 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
1-82.1 through 1-84	1-82.1 through 1-84
5-9 and 5-10	5-9 and 5-10
5-17 through 5-18.2	5-17 through 5-18.2

2. Retain this sheet in front of manual for reference purposes.

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Chief of Staff

Official:

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TM 55-1520-210-23-1
C 1

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 8 January 1989

Aviation Unit and Intermediate
Maintenance Instructions

ARMY MODEL UH-1H/V/EH-1H/X
HELICOPTERS

TN 55-1520-210-23-1, 30 September 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
1-9 and 1-10	1-9 and 1-10
1-21 and 1-22	1-21 and 1-22
1-23 and 1-24	1-23 and 1-24
1-51 and 1-52	1-51 and 1-52
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5-3 and 5-4	5-3 through 5-4.2
5-5 through 5-6.1	5-5 and 5-6
5-9 and 5-10	5-9 and 5-10
5-15 through 5-18	5-15 through 5-18.2
5-19 through 5-22	5-19 through 5-22.2
	5-28.3 and 5-28.4
5-29 through 5-32	5-29 through 5-32.2
5-33 through 5-34.2	5-33 and 5-34
5-38.1 and 5-38.2	5-38.1 and 5-38.2
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5-109 through 5-114	5-109 through 5-114
5-129 through 5-130.2	5-129 through 5-130.2
6-19 and 6-20	6-19 and 6-20
6-83 and 6-84	6-83 and 6-84

URGENT

Remove pages	Insert pages
6-101 and 6-102	6-101 and 6-102
6-107 and 6-108	6-107 and 6-108
6-115 and 6-116	6-115 and 6-116

2. Retain this sheet in front of manual for reference purposes.

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TECHNICAL MANUAL

No. 55-1520-210-23-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C.
30 September 1987

AVIATION UNIT AND INTERMEDIATE MAINTENANCE INSTRUCTIONS ARMY MODEL UH-1H/V/EH-1 H/X

This manual is printed in three volumes as follows:
TM 55-1520-210-23-1, consisting of Table of Contents, preface, chapters 1 through 6.
TM 55-1520-210-23-2, consisting of Table of Contents, chapters 7 through 17.
TM 55-1520-210-23-3, consisting of Table of Contents, appendix A through F, and Index.
The Appendixes and Index are applicable to all volumes.

WARNING

Personnel performing operations, procedures, and practices which are included or implied in this technical manual shall observe the following warnings. Disregard of these warnings and precautionary information can cause serious injury, or death.

Warnings, cautions, and notes are used to emphasize important and critical instructions and are used for the following conditions:

WARNING

An operating procedure, practice, etc., which, if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc., which, if not strictly observed, could result in damage to or destruction of equipment.

NOTE

An operating procedure, condition, etc., which it is essential to highlight.

NOISE

Sound pressure levels in this helicopter during some operating conditions exceed the Surgeon General hearing conservation criteria, as defined in TB MED 501. Hearing protection devices, such as aviator helmet or ear plugs are required to be worn by all personnel in and around the helicopter during its operation.

ELECTROLYTE

Corrosive Battery Electrolyte (Potassium Hydroxide). Wear rubber gloves, apron, and face shield when handling leaking batteries. If potassium hydroxide is spilled on clothing, or other material wash immediately with clean water. If spilled on personnel immediately start flushing the affected area with clean water. Continue washing until medical assistance arrives.

TOXIC POISONS

Turbine fuels and lubricating oils contain additives which are poisonous and readily absorbed through the skin. Do not allow them to remain on skin longer than necessary.

HANDLING HYDRAULIC FLUID (MIL-H-83282

Prolonged contact with liquid or mist can irritate eyes and skin. After any prolonged contact with skin, immediately wash contacted area with soap and water. If liquid contacts eyes, flush immediately with clear water. If liquid is swallowed, do not induce vomiting; get immediate medical attention. Wear rubber gloves when handling liquid. If prolonged contact with mist is likely, wear an apporopriate respirator. When fluid is decomposed by heating, toxic gases are released.

STARTING HELICOPTER

Starting and operation of the helicopter will be performed only by authorized personnel in accordance with AR 95-1.

GROUNDING HELICOPTER

The helicopter should be electrically grounded when parked. Turn off all power switches before making electrical connections or disconnections. Serious burns and electrical shock can result from contact with exposed electrical wires or connectors.

Before removing any engine ignition system component, ground the leads to dissipate any stored voltage in ignition unit.

FIRE EXTINGUISHER

Exposure to high concentrations of monobromotrifluoromethane (CF3BR) extinguishing agent or decomposition products should be avoided. The liquid should not be allowed to come into contact with the skin, as it may cause frost bite or low temperature burns.

ARMAMENT

Loaded weapons, or weapons being loaded or unloaded, shall be pointed in a direction which offers the least exposure to personnel or property in the event of accidental firing. Personnel shall remain clear of hazardous area of all loaded weapons.

ANY ROTATION OF THE GUN ARMAMENT SUBSYSTEM BARRELS WILL CAUSE THE GUN TO FIRE. Upon landing, immediately alert personnel to probable presence of live rounds in the gun. Summon armament repairman to clear weapon.

FUELING AND DEFUELING

When refueling helicopter, the refueling vehicle or forward air refueling unit must be parked a minimum of 20 feet from the helicopter. Before starting the fueling operation, always insert fueling nozzle grounding chain of fuel truck ground wire into GROUND HERE receptacle located on the right side of the helicopter aft of the cabin area. Refer to FM 10-68.

When defueling, turn off all electrical switches and disconnect external power from the helicopter. The helicopter must be electrically grounded prior to defueling.

RADIOACTIVE MATERIALS

Self-luminous dials and ignition units may contain radioactive materials. if such an instrument or unit is broken or becomes unsealed, avoid personal contact. Use forceps or gloves made of rubber or polyethylene to pick up contaminated material. Place materials and gloves in a plastic bag. Seal bag and dispose of it as radioactive waste in accordance with AR755-15 and TM 3-261 (Refer to TB 43-0108). Repair procedures shall conform to requirements in AR700-52.

CLEANING SOLVENTS

Cleaning solvents may be flammable and toxic. Use only in well ventilated areas. Avoid inhalation of vapor and skin contact. Do not use solvents near open flame or in areas where very high temperatures prevail.

ROTOR BLADES

Personnel will stay clear of rotor blades during operation. Refer to Chapter 1 for rotor blade dimensions and clearances.

TOOLS

Use only chrome plated steel or unplated steel tools for disassembly or reassembly procedures. Because the platings are prone to chipping and flaking, the use of cadmium or zink plated tools is not permitted. If these chips or flakes become embedded in aircraft parts, galvanic corrosion will result. If these chips or flakes enter fuel or oil wetted components, they may eventually clog the filter or produce intergranular attack of nickel or titanium base alloys at elevated temperatures. Regardless of the type of plating, all tools must be serviceable and free of chipping.

LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with regulations.

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line, or other change symbol, in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Dates of issue for original and changed pages are:

Original . . . . . 0 . . . . . 30 September 1987
Change . . . . . 1 . . . . . 8 January 1989
Change . . . . . 2 . . . . . 15 May 1989
Change . . . . . 3 . . . . . 23 June 1989
Change . . . . . 4 . . . . . 28 July 1989
Change . . . . . 5 . . . . . 06 October 1989
Change . . . . . 6 . . . . . 17 November 1989
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Change . . . . . 8 . . . . . 2 January 1990
Change . . . . . 9 . . . . . 31 January 1990
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*Zero in this column indicates an original page.

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*Zero in this column indicates an original page.

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TECHNICAL MANUAL

TM 55-1520-210-23-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 September 1987

AVIATION AND INTERMEDIATE MAINTENANCE INSTRUCTIONS ARMY MODEL UH-1H/V/EH-1H/X HELICOPTER

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) located in the back of this manual, directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our fax number is: DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is: 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual immediately preceding the hard copy 2028. For the World Wide Web use: https://amcom2028.redstone.army.mil.

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PREFACE

P–1. General.

a. This manual is the official document for Aviation Unit and Intermediate Maintenance of Army Model UH–1V, UH–1H, EH–1H, and EH–1X Helicopters.

b. The purpose of this manual is to familiarize you with the maintenance functions to be performed at the Aviation Unit (AVUM) and Intermediate Maintenance (AVIM) levels. The Table of Contents for this manual is provided to assist in determining the chapter in the manual in which individual functions are covered. This manual provides all essential information for personnel to accomplish Aviation Unit and Intermediate Maintenance on the complete airframe, its components, and systems, excluding armament and avionics subsystem as indicated for Aviation Unit and Intermediate Maintenance activities in the Maintenance Allocation Chart (MAC). (Refer to Appendix B.)

P–2. Quality Assurance/Quality Control (QA/QC). Personnel will assure proper maintenance has been performed by verifying dimensions and tolerances contained throughout this technical manual have been complied with.

P–3. Description. Army helicopter models UH–1V, UH–1H, EH–1H, and EH–1X are single engine, utility type helicopters. The EH–1H and EH–1X are especially configured for electronic counter measures missions. The fuselage is all metal construction consisting of the forward section and aft section (tailboom). The forward section provides support for the cabin, landing gear, power plant, fuel cells, transmission, and tailboom. The rotor system consists of two bladed semi–rigid main rotor and a two bladed, delta hinged tail rotor.

P-4. Reporting of Errors. You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) located in the back of this manual, directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MC-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our fax number is DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is: 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual immediately preceding the hard copy 2028. For the World Wide Web Use: http://amcom2028.redstone.army.mil.

P–5. Destruction of Army Material to Prevent Enemy Use. For destructions of Army material to prevent enemy use, refer to TM 750–244–1–5.

P–6. Maintenance of Forms and Records. Maintenance of forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by DA PAM 738–751.

P–7. Authority for Substitution. Substitution of interchange of items of material for maintenance or Department of the Army aircraft/helicopter shall not be authorized, nor shall orders be issued for shipment. Substitution or interchangeability shall only be authorized by AMCOM.

P–8. Special Tools and Equipment. Aviation Unit (AVUM) and Intermediate Maintenance (AVIM) special tools and equipment will be found in TM 55–1520–210–23P Repair Parts and Special Tools List (RPSTL). Special tools and test equipment for complex tasks are included in this manual.

P–9. Calibration.

a. Helicopter components, accessories, and instruments requiring calibration are specified in Chapter 1.

b. Special tools and test equipment shall be calibrated as specified in TB 750–25, Army Metrology and Calibration System and TB 43–180, Calibration Procedure.

P–10. Storage. Refer to TM 740–90–1 and to Appendix E for Storage of Aircraft.

P–11. Explanation of Change Symbols. Changes, except as noted below to the text and tables, including new material on added pages, are indicated by a verticle line in the outer margin extending close to the entire area of the material affected; exception; pages with emergency markings, which consist of black diagonal lines around three edges, may have the verticle line or change symbol placed along the inner margins.

Symbols show current changes only. A miniature pointing hand symbol is used to denote a change to an illustration. However, a vertical bar in the outer margin, rather than miniature pointing hand is utilized where there have been extensive changes made to an illustration. Change symbols are not utilized to indicate changes in the following:

a. Introductory material.

b. Indexes and tabular data where changes cannot be identified.

c. Blank space resulting from the deletion of text, an illustration, or a table.

d. Correction of minor inaccuracies, such as spelling, punctuation, relocation of material, etc., unless such correction changes the meaning of instructive information and procedures.

P–12. Engineering Authorization. All request for engineering authorization, when required by this manual will be forwarded to USA AMCOM, ATTN: AMSAM–RD–AE–I–D–U, Redstone Arsenal, AL 35898–5230. Urgent requests shall be clearly identified to insure priority handling and response. The requests shall include detailed information on the problem, e.g. sketches, photographs, dimensional data, etc., to assist in the evaluation and prompt reply.

P–13. Designator Symbols. Designator symbols **H** , **V** , **C B** , or **M B** are used in conjunction with text contents, text headings and illustration titles to show limited effectivity of the material. One or more designator symbols may follow a text heading or illustration titles to show limited effectivity of the material. One or more designator symbols may follow text heading or illustration title to indicate proper effectivity, unless the material applies to all models an configurations within the manual. If the material applies to all series and configurations, no designator symbols will be used. Where practical, descriptive information shall be condensed and combined for all models to avoid duplication. The symbol **H** refers to UH–1H, **V** refers to UH–1V. The symbol **C B** refers to the composite main rotor blade and **M B** refers to the metal main rotor blade.

CHAPTER 1

AIRCRAFT GENERAL

SECTION I. SERVICING

1-1. SERVICING.

1-2. Description - Servicing. Instructions and information for complete servicing of the helicopter with fuel, oil, hydraulic fluid, and other fluids are provided in the following paragraphs. Locations of sight gages and drains are shown on Servicing Points Diagram with indication of how frequently each reservoir should be checked and filled or drained and refilled (figure 1-1). Instructions for use of greases and other lubrication not shown in servicing illustration will be found in figure 1-6, Lubrication Chart.

1-3. Fuel Systems - Servicing.

WARNING

Servicing personnel must comply with all safety precautions specified in FM 10-68, Aircraft Refueling Field Manual.

a. Fuel Tank Capacities.

FUEL TANK CAPACITY	U.S. GALLON
Total	208.5
Usable	206.5

b. Approved Fuel.

ENGINE FUEL SPECIFICATION

Army Standard Fuel	Alternate Fuel	Emergency Fuel
MIL-T-5624 Grade JP-4	MIL-T-5624 Grade JP-5	MIL-G-5572 Aviation Gasoline (Refer to TB 55-9150-200-24)

NOTE

Service with specified turbine fuel (C119). When specified fuel is not available, refer to TM 55-1520-210-10 and TB 55-9150-200-24 for information on other fuels and limitations on their use. An entry shall be made on the DA Form 2408-13 if emergency fuel is used.

c. The helicopter can be serviced by any of the following methods. Refer to figure 1-1.

(1) Closed Circuit Refueling (Power Off).

(a) Make sure fire guard is in position with fire extinguisher.

(b) Ground servicing unit to ground rod.

(c) Make sure helicopter is statically grounded to a ground rod.

(d) Bond servicing unit to helicopter

(e) Bond fuel nozzle to ground receptacle (2) located below fuel receptacle on helicopter.

CAUTION

Make sure servicing unit pressure is not above 125 psi while refueling.

(f) Remove fuel tank filler cap (3) and make sure refueling module is in closed and locked position (3.1).

(g) Remove nozzle cap, insert nozzle into fuel receptacle and lock into position.

(h) Position flow control handle to ON or FLOW. Fuel flow will automatically stop when fuel cell is full. Just before normal automatic shutoff, fuel flow may cycle several times as maximum fuel level is reached.

(i) Make sure flow control handle is in OFF or NO FLOW position and remove nozzle.

(j) Replace fuel nozzle cap and fuel tank filler cap (3).

(k) Disconnect fuel nozzle ground cable.

(l) Disconnect ground cable from helicopter to ground rod.

(m) Disconnect servicing unit ground cables from ground rod and helicopter.

(n) Return fire extinguisher to designated location.

(2) Gravity or Open Port Refueling (Power Off).

(a) Make sure fire guard is in position with fire extinguisher.

(b) Ground servicing unit to ground rod.

(c) Make sure helicopter is statically grounded to a ground rod.

(d) Bond servicing unit to helicopter.

(e) Bond fuel nozzle to ground receptacle (2) located below fuel receptacle on helicopter.

(f) Remove fuel tank filler cap (3).

(g) Using latch tool attached to filler cap lanyard (3.2), unlatch and open refueling module (3.3).

(h) Remove nozzle cap and insert nozzle into fuel receptacle.

(i) Refuel to specified level, remove nozzle and replace nozzle cap.

(j) Close refueling module by pulling lanyard (3.2) until latch (3.4) is in locked position. Replace fuel tank filler cap (3).

(k) Disconnect fuel nozzle ground cable.

(l) Disconnect ground cable from helicopter to ground rod.

(m) Disconnect servicing unit ground cables from ground rod and helicopter.

(n) Return fire extinguisher to designated location.

(3) Rapid (Hot) Refueling (Closed Circuit).

(a) Before Rapid Refueling:

(1) Throttle – Idle.

(2) FORCE TRIM – ON or controls frictioned.

WARNING

In case of fire, observe fire emergency procedures in FM 10-68. During Rapid Refueling, a crewmember should observe the refueling operation (performed by authorized refueling personnel) and stand fire guard as required. One crewmember must remain in the aircraft to monitor controls. Only emergency radio transmission should be made during Rapid Refueling.

(b) Make sure fire guard is in position with fire extinguisher.

(c) Ground servicing unit to ground rod.

(d) Make sure helicopter is statically grounded to a ground rod.

(e) Bond servicing unit to helicopter.

(f) Bond fuel nozzle to ground receptacle (2) located below fuel receptacle on helicopter.

CAUTION

Make sure servicing unit pressure is not above 125 psi while refueling.

(g) Remove fuel tank filler cap (3) and make sure refueling module is in closed and locked position (3.1).

(h) Remove nozzle cap, insert nozzle in fuel receptacle and lock into position.

(i) Position flow control handle to ON or FLOW. Fuel flow will automatically stop when fuel cell is full. Just before normal automatic shutoff, fuel flow may cycle several times as maximum fuel level is reached.

(j) Make sure flow control handle is in OFF or NO FLOW position and remove nozzle.

(k) Replace fuel nozzle cap and fuel tank filler cap (3).

(l) Disconnect fuel nozzle ground cable.

(m) Disconnect ground cable from helicopter to ground rod.

(n) Disconnect servicing unit ground cables from ground rod and helicopter.

(o) Advise pilot that the fuel cap is secure and grounding cables are removed.

(p) Return fire extinguisher to designated location.

(4) Rapid (Hot) Refueling (Gravity).

(a) Before Rapid Refueling:

(1) Throttle – Idle.

WARNING

(2) FORCE TRIM – ON or controls frictioned.

In case of fire, observe emergency procedures in FM 10-88.

During Rapid Refueling, a crewmember should observe the refueling operation (performed by authorized refueling personnel) and stand fire guard as required. One crewmember must remain in the aircraft to monitor controls. Only emergency radio transmissions should be made during rapid refueling.

(b) Make sure fire guard is in position with fire extinguisher.

(c) Ground servicing unit to ground rod.

(d) Make sure helicopter is statically grounded to ground rod.

(e) Bond servicing unit to helicopter.

(f) Bond fuel nozzle to ground receptacle (2) located below fuel receptacle on helicopter.

(9) Remove fuel tank filler cap (3).

(h) Using latch tool attached to filler cap lanyard (3.2) unlatch and open refueling module (3.3),

(i) Remove nozzle cap and insert nozzle into fuel receptacle.

(j) Refuel to specified level, remove nozzle and replace nozzle cap.

(k) Close refueling module by pulling lanyard (3.2) until latch (3.4) is in looked position (3. 1). Replace filler cap [3).

(1) Disconnect fuel nozzle ground cable.

(m) Disconnect ground cable from helicopter to ground rod,

(n) Disconnect servicing unit ground cables from landing gear cross tube. ground rod and helicopter.

(o) Advise pilot that the fuel cap is secure and grounding cables are removed.

(p) Return fire extinguisher to designated location.

d. Defueling.

NOTE

Refer to FM 10-68 for Defueling procedures.

After defueling operation is complete, drain residual fuel in tanks through defuel valves.

e. Defueling Valves.

(1) Defuel helicopters, with noncrashworthy fuel system incorporated, at defuel valves (16, figure 1-1).

(2) Defuel helicopters, with crashworthy fuel system incorporated, at gravity defuel valves located on sumps adjacent to drain valves (18, figure 1-1). The defuel valve is activated by using a fitting such as: AN815-12 union, AN832-12 union, AN919-12 reducer, and MS33656E12 end fitting after removing protection cover.

NOTE

When cover is installed after defueling, use only enough torque to slightly compress seal.

(3) Drain trapped fuel at drain valves (17 and 18, figure 1-1).

NOTE

Each forward cell has two drain valves, one forward and one aft of internal baffle.

(4) Electric boost pump has a seal valve.

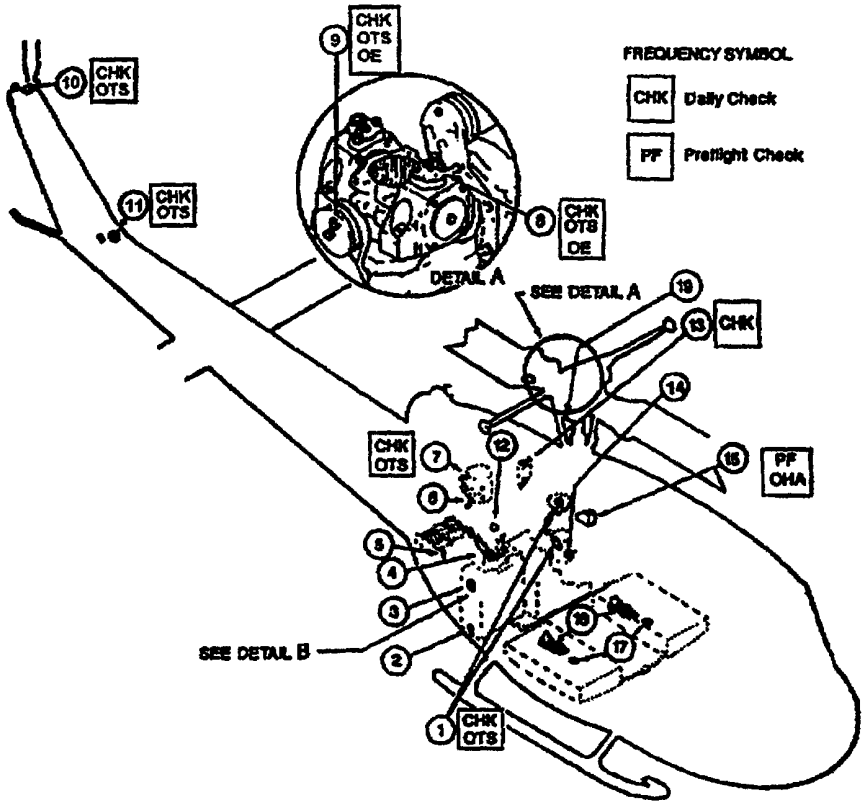
(5) To drain main fuel filter (13, figure 1-1) use valve in drain line from filter sump. Access is by opening lower left engine cowl. Drain line discharges just forward of aft

NOTE

An entry shall be made on DA Form 2408-13 if emergency fuel is used.

1-4. Auxiliary Fuel System—Crashworthy. A crashworthy fuel system, when installed, is located at the rear of the cabin and is accessible through the cargo doors. Each fuel cell is filled through a filler cap or a closed circuit refueling receiver located on top of the fuel cell. Each cell contains 150 U.S. gallons of fuel and the drain valves are located at cabin floor level, outboard of the fuel cells. Observe same fuel handling precautions as the main fuel system.

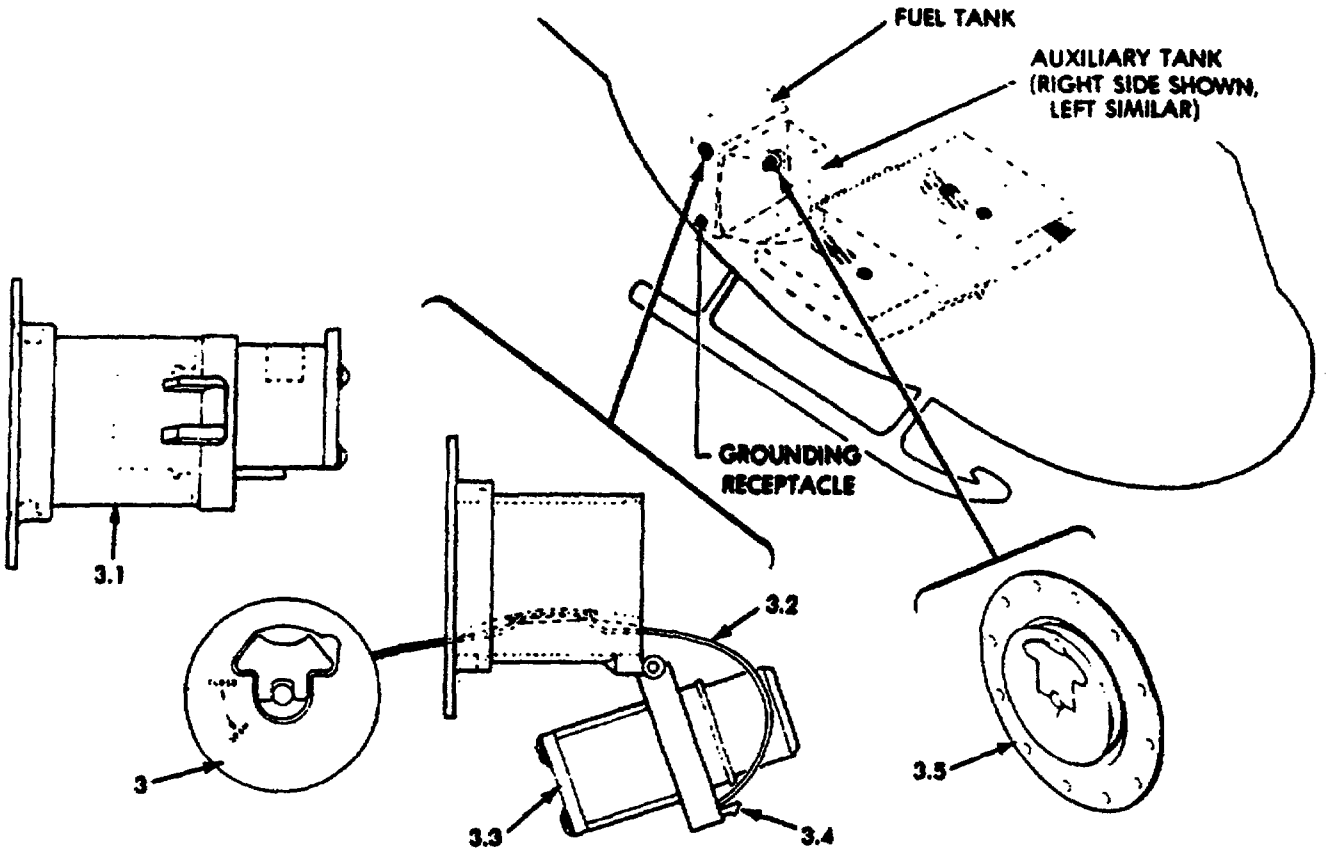
1-5. Engine Oil System. Engine oil tank (7, figure 1-1) is in engine compartment at right side. Oil level can be checked through small door marked ACCESS FOR FIRE EXTINGUISHERS by viewing sight gage plugs on tank. Before servicing oil, determine whether system contains MIL-L-7808 (C168) or MIL-L-23699 oil (C166).



LUBRICANT - TEMPERATURE REQUIREMENTS

Symbol	Specification	Ambient Temperature
OTS	MIL-L-23699 (C166)	-25°F and above
	MIL-L-7808 (C168)	0°F and below
	DOD-L-85734 (C166A)	0°F and above
	NOTE	
	OTS oil, DOD-L-85734 (C166A) should be used only in transmission and not in the engine.	
OHA	MIL-H-83282 (C131)	-30°F (-35°C) and above
	NOTE	
	Changing to fire resistant hydraulic fluid requires system draining. Refer to TB 55-1500-344-25.	
	MIL-H-5606 (C130)	-31°F (-36°C) and below
OE		
	NOTE	
	OE oil is used only in main rotor hub P/N 204-012-101-31. Do not mix OE and OTS oil.	
	MIL-L-2104 Grade 40 (C172)	40°F (5°C) and above
	MIL-L-2104 Grade 30 (C173)	0°F (-18°C) to 39°F (4°C)
	or	
	MIL-L-46152 Grade 30 (C170)	
	MIL-L-2104 Grade 10 (C174)	-20°F (-29°C) to -1°F (-19°C)
	or	
	MIL-L-46152 Grade 10W30 (C171)	
	MIL-L-46167 (C132)	-65°F (-54°C) to -21°F (-30°C)

Figure 1-1. Servicing Points Diagram (Sheet 1 of 2)



DETAIL B

1. Transmission filler and sight gage (OTS)
2. Ground receptacle
3. Fuel tank filler
3.1. Closed circuit refueling receiver (Module closed)
3.2. Lanyard
3.3. Module (Open)
3.4. Latch
3.5. Auxiliary fuel tank filler (gravity)
4. Transmission oil cooler drain
5. Engine oil cooler drain
6. Engine oil tank drain
7. Engine oil tank (OTS)
8. Pillow block reservoir (OTS or OE)
9. Grip reservoir (OTS or OE)
10. Tail rotor gearbox (OTS)
11. Intermediate gearbox (OTS)
12. External power receptacle
13. Fuel filter
14. Transmission sump drain
15. Hydraulic reservoir (OHA)
16. Deleted
17. Forward fuel cell drain valves
18. Sump drain valves
19. Stabilizer bar dampers (use only MIL-H-5606)

Figure 1-1. Servicing Points Diagram (Sheet 2 of 2)

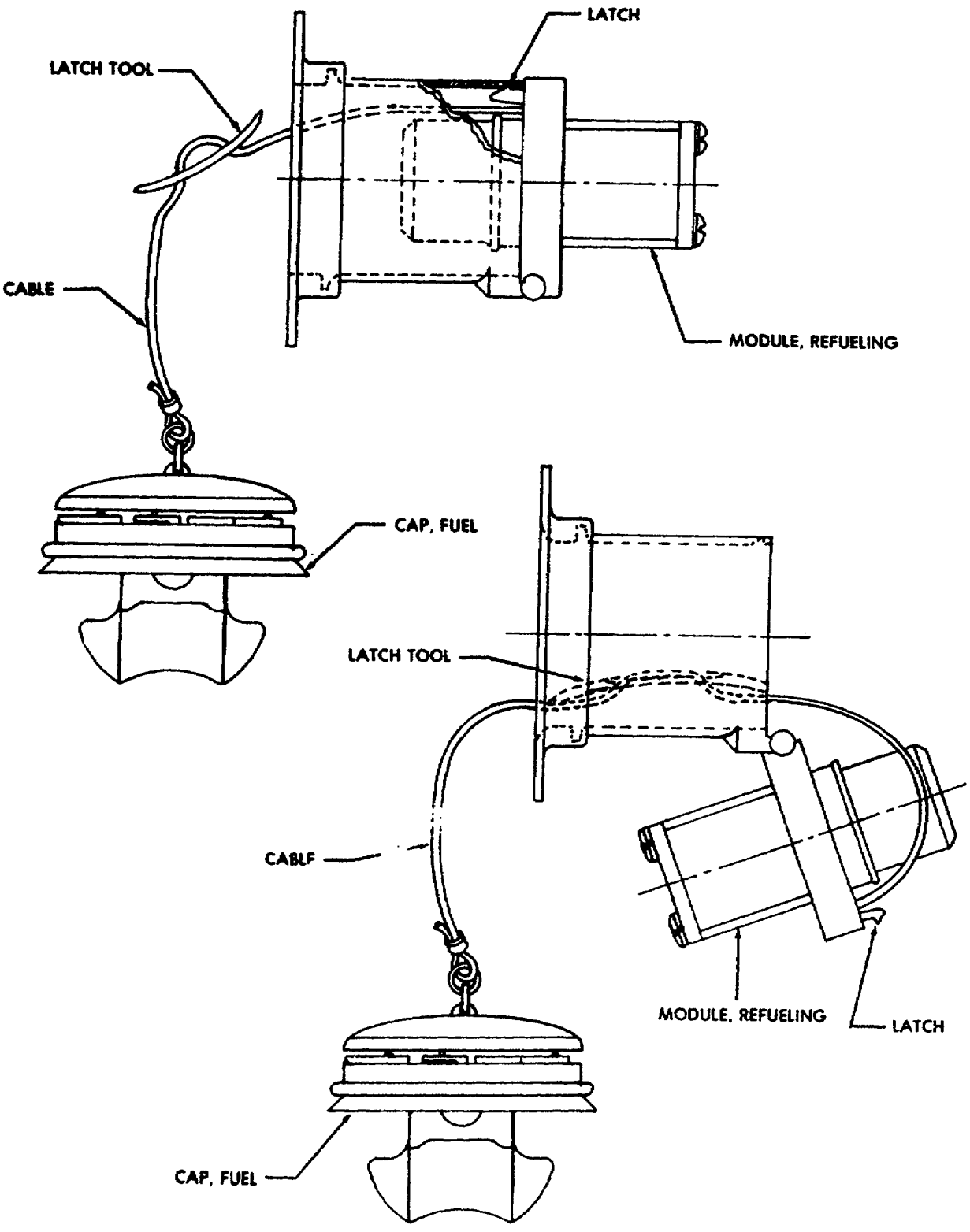


Figure 1-1.1. Receiver and Cap Assembly

CAUTION

Do not mix MIL-L-7808 (C168) and MIL-L-23699 oils (C166) except in cases of emergency. If this becomes necessary, drain the system within 6 hours of operation according to procedures in TM 55-2840-229-23.

a. Oil Usage and Changing.

NOTE

To identify type of oil in system, refer to TB 55-9150-200-24.

(1) Usage of oils:

(a) MIL-L-23699 oil (C166) is used in engine, transmission, gearboxes, and rotor hubs (except main rotor hub, P/N 204-012-101-31) and is authorized for ambient temperatures above -25°F.

(b) MIL-L-7808 oil (C168) is used in engine, transmission, gearboxes, and rotor hubs (except main rotor hub P/N 204-012-101-31) and is specified for prolonged operation in ambient temperatures below 0°F. This oil may be used when MIL-L-23699 is not available; change from MIL-L-7808 to MIL-L-23699 at next scheduled oil change.

(c) Main rotor hub assemblies, P/N 204-012-101-31, use lubricant identified on figure 1-1. All other main rotor hubs use oil that is stenciled on the hub.

(2) Changing Engine Oil:

CAUTION

Lubrication oil made to MIL-L-7808 by Shell Oil Company under their part number 307, qualification number 7D-1, shall not be used in UH-1 series aircraft.

(a) When changing from MIL-L-7808 oil (C168) to MIL-L-23699 oil (C166) in engine oil system, refer to TM 55-2840-229-23.

(b) When changing from MIL-L-23699 oil (C166) to MIL-L-7808 oil (C166) in engine oil system, refer to TM 55-2840-229-23.

Engine Oil CAPACITY	U.S. GALLONS
System	3.8
Tanks – Normal Level (between top and bottom line on upper sight gage)	3.0
Tanks – Ferry Level (top line upper sight gage)	3.25

NOTE

Maximum engine oil consumption is 0.3 gallons per hour (2.4 U.S. Pints).

(3) When changing from MIL-L-7808 oil to MIL-L-23699 oil or from MIL-L-23699 to MIL-L-7808 oil in the transmission, gearboxes, and rotor hub, proceed as follows:

(a) Drain oil.

(b) Change oil filter elements.

(c) Perform normal inspection.

(d) Replenish with appropriate oil. (Refer to step (1) above.)

b. Draining Engine Oil System.

(1) Drain engine oil tank by opening valve in drain line below tank which discharges overboard at lower left side of fuselage.

(2) Drain engine oil cooler by opening valve (17, figure 4-18) located below the oil cooler. Access to valve is from outside and under aft fuselage.

1-6. Transmission Oil System. Transmission sump oil level sight gages (1, figure 1-1) can be checked by use of a small window and pushbutton switch for light, located either on front or right side of pylon structural island in cabin. Filler cap is located at upper right on transmission, accessible from walkway on cabin roof either with transmission fairing open or through a small either with transmission fairing open or through a small door in closed faking. Before servicing, determine whether system contains MIL-L-7808 oil (C168) or MIL-L-23699 oil (C166) or DOD-L-85734 (C166A).

CAUTION

Do not overfill transmission.

TRANSMISSION OIL CAPACITY	U.S QTS.
System	11.0
Sump	9.0
Sump Refill	1.5

CAUTION

Do not mix MIL-L-7808 (C168) and MIL-L-23699 oils (C166) or DOD-L- 85734 (C166A) except in cases of emergency. If this becomes necessary, drain the system within 6 hours of operation.

a. Draining transmission oil system.

(1) Drain transmission through valve (14, figure 1-1) under sump, accessible through cargo-sling compartment.

(2) Drain transmission oil cooler through two drains (4, figure 1-1) located in lower left side of fuselage accessible through panel behind aft landing gear crosstube.

b. Fill transmission to proper level with oil (C168) or (C166) or (C166A).

1-7. Main and Tail Rotor System. Main rotor hub has an oil reservoir on each pillow block (8, figure 1-1) and on each grip (9, figure 1-1), which are serviced with oil or if greased hub is installed refer to step al and a2. Before servicing oil, determine which lubricant system contains. Refer to figure 1-1 for type of lubricants being used. Oil level can be seen through transparent inserts. Reservoirs can be serviced as required, by removing filler plugs.

a. Filling Reservoirs.

(1) Fill pillow block reservoirs one-half full.

NOTE

in temperatures below 0 degrees C (32 degrees F), fill pillow blocks full.

(2) Fill grip reservoirs one-half full.

(3) Reinstall filler plugs.

al. The main rotor greased hub is lubricated by hand grease gun, using MIL-G-81322 (see figure 1-6, sheet 2).

a2. On initial installation, the main rotor greased hub is lubricated as follows:

(1) Ground run for 5 minutes at 6600 ENG/324 Rotor RPM. After shutdown purge hub, with grease until grease passes through grip plate relief fittings and trunnion seals.

(2) After the first fright purge again as in step (1).

(3) After ten hours of fright, and each 50 hours thereafter purge again as in step (1).

b. Stabilizer Bar Dampers. Visually check both stabilizer bar dampers to be full of hydraulic fluid (C130) to top of window on each damper if level is only slightly (approximately 1/8 inch maximum) below top of window, refill through plug at top. if level is lower than 1/8 inch refer to paragraph 5-54. Check for signs of leakage and record conditions on maintenance form since further checks may be necessary.

1-8. intermediate (42 Degree) and Tail Rotor (90 Degree) Gearboxes. intermediate gearbox (11, figure 1-1) and tail rotor gearbox (10) have sight gage plugs for checking level of oil (C166, C166A,C168), and have filler caps for servicing when required. Before servicing oil, determine which lubricant system contains. Refer to TB 55-9150-200-24 for type of lubricant being used. Oil level of Intermediate gearbox can been seen through a hole in fairing, but fairing may be removed for filling.

CAUTION

Do not interchange filler caps between 42 degree and 90 degree gearboxes, since this can cause intermediate gear-box to be pumped dry. Cap that is vented and is identified by a white dot is installed on 90 degree gearbox. Cap identified with a black dot is installed on 42 degree gearbox.

Do not mix MIL-L-7808 (C168) MIL-L-23699 (C166) or DOD-L-85734 (C166A) oils except In cases of emergency. if this becomes necessary, drain the system within 6 hours of operation.

1-8.1. Servicing – intermediate (42 Degree) and Tail Rotor (90 Degree) Gearboxes. Service intermediate and tail rotor gear boxes with appropriate oil (C166, C166A or C168) to oil level mark on sight gage.

CAUTION

When servicing gear boxes ensure no moisture or contamination enters system.

1-9. Hydraulic Reservoir. Check sight gage of hydraulic reservoir (15, figure 1-1) through viewing hole provided on right side of transmission fairing.

WARNING

Prolonged contact with hydraulic fluid (MIL-H-83282) liquid or mist can Irritate eyes and skin. After any prolonged contact with skin, immediately wash contacted ares with soap and water. If liquid contacts eyes, flush immediately with clear water. If liquid is swallowed, do not induce vomiting; get immediate medical attention. Wear rubber gloves when handling liquid. if prolonged contact with mist is likely, wear an appropriate respirator. When fluid is decomposed by heating, toxic gases are released.

a. Servicing. If reservoir servicing is required, open transmission fairing for access. Remove cap and fill reservoir to overflow with hydraulic fluid (C130 or C131). Reinstall filler cap. Close transmission fairing.

CAUTION

To avoid contamination, do not use previously opened cans of hydraulic fluid. A new, sealed can of fluid shall be used.

NOTE

Refer to TB 55-1500-334-25 for procedures governing change over to fire resistant hydraulic fluid.

HYDRAULIC FLUID CAPACITY	U.S. PINTS
System	10.0
Reservoir	5.3
Reservoir Refill	2.5

b. Draining Hydraulic Reservoir. Drain reservoir by removing plug from part marked DRAIN on lower aft side of reservoir.

1-10. Ground Handling Wheel Pump. Hold pump in an upright position, with oil hole and handle socket at top. Fill with hydraulic fluid (C130) until hydraulic fluid comes out filler hole. Check pump for leaks and proper operation.

1-11. Ground Handling Wheel Tires. Each ground handling assembly is equipped with two Type III, 700-6 6-ply aircraft tires. Inflate tires to 50 psi.

1-12. Battery. Refer to TM 11-6140-203-14-2 for servicing instructions.

1-13. Smoke Generator Subsystem Tank. (Paragraph 16-26).

1-14. Cleaning.

NOTE

Additional cleaning procedures are covered in this manual under individual components.

CAUTION

Use extreme caution when washing near bearings. Do not spray water or cleaning fluids directly on bearings. Bearings which can be lubricated will be lubricated after washing. Bearings which cannot be lubricated will be covered during washing to prevent moisture intrusion.

CAUTION

Ensure contaminants do not enter 42 and 90 degree gearbox system. Use extreme caution when cleaning areas, which may allow cleaning materials to enter oil system.

1-15. Description - Cleaning. Cleaning the helicopter before preparing it for storage is important because residues from exhaust gases, dirt, and contamination of any kind will accelerate corrosion, whether coated with preservative compound or not. The helicopter must be grounded prior to any cleaning, maintenance, disassembly or preservation.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

CAUTION

To preclude damage to bonded panels, solvents and water are to be applied at the minimum pressure required to maintain a constant flow suitable for washing or rinsing. Steam cleaning is not to be utilized.

1-16. interior - Cleaning. Refer to TM 1-1500-344-23.

CAUTION

To preclude damage to bonded panels, solvents and water are to be applied at the minimum pressure required to maintain a constant flow suitable for washing or rinsing. Steam cleaning is not to be utilized.

1-17. Exterior- Cleaning. Refer to TM 1-1500-344-23.

1-18. Plexiglass - Cleaning. Refer to TM 1-1500-344-23.

1-19. **MB** Rotor Blades - Cleaning.

a. Rotor blades of helicopter operating in high humidity or salt-laden atmosphere will require the following minimum daily blade cleaning:

(1) Wash blades thoroughly with cleaning compound (C67).

(2) Rinse with clear water and dry.

b. Rotor blades of helicopter operating in any environment will require cleaning in accordance with section IV.

(1) Wash with cleaning compound (C67).

(2) Rinse thoroughly with water. Dry with clean cloth.

1-19.1 **CB** Composite Main Rotor Blades - Cleaning.

a. Clean composite main rotor blades with one part cleaning compound (C66.1) and nine parts water.

WARNING

Drycleaning solvent (C261) is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapor and contact with skin or eyes.

CAUTION

Do not clean polyurethane leading edge abrasion strip with drycleaning solvent (C261). Drycleaning solvent will deteriorate and cause damage to the polyurethane abrasion strip.

b. Remove stubborn deposits from all areas of blade except the polyurethane abrasion strip with drycleaning solvent (C261). Use clean cloth dampened with solvent to avoid runover or spillage onto the abrasion strip.

1-20. Treatment of Aluminum and Magnesium Alloy Corrosion. Aluminum and Magnesium alloy corrosion will be treated in accordance with table 2-4. Apply the protective paint finish to the affected area immediately after drying of chemical treatment in accordance with TB 746-93-2.

1-21. Snow and Ice Removal. Refer to TM 1-1500-344-23 for procedures to remove snow and ice. De-icing fluid (MIL-A-8243) may be used to prevent icing or remove ice accumulation from the aircraft (including rotor blades).

1-21.1. Windshield (Interior and Exterior). Refer to TM 1-1500-344-23.

1-22. Consumable Maintenance Supplies and Materials.

1-23. Description - Consumable Maintenance Supplies and Materials. Consumable maintenance supplies and materials are listed In table 1-1 in alphabetical order. Each consumable also has an item number assigned for ease of location and reference.

When an item number is referenced in the manual you may locate the item through its C designation and item number. C designators are used only with consumable maintenance supplies and materials. Consumable maintenance supplies and materials tables are found only in this chapter; therefore the table numbers will not be referenced in the text.

a. Surface Texture. RMS (Root Mean Squared) and RHR (Root Height Radius) are methods of measuring surface texture. A profilometer measuring in microinches is used to read surface texture. Honing produces a finish of 4 to 32 microinches, and reaming produces a finish of 32 to 125 microinches.

The following table may be used to determine the Abrasive Grit Number to achieve a desired surface texture:

ABRASIVE GRIT NUMBER	SURFACE TEXTURE (MICROINCHES)
500	4 to 16 (Satin-Matte)
320	10 to 32 (Grey-Satin)
240	15 to 63
180	85 MAX
120	125 MAX
60	250 MAX

1-23.1. The supplies and material listed in this table 1-1 are required for maintenance support of this equipment and are authorized to be requisitioned by CTA 50-970 (Common Table of Allowances).

Table 1-1. Consumable Maintenance Supplies and Materials

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 1	Abrasive Cloth, Silicon Carbide 400 Grit	P-C-451 (81348)	5350-00-174-0995
C 2	180 Grit		5350-00-174-1001
C 3	600 Grit		5350-00-174-0985
C 4	120 Grit		5350-00-559-7780
C 5	250 Grit		5350-00-297-6670
C 6	Abrasive Cloth, Aluminum Oxide 400 Grit	P-C-451 (81348)	5350-00-865-5700
C 7	180 Grit		5350-00-192-5051
C 8	120 Grit		5350-00-638-2693
C 9	250 Grit		5350-00-161-9715
C 10	Abrasive, Grain Soft for Carbon Removal	MIL-G-5634 Type III (813491)	5350-00-050-1094
C 11	Abrasive Pads, Nylon Web, Scotch-Brite, Type A Very Fine	L-P-50, Type I Class 1, Size 1 (81348)	7920-00-659-9175
C 11.1	Abrasive Paper No. 60 grit	A-A-1202 (58536)	5350-00-598-6105
C 11.2	Use C 4		
C 11.3	Use C 2		
C 11.4	Abrasive Paper No. 220 grit	A-A-1201 (56536)	5350-00-186-8819

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 11.5	Abrasive Paper No. 240 grit	P-P-101 (81348)	5350-00-224-7207
C 11.6	Abrasive Paper No. 280 grit	P-P-101 (81348)	5350-00-224-7205
C 12	Acetone, Technical	O-A-51D	6810-00-184-4796
C 13	Acid, Boric, Technical Grade	O-C-265 (81348)	6810-00-264-6535
C 14	Acrylic Lacquer, P-95, Gloss, Colorless	MIL-L-81352 (81349)	8010-00-490-7651
C 15	Aluminized No. 17178	T-T-L-32 (81348)	8010-00-241-8406
C 16	Lusterless Black No. 37038	MlL-L-19538 (81349)	8010-00-527-2884
C 17	Gloss Black No. 17038	MIL-L-81352 (81349)	8010-00-935-7077
C 18	Gull Grey No. 26440	MIL-L-81352 (81 349)	8010-00-935-7060
C 19	Insignia Red No. 11136	MIL-L-19537 (81349)	8010-00-551-7932
C 20	Lusterless Olive Drab No. 34087	MIL-L-81352 (81349)	8010-00-144-9998
C 21	Lusterless Orange-Yellow No. 33538	MIL-L-19538 (81349)	8010-00-530-6387
C 22	Adhesive, Silicone Rubber	MIL-A-46146 Type	8040-00-118-2695
C 23	Deleted		
C 24	Adhesive, Air Drying Liquid Silicone, BEMS 15001	MIL-A47317 (77066)	8040-00-097-6524

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 25	Adhesive, Airframe Structure Heat Resistant, Metal to Metal Hysol EA9605	MMM-A-132, Type 1, (81348)	8040-00-152-0017
C 26	Adhesive	MMM-A-134TY2 (81348)	8040-00-691-1322
C 27	Adhesive, EA9309	BHT Spec. 299-947-125 Type I (33564)	8040-01-163-3481
C 28	Adhesive EC2216 Scotchweld	BHT Spec. 299-947-061 (04953)	8040-00-145-0019
C 29	Adhesive, Epoxy	EA934 Type 1, Class 3 (33564) 1 qt	8040-01-102-2098
C 29.1	Deleted		
C 29.2	Adhesive Kit,	(EA956A/B) Hysol (04347)	8040-01-126-6271
C 29.3	Adhesive Kit	TSK-L-100 P/N 25-1004 Task Research Inc. Santa Paula, Calif. 93060 (61272)	1615-01-205-6138
C 29.4	Deleted		
C 30	Adhesive, EA9340	(33564)	8040-00-944-7292
C 31	Adhesive, Episeal 10-10	(19012)	8040-00-944-7292
C 32	Adhesive, Metalset A-4	(90414)	8040-00-944-7292
C 33	Adhesive, RP1258	(02684)	8040-00-944-7292
C 34	Adhesive, Epoxy EC2126	MMM-A-1617 (81348)	8040-00-262-9011
C 35	Adhesive, Liquid Form EC678	MIL-A-9117 (81349)	8040-00-262-9060

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 36	Adhesive	MMM-A-134TY1 (81348)	8040-00-270-8137
C 37	Adhesive, Paste, No. 19	(80703)	8040-00-105-0254
C 38	Adhesive, RP 1257-3A	(02684)	8030-00-891-3113
C 39	Adhesive, Synthetic Rubber	EC776 (04963)	8040-00-597-9723
C 39.1	Adhesive	EA960SF (Hysol) BHTI 299-947-072	
C 40	Adhesive	Bondmaster M24 (01666)	8040-00-181-7784
C 41	Adhesive	MIL-S-8784 CLB-112	8030-00-152-0022
C 41.1	Use C-29		
C 42	Alcohol, Isopropyl, Technical	TT-1-735 (81348)	6810-00-855-6160
C 43	Methanol, Technical	0-M-232 (81348)	6810-00-275-6010
C 44	Alkaline Aluminum Cleaner	MIL-C-5410 (81349)	6850-00-628-7249
C 45	Deleted		
C 46	Ammonium Nitrate Solution	Commercial	
C 47	Anti-Seize Compound	(81349) MIL-A-9070	8030-00-597-5367
C 48	Bag, Transparent	MIL-B-22020 (81349)	8105-00-027-8485
C 48.1	Bleeder Fabric - Polyester Formed Fabric for Vacuum Bag, Layups, and Metal Bonding	MIL-C-9084 (81349)	8305-00-530-0110
C 49	Deleted		

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 49.1	Use C218		
C 50	Bottle, Fuel Sample 16 oz	S-8275G (64484)	6640-00-404-0660
C 51	Bottle, Fuel Sample 32 oz	S-8275H (64484)	6640-00-404-0661
C 52	Brush, Bristle	HB643 Type 2, Class 1 (81348)	7920-00-514-2417
C 53	Calibrating Fluid, Aircraft Fuel System Components	MIL-C-7024B, Type II (81349)	6850-00-264-5771
C 54	Calking, Lead	QQ-C-40 (81348)	5330-00-171-6545
C 55	Catalyst, Noucure 28	Nudex Products Co. Heyden Chemical Corp Elizabeth, NJ	6810-00-546-4853
C 56	Cellophane	L-C-110, Type VII Class 2 (82348)	8135-00-061-5819
C 57	Cement, EC1357	(76381)	8040-00-165-8614
C 58	Deleted		
C 59	Cement, Proseal 584	(83527)	8040-00-964-6757
C 60	Cement Rubber	MIL-C-23092 (02104)	8040-00-051-1318
C 61	Cheesecloth	(81348)	8305-00-205-3496
C 62	Chemical Film Material (Alodine No. 1200)	MIL-C-81706 Class 1A, Form II	8030-00-057-2354
C 63	Chemical Film Solution	Dow Type 1 or 6, Brush on, MIL-L-3171	
C 64	Chromic Acid, Technical	O-C-303b, Type II (81348)	6810-00-264-6517

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM		NSN
C 65	Cleaner, Engine, B & B 3100	(21361)		6850-00-181-7594
C 66	Cleaner, Glass	P-G-406 Type I		7930-00-664-6910
C 66.1	Cleaning Compound	MIL-C-25769		6850-00-935-0995
C 67	Cleaning Compound, Aircraft Surface, Alkaline Waterbase	MIL-C-87936 (81349)	5 Gal. 55 Gal.	6850-01-184-7453 6850-01-184-3182
C 67.1	Cleaning Compound	MIL-C-87936 Type 1		6850-01-181-0273
C 68	Cloth, Crocus, 600 Grit	P-C-458 (81348)		5350-00-221-0872
C 69	Cloth, Fiberglass 120 or 127 Weave (Volan A finish)	MIL-C-9084 (81349)		8305-00-082-6135
C 70	Cloth, Synthetic and Fibrous, Glass Coated	MIL-C-22787 (81349)		8305-00-514-4263
C 70.1	Coating, Aliphatic Polyurethane	MIL-C-46168 Color No. 37038 FED-STD-595		8010-01-146-2646
C 70.2	Coating, Polyurethane Copper Filled, Kit 1 gal	599-A-8574-1 87354		8010-01-275-7966
C 70.3	Coating, Polyurethane Copper Filled 12 oz Aerosol Can	599-Y-1002 87354		
C 71	Coating, Walkway Type 3	MIL-W-5044 (81349)		5610-00-641-0427
C 72	Compound, Carbon Removing	P-C-111 (81348)		6850-00-965-2332
C 73	Compound, Carbon Removing Agitated Tank	MIL-C-19853 (81349)		6850-00-543-7801
C74	Compound, Cleaning, Oil Cooler Solvent	MIL-C-6864 (81349)		6850-00-551-3694
C 75	Delete			
C 76	Compound, Coating Metal Penetrant	MIL-C-8514 (81349)		8030-00-082-2425
C 77	Compound, Lapping No. 400	MIL-L-1786C (81349)		5350-00-151-6111
C 78	Deleted			

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 79	Compound, Retaining	MIL-S-22473 Grade CV	8030-00-081-2330
C 80	Compound, Sealing, Noncuring, Polysulfide Base	MIL-S-11030 Type 1, Class 1 (81349)	8030-00-275-8114
C 80.1	Compound, Mold Release	Rahm 0225 (Spray Type)	8030-01-064-4951
C 80.2	Deleted		
C 81	Compound, Turco No. 713	MIL-C-19853 (81349)	6850-00-543-7801
C 82	Compound, Valve Grinding Silicon Carbide, Grit No. 400	SS-C-614 Type I (81348)	5350-00-193-1348
C 83	Deleted		
C 84	Cord, Nylon	MIL-C-5040 Type III	4020-00-246-0688
C 85	Corrosion Preventive Aircraft Engine	MIL-C-6529C Type II (81349)	6850-00-209-7230
C 86	Corrosion Preventive Compound, Solvent Cutback, Cold Application	MIL-C-16173D Grade I (81349)	8030-00-231-2345
C 87	Corrosion Preventive Compound, Solvent Cutback, Cold Application	MIL-C-16173 Grade 2	8030-00-244-1297
C 88	Corrosion Preventive, Fingerprint Remover	MIL-C-15074 (81349)	8030-00-664-4017
C 89	Corrosion Preventive Oil, Gas Turbine Engine, Aircraft Synthetic Base	MIL-C-8818C (81349)	6850-00-273-2395
C 90	Corrosion Preventive Oil	MIL-C-5541	8030-00-811-3723
C 91	Corrosion Preventive Petrolatum, Hot Application	MIL-C-11796B Class 3 (81349)	8030-00-231-2353
C 92	Corrosion Preventive Petrolatum	MIL-C-11796B Class 1A	8030-00-823-8054
C 93	Cotton Flannel Cloth	CCC-C-458	8305-00-653-1259

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 94	Deleted		
C 95	Cushioning Material, Bound Fiber	MIL-B121 Type II (83149)	8135-00-753-4661
C 96	Cushioning Material, Cellulosic	PPP-C-843 Type II (81348)	8135-00-183-8814
C 97	Cushioning Material, Uncompressed Bond, Fiber for Packing	PPP-C-1120 Type IV, Class A, (81348)	8135-00-664-0057
C 98	Detergent, General Purpose (Spray On, Wipe Off)	MIL-D-16791 (81349)	7930-00-985-6911
C 99	Detergent, General Purpose		7930-00-527-1237
C 100	Detergent, Liquid No. 285 Type I	P-S-624	8520-00-237-8292
C 101	Detergent, Mild	P-D-410(81348)	7930-00-880-4454
C 102	Dev. Con F, Holding Compound	MIL-C-24176 (81349)	8030-00-670-8553
C 103	Dip Compound	AE10187-001 (00624)	8030-00-907-0879
C 104	Deleted		
C 105	Desiccants, Activated	MIL-D-3464D (81349)	6850-00-264-6562
C 105.1	Edge Breather, Fiberglass		
C 106	Enamel, Aklyd, Gloss Color No. 13618	TT-E-489 (81348)	8010-00-052-9944
C 107	Epoxy, Anti-Static	XA148 (06613)	8010-00-151-9979
C 108	Epoxy, Coating Camouflage, Color 57038 (Black)	MIL-C-22750C Type III	8010-01-030-7254
C 109	Epoxy, Engine Gray AD Components A&B E2833A, E2833B	(16193)	8010-00-891-3112

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
c 110	Epoxy Primer, Super Koropon	BHT Spec, 299-947-060 MIL-P-23377 (81349)	8010-00-082-2450
c 111	Ethylene Glycol Monomethyl, Technical	0-E-780 (81348)	6810-00-264-8997
C 111.1	Deleted.		
C 112	Felt, Ink, Black	(01195)	7510-00-438-6804
c 113	Felt, Sheet 0.062-inch Thick, Hard Rabbit Fur	6112 (55899)	8305-01-031-0130
c 114	Filler, RP1220	(02684)	8030-00-878-2063
c 114.1	Film, Vacuum Bag, High and Intermediate Temperature		
C 115	Flexible Barrier Material, Water Proofed, Grease-Proof	MIL-B-121 Type 1, Class 1 Grade A (81 349)	8135-00-224-8885
c 116	Flux, Brazing, Silver Alloy, Low Melting Point	0-F-499C	3439-00-943-8889
C 117	Deleted		
c 118	Deleted		
c 119	Fuel, Turbine, Grades JP-4 and JP-5	MIL-T-5624 (81349)	JP-4 9130-00-256-8613 JP-5 9130-00-273-2379
C 120	Gasoline, Aviation	MIL-G-5572 (81349)	9130-00-160-1839
c 120.1	Gloves, Cotton, White	MIL-G-3866 (81349)	8415-00-268-8353
c 120.2	Gloves, Plastic, Lt. Wt., Med Size	MIL-G-36592	6515-00-462-0832
C 120.3	Deleted.		
c 121	Grease (GOB)	MIL-G-25537B	9150-00-478-0055

Table 1-1. Consumable Maintenance Supplies end Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 122	Grease, Aircraft and Instrument	MIL-G-23827 (81349)	9150-00-985-7246
C 123	Grease, Graphite, Aircraft Lubricating	W-G-671 (81348)	9150-00-190-0918
C 124	Grease (Lubriplate)	MIL-G-46003 130A (73219)	9150-00-057-8976
C 125	Grease	G-60/EPV 76736	9150-00-935-4015
C 126	Grease, Molybdenum, High and Low Temperature	MIL-G-21164B (81349)	9150-00-754-2595
C 127	Grease	MIL-G-3278	9150-00-985-7243
C 128	Grease, Pneumatic System	MIL-G-4343 (81349)	9150-00-269-8255
C 129	Grease, Wide Temperature Range, General Purpose	MIL-G-81322 (81349)	9150-00-944-8953 or 9150-00-484-4009
C 130	Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordnance	MIL-H-5606C (813491	9150-00-252-6383
C 131	Hydraulic Fluid, Fire Resistant	MIL-H-83282 (81 349)	9150-00-149-7431
C 132	Deleted		
C 133	Dexron II Automatic Transmission Fluid	MIL-L-46167 (24617) (Qt)	9150-00-698-2382
C 134	Hydrochloric Acid, (Muriatic)	O-H-765A (81348)	6810-00-222-9641
C 135	Inhibitor, Corrosion, Rust Lick 606	(14098)	6850-00-066-2333
C 136	Inhibitor, Rust and Preservative	LPS-2WD-40 (1 GAL)	8030-00-938-1947
C 137	Ink, Black, Marco S-1147	(87049)	7510-00-469-7910
C 138	Ink, White, Marking	TT-1-1795 (81348)	7510-00-497-1794

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

	ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C	139	Ink, Marking Stencil Color Opaque	TT-1-558 (81348)	7510-00-224-6733
C	140	Ink, Marking, Parachute Color Blue	MIL-I-6903 Type IV (81349)	7510-00-286-5362
C	141	Insulation Varnish	Glyptol 1201 PT (89954)	5970-00-583-0401
C	142	Insulation Tape, Electrical Plastic, Pressure-Sensitive Scotch Brand No. 17	MIL-I-24391 (81349)	5970-00-419-4291
C	143	Kerosene	VV-K-211D (81348)	9140-00-242-6748
C	144	Paint Polyurethane, Aircraft Green	MIL-C-46168	
C	145	Lacquer, Camouflage, Lusterless Black, No. 37038	TT-L-20A (81348)	8010-00-166-3147
C	146	Lacquer, Dark Gull Grey No. 36231	TT-L-20A (81348)	8010-00-515-1568
C	147	Lacquer, Cellulose Nitrate, Gloss Grey Color No. 16081	TT-L-32 (81349)	8010-00-257-5379
C	146	Deleted		
C	149	Lacquer, Olive Drab Lusterless No. 34087	MIL-L-19538 (81349)	8010-00-082-2479
C	150	Deleted		
C	151	Lead, Red, Dry and Paste in Oil	TT-R-191D (81348)	8010-00-243-9265
C	152	Liquid, Fluorescent Penetrant	MIL-I-25135 (81349)	6850-00-145-0255
C	153	Liquid Resin, General Epoxy Purpose Laminating Epon 828	MIL-R-9300 Type 1, Grade 0 (86961)	8040-00-822-6430
C	154	Lockwire	MS20995C20	9505-00-221-2650

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF NO. AND FSCM	NSN
C 155	Lockwire	MS20995C32 (96906)	9505-00-293-4208
C 156	Lockwire	QQ-W-423 (81348)	9505-00-804-3814
C 157	Lockwire	MS20995C41 (96906)	9505-00-331-3275
C 158	Lubricant, Driveshaft Couplings (Tube Pack)	BHT 204-040-755-5 (3913G1)	9150-00-506-8497
C 159	Lubricant, Enclosed Gear Straight (Mineral)	VV-L765, Grade 250 (81348)	9150-00-292-0097
C 160	Lubricant, Molybdenum Disulfide	MIL-M-7866 (81349)	6810-00-264-6715
C 161	Lubricant, Plastilube, Moly No. 3	(02307)	9150-00-141-4481
C 162	Lubricant, Solid Film, Heat Cure	MIL-L-8937D (81349)	9150-00-985-7255
C 163	Lubricant, Dry Film	MIL-L-23398 (81349)	9150-01-260-2534
C 164	Lubricant, Graphite	MIL-G-6711	9620-00-233-6712
C 165	Lubricating Grease	FS-36512 (71984)	9150-00-040-1423
C 166	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base Aeroshell Turbine Oil 550	MIL-L-23699B (8oz) (81349) (qt)	9150-00-180-6266 9150-00-985-7099
C 166A	Lubricating Oil, Synthetic Base	DOD-L-85734	9150-01-209-2684
C 167	Lubricating Oil, Grade 1010	MIL-L-6081	9150-00-273-2388
C 168	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base Exxon Turbine Oil 2389	MIL-L-7808 (Qt) (81349)	9150-00-782-2627
C 169	Lubricating Oil, General Purpose, Low Temperature	MILL-7870 (Qt) (81349)	9150-00-263-3490

Table 1-1 Consumable Maintenance Supplies and Materials (Cont)

ITEM NO	DESCRIPTION	REF. NO, AND FSCM	NSN
C 170	Lubricating Oil, Internal Combustion Engine Grade 30	MIL-L-46152 (Qt) (81349) (55 Gal)	9150-00-186-6689 9150-00-186-6696
C 171	Lubricating Oil, Internal Combustion Engine Grade 10W-30	MIL-L-46152 (Qt) (81349) (55 Gall	9150-00-186-6703 9150-00-186-6701
C 172	Lubricating Oil, Internal Combustion Engine Grade 40	MIL-L-2104 (Qt) (81349)	9150-00-189-6730
C 173	Lubricating Oil, Internal Combustion Engine Grade 30	MIL-L-2104 (Qt) (81349) (55 Gal)	9150-00-189-6729 9150-00-188-6729
C 174	Lubricating Oil, Internal Combustion Engine Grade 10	MIL-L-2104 (Qt) (81349) (55 Gal)	9150-00-189-6727 9150-00-191-2772
C 175	Marker, Tube Type	GG-M-00114 (81349)	7520-00-973-1062
C 176	Methanol	O-M-232 (81348)	6810-00-275-6010
C 177	Methyl-Ethyl-Ketone	TT-M-261b (81348)	6810-00-281-2785
C 178	Naphtha, Aliphatic	TT-N-95 Type 2 (81348)	6810-00-238-8119
C 179	Nicro-Braze	AMS 4777 (81343)	3439-00-139-9214
C 180	Nitric Acid, Technical	O-N-350 (81348)	6810-00-237-2918
C 181	Plastic Sheet	LP410 (81348)	9330-00-143-8604
C 182	Oil, Castor, Technical	JJJ-C-86 (81348)	9150-00-261-7455
C 183	Oil, Cutting	VV-C-846	9150-00-261-8144
C 184	Oil, Cutting Fluid	MIL-C-46149 (81349)	9150-00-004-8990

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO	REF DESCRIPTION	NO. AND FSCM	NSN
C 185	Oil, Cutting, Sulphurized Mineral	W-C-850	9150-00-883-8478
C 186	Oil, Diesel Fuel	MIL-F-16884 (81349)	9140-00-255-7764
C 187	Oil, Diesel Fuel	W-F-800	
C 188	Grades DF-A	(81349)	9140-00-286-5282
C 189	Grades DF-1	(81349)	9140-00-286-5286
C 190	Grades DF-2	(81349)	9140-00-286-5296
C 191	Oil, Fog Type SGF2	MIL-F-12070 (55 Gal) (81349)	9150-00-261-7895
C 192	Oil, Lubricating	MIL-L-6081 (Qt) Grade 1010 (81349)	9150-00-273-2388
C 193	Oil, Penetrating	W-P-216 (81348)	9150-00-261-7899
C 194	Marker, Tube Type	GG-M00114 (81348)	7520-00-973-1059
C 194.1	Paint Brush, 1-Inch Wide	H-B-491 (81348)	8020-00-205-6511
C 195	Paint, Epoxy	MIL-C-22750 (Qt) (81349)	8010-00-030-7354
C 196	Paint, Epoxy (Catalyzed) Grey Color No	TT-L-32 16473	8010-00-598-5158 (81348)
C 197	Paint, Heat Resistant Color No	MIL-P-14105 34087	8010-00-616-4009 (81349)
C 197.1	Peel Ply, Fabric, Synthetic, Nonbonding, Code 51789, Color Orange, Wt yard or Equivalent	Precision Fabrics Group, Inc. 1.98 oz per square Montvale, N.J. 07645	50 Chestnut Ridge Rd.
C 198	Pencil, Nonmechanical, Colored Lead	SS-P-201D (81348)	7510-00-285-5832
C 199	Pencil, Yellow Colorbrite 2107	(73685)	7510-00-465-0994

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO	REF DESCRIPTION	NO. AND FSCM	NSN
C 200	Penetrant, Inspection Material	MIL-1-25135 (81349)	6850-00-782-2725
C 201	Petrolatum, Technical	W-P-236 (81348)	9150-00-250-0926
C 202	Deleted		
C 202A	Pigment, Iron Blue	TT-P-381 (81348) TT-P-381 CR2A (80244)	8010-00-551-0128
C 202B	Pigment, Iron Blue	TT-P-381 (81348) TT-P-381 CR2A (80244) 88 (06542)	8010-00-281-2734
C 203	Pigment, Red Oxide, B3100F	(8000)	8010-01-016-6584
C 203.1	Plastic Spreader	No 354, or Equivalent Dynatron/Bond Corp. Atlanta, Ga.	
C 204	Deleted		
C 205	Polish, Abrasive, for Glass	MIL-P-3237	5350-00-299-8651
C 206	Polyamide Epoxy Primer Class 2	MIL-P-23377 (81349)	8010-00-082-2450
C 207	Polyurethane Coating	MIL-C-89286	8010-00-181-8282
C 208	Polyurethane Foam Tape, High Density, Single Coated Scotch foam 4104	4104X1-2 (76381)	9330-00-984-5834
C 209	Primer, Adhesive A934B	(03481)	8040-00-943-2502
C 210	Primer, Lacquer	MIL-P-7962B (81349)	8010-00584-2426
C 211	Primer, Lacquer Grade	MIL-S-22473	
C 212	AA	(81349)	8030-00-081-2341
C 213	Deleted		
C 214	T	(81349)	80300-181-8372

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 215	Primer Coating	TT-P-1757 (81348)	8010-00-835-2114
C 216	Protective, Steel Corrosion	MIL-C-1057B (81349)	6850-00-174-9672
C 217	Prussian Blue Color (Thinned in Oil)	MIL-P-30501 (8 13491	8010-00-247-8706
C 218	Putty, Zinc Chromate, General Purpose	MIL-P-8116 (81349)	8030-00-664-4968
C 218.1	Use C 110		
C 219	Primer, Zinc Chromate	TT-P-1757 (81348)	8010-00-297-0593
C 220	Remover, paint Organic, Solvent Type, Water Rinsable	TT-R-251 Type IV Class 8 (81348)	8010-00-926-4727
C 221	Rain Repellent, Windshield	REPCON	6850-00-139-5297
C 222	Remover, Tracer, Technical K41OA	(00929)	6625-00-887-7757
C 222.1	Deleted.		
C 223	Retaining Compound Single Component, Anderobic	MIL-R-46082A (81349)	8030-00-891-8358
C 224	Rod, Filler, 4043	QQ-R-566a (81348)	3439-00-178-8590
C 225	Deleted		
C 226	Rod, Stainless Steel, SAE Type 309	(61497)	3439-00-246-0575
C 227	Deleted		
C 228	Rod, Welding	MIL-R-5031	3439-00-288-1469

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 229	Rubber, Sheet, Soft	MIL-R-6130, Type II, Grade A (81349)	9320-00-618-3180
C 230	Rubber Sheet, Solid 1.5 Thick	MIL-R-6855 Class 2, Grade 60	9320-00-241-9765
C 231	Sandpaper, Waterproof Grit No. 180	P-P-101 (81348)	5350-00-721-8117
C 231.1	Grit No. 80		5380-00-619-9167
C 232	Use C 11.6		5350-00-224-7205
C 233	Grit No. 400		5350-00-224-7201
C 234	Grit No. 600		5350-00-224-7215
C 235	Grit No. 320		5350-00-224-7203
C 236	Use C 11.5		5350-00-224-7207
C 237	Sealant, Proseal, No. 706, PPS 4407	MIL-S-8784 (81349)	8030-00-616-9191
C 238	Sealing, Compound, Dielectric Pre-Mixed and Prefrozen Pro-Seal 727	BHT Spec 299-947-074, Type 2, Class 1,2,3	8030-00-664-7583
C 239	Sealing Compound, Firewall	MIL-S-38249	8030-00-783-8898
C 240	Sealing Compound Permatex 1372	1372 W (77247)	8030-00-599-7753
C 241	Sealing Compound	MIL-S-7124	8030-00-275-8117
C 242	Sealing Compound	MIL-S-8802	8030-00-723-2746
C 243	Sealing Compound	Locktite 601 (05972)	8030-00-180-6222
C 244	Sealing Compound, Polysulfide Base, High Adhesion, Pre-Mixed and Prefrozen Proseal 890	MIL-S-8802E	8030-00-753-4599
C 245	Sealing Compound, Permatex	MIL-S-45180C	8030-00-252-3391

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

	ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
c	245.1	Sealing Compound, Vacuum Bag, Extended General Purpose	MIL-P-8116 (81349)	8030-00-664-4986
c	246	Shellac, Body 2	TT-S-300 Type 1, Grade B (81348)	8010-00-160-6911
c	247	Shot, Lead, 1 lb 10511620	(19200)	9650-00-312-6640
c	246	Silastic, 140	(71984)	8040-00-701-9546
c	249	Deleted		
c	250	Silicone Compound	MIL-S-8660B (81349)	6850-00-880-7616
c	251	Silver Brazing Alloy Easy Flo 45	QQ-B-654 Grade IV 0.063 (81348)	3439-00-262-4188
c	252	Soap, Toilet Cake	P-S-620 (81346)	8520-00-531-6484
c	253	Deleted		
c	254	Sodium Bichromate, Technical	O-S-595	6810-00-262-8566
c	255	Sodium Hydroxide, Tehnical	O-S-598 (81348)	6810-00-270-8177
c	256	Solder Flux Core	QQ-S-571 (81348)	3429-00-224-3567
c	257	Solution, Leak Test Oxygen System	MIL-L-25567 (81349)	6850-00-621-1820
c	258	Solution, Light Water FC-194	(76381)	4210-00-935-1616
c	259	Solution, Liquid Soap	P-S-624 (81348)	8520-00-228-0598
c	260	Solvent	TT-M-268 (81348)	6810-00-286-3785

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 261	Solvent, Drycleaning	P-D-680, Type II (81348)	6850-00-274-5421
C 262	Spray Kit, Self-Pressurizing	MIL-S-22805	4940-00-803-6444
C 263	Stone, Arkansas Hand, Fine		5335-00-243-6087
C 264	Stone, India, Fine	SS-S-736, Type II, Class B (81348)	5345-00-144-6894
C 265	Strippable, Coating White No. 72-W-005	MIL-C-6799 Type II, Class 2 (81349)	8030-00-297-0189
C 266	Stripper, Rust, Oakite	MIL-C-46156 (81349)	6850-00-935-5853
C 267	Strip, Rub	MIL-P-22241 (81349)	5970-00-063-8526
C 268	Deleted		
C 269	Syringe, Hypodermic (LUER-LOK), 10cc Capacity and No. 16 Gauge DZ 1-14 Needle	(06531)	6515-00-514-2395
C 269.1	Tack Rag	G99-2 (16241)	7920-00-165-7154
C 270	Tape	PPP-T-680 Type I	7510-00-835-1247
C 271	Tape, Adhesive, One-Inch Transparent	L-T-900 (81348)	7510-00-551-9823
C 272	Tape, Scotch-Rite 31		(Yellow) 9390-00-106-2465 (Red) 9390-00-106-2466 [Green) 9390-00-106-2467
C 273	Tape, Antiseize	MIL-T-27730 (81349)	8030-00-889-3535

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 273.1	Use C276		
C 274	Tape, Instrument Marking	LS-300, Yellow (81348)	9390-00-106-2465
		LS-300, Green (81348)	9390-00-106-2466
		Fasign 1502, Red (80509)	9390-00-106-2467
C 275	Deleted		
C 276	Tape, Masking, 2 inch	UU-T-106 (81348)	7510-00-290-2026
C 277	Tape, Plastic Foam (Y9132B)	(76381)	7510-00-878-2052
C 278	Tape, Pressure-Sensitive Adhesive, For Dissimilar Metal Separation	PERMACEL, A NITTO DENKO CO. CUSTOMER SERVICE DEPT. U.S. HIGHWAY #1 NEW BRUNSWICK, NJ 08902 USA TEL: 800-755-8273 TAPES & TECHNICAL SOLUTIONS, LLC 363 WOODYCREST AVE NASHVILLE, TN 37210 USA TEL: 800-714-8806 615-244-7554	
C 279	Tape, Pressure-Sensitive Adhesive, Waterproof for Packaging	PPP-T-60, Type 2 (81348)	7510-00-663-0199
C 280	Tape, Pressure-Sensitive Polyurethane Film (Y9265A)	BHT Spec. 299-947-113 (76381)	7510-00-145-0171
C 281	Tape, Vinyl, 0.003 Inch Thick, No. 473	A-A-1689 (58536)	7510-00-515-2856
C 282	Teflon Tape 3M 5490	BHT Spec. 299-947-110, Type III, Class 1 (76381)	8135-00-923-0591
C 283	Tetrachloroethylene (Perchlorethylene), Vapor Degreasing Grade	A-A-857 (58536)	8010-00-160-5788
C 284	Thinner, Acrylic Lacquer	MIL-T-19544	8010-00-527-2897
C 284.1	Thinner, Urethane	TT-T-291 81348	8010-00-242-2089
C 285	Thread Compound, Seize, Graphite Petroleum	MIL-T-5544B (81349)	8030-00-087-8630

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 286	Thread, Cotton Binding	V-T-276F (81348)	8310-00-187-3920
C 287	Thread, Nylon	V-T-295A (81348)	8310-00-262-2772
C 288	Toluene, Technical	TT-T-548C (81348)	6810-00-281-2002
C 289	Deleted		
C 290	Trichlorethylene, Stabilized	O-T-634B Type II	6810-00-184-4800
C 291	Solvent, Drycleaning	P-D-680, Type II (81348)	6850-00-274-5421
C 292	Alcohol, Isopropyl, Technical	TT-1-735 (81348)	6810-00-855-6160
C 292.1	Deleted		
C 293	Deleted		
C 294	Twill, Black One Side Coated Nylon Style 665-602		
C 295	Twine, Lacing and Tying, Waxed	MIL-T-713, Type R Class 2 (32345)	4020-00-202-1924
C 296	Varnish, Glyceryl Phosphate Base	TT-V-109 (81348)	8010-00-221-2809
C 297	Varnish, Spar, Phenolic-Resin	TV-119 (81348)	8010-00-597-7856
C 298	Vista-Strip (Paste) and Stripper SA	(44389)	8010-00-985-2963
C 299	Deleted		
C 300	Deleted		

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 301	Deleted		
C 302	Wire, Filler	AMS 5680	3439-00-288-1471
C 303	Wire, Filler	AMS 5784 (81343)	3439-00-471-9899
C 304	Wire, Filler	AMS 5786 (81343)	3439-00-178-8597
C 305	Wire, Shear or Seal, Copper 0.020 Inch Diameter	MS20995-CY20	9525-01-047-6455
C 306	Wire, Steel Corrosion Resistant 0.020 inch diameter	QQ-W-423 (81348)	9505-00-596-5101
C 307	Wire, Welding	AMS 5774	
C 308	Deleted		
C 309	Wool, Aluminum	FF-W-1825	5350-00-286-4851
C 310	Wool, Steel	FF-S-740 (81348)	5350-00-240-2920
C 311	Xylene	TT-X-916b, Grade A (81348)	6810-00-598-6600
C 312	Zinc Chromate Primer	TT-P-1757 (81348)	8010-00-297-0593
C 313	Cellulose, Nitrate Dope	MIL-D-5549A (81349)	8010-00-223-4037
C 314	Plug Path Repair Kit CB	K747-201-7 (84953)	1615-01-041-7063
		K747-201-9	1615-01-041-7064
		K747-201-101	1615-01-041-7065
		K747-201-103	1615-01-041-7066
		K747-201-105	1615-01-041-7067
		K747-201-107	1615-01-041-7068
		K747-201-109	1615-01-041-7069
		K747-201 -111	1615-01-042-9467

Table 1-1. Consumable Maintenance Supplies and Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
C 315	Skin Patch Repair Kit CB	K747-201-1 (3 inch) (84953)	1615-01-041-7060
		K747-201-3 (5 inch)	1615-01-041-7061
		K747-201-5 (9 inch)	1615-01-041-7062
C 316	Trailing Edge Doubler Patch Repair Kit CB	K747-201-113 (84953)	1615-01-042-9466
C 317	Adhesive/Sealant	ASTM Standard D1002	8040-01-284-3984
C 318	Deleted		
C 319	3M Blade Erosion Tape Kit	70-0703-2971-2 (52152)	1615-01-328-5239
C 320	Fiberglass Repair Kit	51607-7021 (78286)	1560-00-856-9222
C 321	Plastics Repair Kit	EA9430 (12405)	8040-01-124-2842
C 322	Fluoroglide FB	(18632)	9150-00-903-6431
C 323	Rubber Sheet, 0.25 Thick	MIL-R-6855	9320-00-241-9758

1-24. SPECIAL TOOLS AND TEST EQUIPMENT.

1-25. Description – Special Tools and Test Equipment. Special tools and test equipment are listed in table 1-2 in alphanumerical order. Each tool or piece of test equipment has an item number assigned for ease of location and reference. When an item number is unknown, you may locate special tools and test equipment through alphanumeric arrangement within the table. When an item is referenced in the manual you may locate the item through its T designator and item number. T designators are used only with special tools and test equipment. The special tools and test equipment table is found only within this chapter; therefore, that table number will not be referenced within the text.

Table 1-2. Special Tools and Test Equipment

USABILITY CODES

R – Removal	RP – Repair/Replace	IN - Installation
D – Disassembly	T - Testing	AD – Adjustment
I - Inspection	A – Assembly	S/P - Storage/Preservation

ITEM NO.	PART NO.	NOMENCLATURE	USABILITY CODE CALIBRATION	FIGURE REFERENCE
T 1	AA4920-8503	Kit, Rotor Balance Positioning	AD	
T 2	AN8515	Wrench, Spanner	D/A	
T 2.1	AN8516	Wrench	D/A	
T 3	AN/PSM-6A	Multimeter	T	
T 3.1	BH112JA-53	Jet Cal Analyzer	A IT	
T 4	BH120-1032-M2	Tool, Torque Nut	IN	
T 5	BL-6529	Wrench, Spline	IN	
T 6	JS953	Kit, Hydraulic	RP	3-4, 3-5
T 7	JTB Model 33FS	Meter, Frequence	T	
T 8	LTCT400	Trailer, Engine	R/IN	
T 9	LTCT434	Stand, Engine	R/IN	
T 9.1	LTCT744	Mobile Engine Test Unit	T	

Table 1-2. Special Tools and Test Equipment (Cont)

ITEM NO.	PART NO.	NOMENCLATURE	USABILITY CODE CALIBRATION	FIGURE REFERENCE
T 10	LTCT773	Sling, Engine Lift	R/IN/RP	4-43
T 10.1	MP-1	Variable Pressure Tester 0 to 150 psi	I/T	
T 11	P01201	Wrench, Power	R/IN	5-7
T 12	PD2659	Socket, Mast Nut	RAN	5-7
T 13	PD2660	Adapter, Reaction Torque	RAN	5-7
T 14	Replaced by TII			
T 15	PD2657	Plate, Anchor	A	
T 16	PD2658	Socket, Splined	R/IN	
T 17	SWE13852-1210	Arm, Engine	R/IN/RP	4-44
T 18	SWE13852-1510	Base, Engine Adapter (SWE13851)	R/IN/RP	4-44
T 19	SWE13852-40	Adapter	R/IN/A	
T 20	SWE13852-500	Adapter	R	
T 21	SWE13855	Stand, Transmission	R/N/A	
T 21.1	TE 12062	Mobile Engine Test Unit	T	
T 22	T100220	Slings, Lifting	RAN	
T 23	T100615-13LW	Fixture Lockwire	IN	
T 24	T555-7	Tool, Seal Installation	A	
T 25	T205-076-099-2	Adapter, Torque	R/D/A	
T 26	T100929	Jack Screws	A/R	
T 27	T101303	Socket	A	
T 28	T101304	Adapter	A	
T 28.1	T101305	Wrench, Splined	D/A	

Table 1-2. Special Tools and Test Equipment (Cont)

ITEM NO.	PART NO.	NOMENCLATURE	USABILITY CODE CALIBRATION	FIGURE REFERENCE
T 29	T101306	Wrench, Splined	D/A	
T 30	T101307	Wrench, Outer Coupling	D/A	
T 31	T101308	Jack Screws	D/A/R	
T 32	T101330	Fixture, Cyclic Stick	AD	
T 33	T101338	Jack Screws	D	
T 34	T101356	Bench, Buildup	AD/D/A/R/IN	
T 35	T101365	Fixture, Quill	R/D/A	
T 36	T101369	Assembly, Support	D/A	
T 37	T101382	Assembly, Ram	D/A	
T 38	PD1469	Wrench	D/A	
T 38.1	PD1470	Socket, Collect	R/IN	
T 38.2	PD1471	Extension, Socket	R/IN	
T 39	T101400	Assembly, Support	AD	
T 40	T101401	Assembly, Scope	AD	
T 41	T101402	Links, Grip Positioning	AD/R/IN/A	
T 42	T101406	Puller, Bearing	D	
T 43	T101407	Tool, Seal Bearing	D	
T 44	T101412	Tool, Grip Spacing	D/A	
T 45	T101414	Wrench	R/IN	
T 46	Deleted			
T 47	T101419	Tool Set, Alignment Engine to Transmission Driveshaft	AD	6-3
T 48	T101420	Fixture, Holding	D/A	
T 49	T101421	Plate, Adapter Buildup Bench	AD/R/D/A/IN	
T 50	T101424	Bar, Bearing Removal	D/A	

Table 1-2. Special Tools and Test Equipment (Cont)

ITEM NO.	PART NO.	NOMENCLATURE	USABILITY CODE CALIBRATION	FIGURE REFERENCE
T 51	T101440	Jack, Transmission Leveling	AD	6-2
T 52	T101449	Wrench, Retaining Nut, Quill	D/A	
T 53	T101452	Hoist, Maintenance	AD/R/l N/A	1-12, 1-13,4-4
T 54	T101455	Fixture, Holding	D/A	
T 55	T101456	Wrench	A	
T 56	T101457	Tool, Grip Spacing	A	
T 56.1	T101485	Gage, Main Rotor Blade Trim Tab	AD	
T 56.2	T101468	Flap Stops	AD	
T 56.3	T101467	support	AD	
T 56.4	Same as T 53			
T 56.5	T101474	Grip Spacing Tool	AD	
T 56.6	T101475	Bearing Removal Tool	R	
T 56.7	T101487	Bearing Installation Tool	IN	
T 56.8	4920-EG-185	Gage	AD	5-4.1
T 57	T101488	Wrench	A/R/D	
T 57.1	T101491	Bearing Puller	R	
T 58	Deleted			
T 58.1	T101525	Bender, Main Rotor Blade Trim Tab	AD	
T 59	T101559	Gage, Grip Spacing	AD	
T 59.1	T101586	Pusher Set	IN	
T 60	T101600	Wrench, Retaining Nut	D/A	
T 61	T107640	Trailer, Engine	R	
T 61.1	T101864	Grip Positioning Links	AD	

Table 1-2. Special Tools and Test Equipment (Cont)

ITEM NO.	PART NO.	NOMENCLATURE	USABILITY CODE CALIBRATION	FIGURE REFERENCE
T 62	T101865	Stops, Flap	AD	
T 62.1	T41000310-1	Torque Adapter	AD	
T 62.2	T204-076-162-3	Retainer Block	D/A	
T 63	T41000870-1	Adapter, Torque	A	
T 64	XW20509	Wrench	R/IN	
T 64.1	204-040-929-29	Cover and Lift Plate	R/iN	6-18
T 65	1560-UH1-772-1	Cable, Extender	T	9-9
T 66	1560-VH1-772-2	Cable, Jumper	T	9-9
T 67	204-076-202-100B	Wrench, Spanner	I	
T 68	387011	Bridge, Automatic (Simmonds) capacitance	T	
T 68.1	PSD60-1AF	Tester Bridge Capacitance	T	8-7.1
T 68.2	PSDAF-537	Cable Assembly (T-Cable)	T	8-7.2
T 69	Deleted			
T 70	4920-EG-008	Stand, Engine	R/IN	
T 71	49208975623	Stand, Engine	R/IN	
T 72	67SPL1275-0114	Tool	D/A	
T 72.1	68SAVAED0221	Tool	A/I	
T 72.2	68SPL-12757-0136	Tool, Seal Retaining Nut	R/IN	
T 73	7A050	Kit, Balancing	AD	5-22, 5-23
T 74	7FA18005-50	Wrench	R/IN	
T 75	Deleted			
T 76	Use T82 and T83			
T 77	7HEL061	Kit, Balancing	AD	5-23
T 78	7HEL065	Kit	AD	
T 78.1	204-011 -178-1	Clevis Assembly, Lifting	R/IN	1-8
T 78.2	7HEL066	Kit	AD	
T 79	2201	Spacer	AD	

Table 1-2. Special Tools and Teat Equipment (Cont)

ITEM NO.	PART NO.	NOMENCLATURE	USABILITY CODE CALIBRATION	FIGURE REFERENCE
T 80	2215	Wheel, Hand	AD	
T 81	2259	Arbor, Balancing	AD	5-23
T 82	2337	Fixture	AD	5-23
T 83	2467	Sleeve	AD	5-23
T 84	2486	Gage, Strut Positioning	AD	5-23
T 85	2586	Plate, Special Tool	AD	
T 86	2588	Adapter	AD	5-23
T 86.1	205-076-099-2	Torque Fixture	A	
T 87	T-27872-2 T-27872-11	Taper, Reamer	A	
T 88	D-5A	Hydraulic Test Stand	T	
T 89		Gage	T	
T 90	TTU-27E	Tachometer Tester	T/I	
T 90.1	71SAVAE-D0009	Fixture, Locating and Drilling	RP	
T 91	NA-2	Thermometer Tester Electric, Field Type	T	
T 92	SWE126377	Socket	R/IN	
T 93	SWE124387	Anchor Plate	R/IN	
T 94	SWE103	Torque Multiplier	R/IN	
T 95	SWE67	Ratchet Socket	R/IN	
T 96	SWE63	Work Handle	R/IN	
T 97	SWE54	Torque Wrench	R/IN	
T 98	S22	Bushing Tool	I	
T 98.1	36D2844	Propeller Protractor	I	
T 99	S135	Packing Seating Tool	I	
T 99.1	T101873	Tool Kit, Bearing Staking	RP	
T 99.2	7199-1	Test Stand, Aircraft Generator	R/P	
T 100	K747-401-1	Blade Repair Fixture	RP	5-26.10

Table 1-2. Special Tools and Teat Equipment (Cont)

ITEM NO.	PART NO.	NOMENCLATURE	USABILITY CODE CALIBRATION	FIGURE REFERENCE
T 101		Heater Blankets Temp. Regulated To 140-160°F, 110 VAC	RP	
T 102	Deleted.			
T 103	4310-00-055-0666	Vacuum Pump	RP	
T 104	Deleted.			
T 105	Deleted.			
T 106	TY9CL2STA	Gage, Gap Setting		6-54.2

1-26. SUPPORT EQUIPMENT.

1-27. Description — Support Equipment. Support equipment will include all equipment authorized for use in support of this helicopter. This listing will be in alphanumerical order and be listed in table 1-3. When an equipment number is unkown It maybe focated through the alphanumerical arrangement within the table.

Table 1-3. Support Equipment

ITEM NO.	PART NUMBER	NOMENCLATURE
1	AA1730-1301	Kit, Aircraft Mooring
2	AA1730-1301-7	Driving Rod Assembly Aircraft Mooring
3	AA1730-1301-9	Eye Assembly Aircraft Mooring
4	AA1730-1301-10	Anchor Guy, Aircraft Mooring
5	AA1730-1301-36	Rod, Aircraft Mooring
6	Deleted	
7	SW1961-2	Tiedown Assembly, Rotor
8	SW4737-1	Tiedown Assembly, Rotor Blade

Table 1-3. Support Equipment (Cont)

ITEM NO.	PART NUMBER	NOMENCLATURE
9	214-706-104-101	Truck, Helicopter, Ground
10	204-070-464-1	Cover Assembly, Engine Exhaust
11	204-070-478-1	Cover Pylon Assembly
12	204-706-058-1	Adapter Kit, Wheel Loading
13	205-070-675-7	Cover Assembly
14	205-070-675-11	Cover, Aircraft Ground

1-28. Standard Torque Procedures and Requirements. Standard torque values are not called out for individual maintenance procedures in this manual. Use the Standard Torque Charts, table 1-4, to determine the correct standard torque. The torque values specified in table 1-4 are based on bolt strength, nut strength, and loading application. The charts allow for determination of proper torque value based on the bolt and nut combination used. To determine the specific chart to be used, determine the designation of both the bolt and nut combination to be tightened, find the chart in which both the bolt and nut are listed, and torque to the value specified for the thread size to be used. In those cases where special torque values are required, the special torque is given in the assembly instructions.

a. Requirements Governing Application of Torque Loads.

(1) Torque is expressed in inch-pounds or foot-pounds. One inch-pound (or one foot-pound) is the twisting force of one pound applied to a twist-type fastener (as a bolt or nut) with one inch (or one foot) of leverage. This twisting stress is applied to the fastener to secure the component. The torque values are listed as either standard or special torques. Use the standard torque values listed in tables 1-4 through 1-6.

(2) Manufacturer-applied lubricant must not be removed nor additional lubricant added.

(3) The bolts, nuts, and the surfaces they bear on must be clean, dry, and free of lubricant (except as stated in (2), above).

(4)The turning (drag) torque required to install a self-locking nut up to the point of final tightening must always be added to the final torque value specified in table 1-4 or the maintenance instruction, as applicable.

(5) Torques specified in maintenance instructions are special torques that take precedence over those in table 1-4.

(6) Bolts and screws with strength of less than 125,000 psi do not require a mandatory torque value. The nut-bolt combination will be tightened sufficiently to make a satisfactory joint.

(7) Bolts and screws with strength of 125,000 psi or higher must be torqued to table 1-4 value (except as stated in preceding. substep (5)).

(8) If extensions are used such that the extension and the torque wrench are not at right angles (90°) to each other, the wrench or indicator reading must be corrected. (Refer to TM 55-1 500-204-25/1.)

(9) Any reuse of self-locking nuts will be governed by the values in table 1-4 and paragraph 1-29.

(10) The bolt must not be rotated during installation or torquing.

b. Installation of Castellated Nuts on Nonrotating (Static) Parts. Maximum applied torque must not exceed the applicable values in table 1-4.

Table 1-4. Standard Torque Chart (Sheet 1 of 5)

TORQUE VALUE CHART I
(*For 125 ksi Bolts - Shear Application)

BOLT	NUT	BOLT THREAD SIZE	RECOMMENDED INSTALLATION TORQUE RANGE	MAXIMUM ALLOWABLE TIGHTENING TORQUE
AN3 thru AN20 AN21 thru AN37 AN42 thru AN49 AN173 thru AN186 AN509 AN525	AN316 AN320 AN341 AN345 AN364	10-32	12 to 15 in.-lb.	25in.-lb.
		1/4-28	30 to 40 in. -lb.	60 in. -lb.
		5/16-24	60 to 85 in. -lb.	140 in.-lb.
MS20004 thru MS20024 MS20033 thru MS20046 MS20073 thru MS20081 MS24694 MS27039	AN150401 thru AN150425 MS20341 MS20364 MS21083	3/8-24	95 to 110 in.-lb.	240 in.-lb.
		7/1 6-20	270 to 300 in. -lb.	500 in. -lb.
		1/2-20	24 to 34 ft.-lb.	55 ft.-lb.
NAS144 thru NAS158 NAS220 thru NAS227 NAS333 thru NAS340 NAS464 NAS517 NAS583 thru NAS590 NAS623 NAS1003 thru NAS1020 NAS1202 thru NAS1210 NAS1218 NAS1297 NAS1303 thru NAS1320 NAS1351 (Non-Locking) NAS1352 (Non-Locking) ALL THREADED STUDS	MS25082 MS35650 MS35691 MS51968 NAS1022	9/16-18	40 to 50 ft.-lb.	80 ft.-lb.
		5/8-18	55 to 65 ft.-lb.	116 ft.-lb.
		3/4-16	108 to 125 ft.-lb.	250 ft.-lb.
		7/8-14	125 to 150 ft.-lb.	350 ft.-lb.
		1-12	183 to 275 ft.-lb.	500 ft.-lb.
		1 1/8-12	250 to 350 ft.-lb.	750 ft.-lb.
		1 1/4-12	450 to 550 ft.-lb.	1250 ft.-lb.

* 1 ksi (kip per square inch)= 1000 psi

NOTES: 1. The above values apply to any combination of bolt and nut shown.
2. The drag torque must be added to the recommended torque for self-locking nuts.

Table 14. Standard Torque Chart (Sheet 2 of 5)

TORQUE VALUE CHART II
(*For 125 ksi Bolts - Tension Application)

BOLT	NUT	THREAD SIZE	RECOMMENDED INSTALLATION TORQUE RANGE	MAXIMUM ALLOWABLE TIGHTENING TORQUE
AN3 thru AN 20 AN42 thru AN49 AN173 thru AN186 AN509 AN525 MS20033 thru MS20046 MS20073 thru MS20081 MS24694 MS27039 NAS220 thru NAS227 NAS333 thru NAS340 NAS517 NAS623 NAS1003 thru NAS1020 NAS1202 thru NAS1210 NAS1297 NAS1352 (Non-locking) ALL THREADED STUDS	AN256 AN310 AN315 AN362 AN363 AN365 AN366 AN121576 thru AN121600 MS9358 MS20365 MS20500 MS21042 thru MS21045 MS21047 thru MS21049 MS21051 thru MS21056 MS21058 thru MS21062 MS21069 MS21076 MS21083 MS21086 MS21208 MS21209 MS21991 MS124651 thru MS124850 MS122076 thru MS122275 NAS509 NAS577 NAS671 NAS679 thru NAS687 NAS696 thru NAS698 NAS1021 NAS1023 NAS1031 NAS1033 NAS1067 NAS1068 NAS1291 NAS1329 NAS1330 NAS1473 NAS1474 80-004 thru 80-007 80-013 90-002 90-003 110-061 110-062	10-32	20 to 25 in.-lb.	40 in.-lb.
		1/4-28	50 to 70 in.-lb.	100 in.-lb.
		5/16-24	100 to 140 in.-lb.	225 in.-lb.
		3/8-24	160 to 190 in.-lb.	390 in.-lb.
		7/16-20	37 to 42 ft.-lb.	70 ft.-lb.
		1/2-20	40 to 58 ft.-lb.	91 ft.-lb.
		9/16- 18	66 to 83 ft.-lb.	133 ft.-lb.
		5/8-18	91 to 108 ft.-lb.	200 ft.-lb.
		3/4-16	191 to 208 ft.-lb.	416 ft.-lb.
		7/8-14	**208 to 250 ft.-lb.**	**583 ft.-lb.**
		1-12	**308 to 458 ft.-lb.**	**833 ft.-lb.**
		1 1/8-12	**416 to 583 ft.-lb.**	**1250 ft.-lb.**
		1 1/4-12	750 to 916 ft.-lb.	2083 ft.-lb.

" 1 ksi (kip per square inch)= 1000 psi

NOTES: 1. The above values apply to any combination of bolt and nut shown.
2. The drag torque must be added to recommended torque for self-locking nuts.

Table 1-4. Standard Torque Chart (Sheet 3 of 5)

TORQUE VALUE CHART III

(*For 160 ksi Bolts - Shear Application)

BOLT	NUT	THREAD SIZE	RECOMMENDED INSTALLATION TORQUE RANGE	MAXIMUM ALLOWABLE TIGHTENING TORQUE
MS20004 thru MS20024 NAS144 thru NAS158 NAS583 thru NAS590 NAS1218 NAS1303 thru NAS1320 NAS1351 (Non-locking)	AN256 thru AN310 AN315 AN362 thru AN366 AN121576 thru AN121600 MS9358 MS20365 MS20500 MS21043 thru MS21045 MS21047 thru MS21049 MS21051 thru MS21056 MS21058 thru MS21062 MS21069 thru MS21076 MS21083 MS21086 M321208 MS21209 MS21991 MS124651 thru MS124850 MS122076 thru MS122275 NAS3509 NAS671 NAS679 thru NAS687 NAS696 thru NAS698 NAS1021 thru NAS1023 NAS1031 NAS1033 NAS1067 NAS1068 NAS1329 NAS1330 NAS1473 NAS1474 80-004 thru 80-007 80-013 90-002 90-003	10-32	20 to 25 in.-lb.	40 in.-lb.
		1/4-28	50 to 70 in.-lb.	100 in.-lb.
		5/16-24	100 to 140 in.-lb.	225 in.-lb,
		3/8-24	160 to 190 in.-lb.	390 in.-lb.
		7/16-20	37 to 42 ft.-lb.	70 ft.-lb,
		1/2-20	40 to 58 ft.-lb.	91 ft.-lb.
		9/16-18	66 to 83 ft.-lb.	133 ft.-lb.
		5/8-18	91 to 108 ft.-lb.	200 ft.-lb.
		3/4-16	191 to 208 ft.-lb.	416 ft.-lb.
		7/8-14	208 to 250 ft.-lb.	583 ft.-lb.
		1-12	308 to 458 ft.-lb.	833 ft.-lb.
		1 1/8-12	416 to 583 ft.-lb.	1250 ft.-lb.
		1 1/4-12	750 to 916 ft.-lb.	2083 ft.-lb.

ž1 ksi (kip per square inch)= 1000 psi

VOTES: 1. The above values apply to any combination of bolt and nut shown
2. Drag torque must be added to recommended torque for self-locking nuts.

Table 1-4. Standard Torque Chart (Sheet 4 of 5)

TORQUE VALUE CHART IV (For 160 ksi Bolts - Tension Application)				
BOLT	NUT	THREAD SIZE	RECOMMENDED INSTALLATION TORQUE RANGE	MAXIMUM ALLOWABLE TIGHTENING TORQUE
MS20004 thru MS20024 NAS144 thru NAS158 NAS583 thru NAS500 NAS1218 NAS1303 thru NAS1320 NAS1351 (Non-locking)	MS21042 NAS577 NAS1291	10-32	30 to 40 in. -lb.	70 in.-lb,
		1/4-28	75 to 95 in.-lb.	170 in.- lb.
		5/16-2-4	120 to 160 in.-lb.	340 in.-lb.
		3/8-24	25 to 28 ft.-lb.	53 ft.-lb.
		7/16-20	39 to 43 ft.-lb.	83 ft.-lb.
		1/2- 20	53 to 71 ft.-lb.	125 ft.-lb.
		9/18-18	83 to 100 ft.-lb.	183 ft.-lb.
		5/8-18	116 to 133 ft.-lb.	250 ft. -lb.
		3/4-16	200 to 216 ft.-lb.	444 ft.-lb.
		7/8-14	333 to 375 ft.-lb.	708 ft.-lb.
		1-12	433 to 583 ft.-lb.	1041 ft.-lb.
		1 1/8-12	691 to 858 ft.-lb.	1541 ft.-lb.
		1 1/4-12	1441 to 1608 ft.-lb.	3041 ft.-lb.

*1 ksi (kip per square inch)= 1000 PSI

NOTES: 1. The above values apply to any combination of bolt and nut shown.
2. Drag torque must be added to recommended torque for self-locking nuts.

Table 1-4. Standard Torque Chart (Sheet 5 of 5)

TORQUE VALUE CHART V

BOLTS

AN3 thru AN20
AN42 thru AN49
AN173 thru AN186

NAS144 thru 158
NAS333 thru NAS340

NAS464
NAS1003 thru NAS1020
NAS1202 thru NAS1210
NAS1297
NAS1303 thru NAS1320

SELF-LOCKING CASTELLATED NUTS

THREAD SIZE	MS 17826 NUT (THIN) RECOMMENDED INSTALLATION TORQUE RANGE	MS 17826 NUT (THIN) MAXIMUM ALLOWABLE TIGHTENING TORQUE	MS 17825 NUT RECOMMENDED INSTALLATION TORQUE RANGE	MS 17825 NUT MAXIMUM ALLOWABLE TIGHTENING TORQUE
10-32	7 to 12 in.-lb.	20 in. -lb.	12 to 15 in. -lb.	35 in.-lb.
1/4-28	25 to 35 in. -lb.	45 in.-lb.	30 to 40 in.-lb.	80 in.-lb.
5/16-24	50 to 70 in.-lb.	90 in. -lb.	60 to 85 in.-lb.	225 in.-lb.
3/8-24	70 to 90 in.-lb.	125 in.-lb.	95 to 110 in.-lb.	325 in.-lb.
7/1 6-20	110 to 150 in.-lb.	225 in. -lb.	270 to 300 in. - lb.	575 in.-lb.
1/2-20	150 to 200 in.-lb.	300 in.-lb.	24 to 34 ft. -lb.	75 ft.-lb.
9/16-18	200 to 300 in.-lb.	400 in. -lb,	40 to 50 ft.-lb,	91 ft.-lb.
5/8-18	300 to 420 in.-lb.	600 in.-lb.	55 to 65 ft.-lb.	133 ft.-lb.
3/4-16	45 to 62 ft.-lb.	91 ft.-lb.	108 to 125 ft.-lb.	233 ft.-lb.
718-14	79 to 96 ft.-lb.	158 ft.-lb.	125 to 150 ft.-lb.	383 ft.-lb.
1-12	125 to 150 ft.-lb,	250 ft.-lb.	183 to 275 ft.-lb.	566 ft.-lb.
1 1/8-12	208 to 292 ft.-lb.	416 ft.-lb.	250 to 350 ft.-lb.	833 ft.-lb.
1 1/4-12	292 to 375 ft.-lb.	583 ft.-lb.	450 to 550 ft.-lb.	1166 ft.-lb.

NOTES: 1 The above values apply to any combination of bolt and nut shown.
2 The maximum torque allowable is based on the strength of the nut.

RECOMMENDED TORQUE* VALUES FOR CONICAL SEALS

Tubing O.D. Inches	Seal Dash No.	All Alum. System except 6061-T6 Aluminum Seal	All Alum. 6061-T6 System Aluminum Seal	All Cres. & Steel System Copper Seal	All Cres. & Steel System Nickel Seal	All Cres. & Steel System Stainless Steel Seal	Aluminum "B" Nut & Sleeve Cres. Fitting Tin Plated Aluminum Seal	Cres. & Steel "B" Nut & Sleeve Alum. Fitting Tin Plated Copper Seal	Alum. "B" Nut Stainless Sleeve Alum. Fitting Tin Plated Copper Seal
1/8	- 2	30 - 50	35 - 65	80 - 90	90 - 100	90 - 100	35 - 65	70 - 80	70 - 80
3/16	- 3	35 - 60	35 - 70	100 - 110	110 - 125	110 - 125	35 - 70	90 - 100	90 - 100
1/4	- 4	40 - 65	70 - 120	150 - 165	165 - 190	165 - 190	70 - 120	135 - 150	135 - 150
5/16	- 5	60 - 80	80 - 130	200 - 220	225 - 250	225 - 250	80 - 130	180 - 200	180 - 200
3/8	- 6	75 - 125	130 - 180	300 - 330	335 - 375	335 - 375	130 - 180	270 - 300	270 - 300
1/2	- 8	150 - 250	300 - 400	500 - 550	575 - 625	575 - 625	300 - 400	450 - 500	450 - 500
5/8	-10	200 - 350	430 - 550	710 - 770	810 - 875	810 - 875	430 - 550	650 - 700	650 - 700
3/4	-12	300 - 500	650 - 800	990 - 110	1125 - 1250	1125 - 1250	650 - 800	900 - 1000	900 - 1000
1	-16	500 - 700	900 - 1100	1300 - 1550	1500 - 1750	1500 - 1750	900 - 1100	1200 - 1400	1200 - 1400
1 1/4	-20	600 - 900	1200 - 1450	1650 - 1950	1875 - 2250	1875 - 2250	1200 - 1450	1500 - 1800	1500 - 1800
1 1/2	-24	600 - 900	1550 - 1850	2200 - 2500	2500 - 2850	2500 - 2850	1550 - 1850	2000 - 2300	2000 - 2300
1 3/4	-28	700 - 1000	2000 - 2350	2800 - 3150	3250 - 3600	3250 - 3600	2000 - 2350	2600 - 2900	2600 - 2900
2	-32	800 - 1100	2500 - 2900	3500 - 3950	4000 - 4500	4000 - 4500	2500 - 2900	3200 - 3600	3200 - 3600

Table 1-4.1 Torque Value Chart for Conical Seal

* Torque values in inch-pounds.

Table 1-5. Torque Values for Fluid Connectors

*FLUID CONNECTORS TORQUE VALUE CHART						
TUBE sIZE	AN818		HOSE END FITTINGS AND HOSE ASSY (MS328740 AND MS28759)	NAS591 THRU NAS596		
	AL TUBING (FLARE MS33583 OR MS33584)	STEEL TUBING (FLARE MS33584)		DASH NO.	STEEL TUBING	AL. TUBING
3/16	30 to 40 in.-lb.	90 to 100 in.-lb.	70 to 100 in. - lb.			
1/4	40 to 65 in. -lb.	135 to 150 in. -lb.	70 to 120 in. - lb.	4	60 to 90 in.-lb.	48 to 96 in. - lb.
5/16	60 to 80 in. -lb.	180 to 200 in.-lb.	85 to 180 in. - lb.	5	66 to 108 in. -lb.	60 to 108 in. -lb.
3/8	75 to 125 in. - lb.	270 to 300 in. -lb.	100 to 250 in. - lb.	6	72 to 120 in.-lb.	72 to 120 in. -lb.
1/2	150 to 250 in. - lb.	450 to 500 in. -lb.	210 to 420 in. -lb.	8	144 to 232 in.-lb.	120 to 216 in. -lb.
5/8	200 to 350 in. -lb.	54 to 58 ft.-lb.	300 to 480 in.-lb.	10	204 to 360 in.-lb.	144 to 360 in. -lb.
3/4	300 to 500 in. -lb.	75 to 83 ft. -lb.	41 to 70 ft.-lb.	12	300 to 540 in. -lb.	216 to 540 in. -lb.
1	41 to 58 ft.-lb.	100 to 116 ft.-lb.	58 to 95 ft. -lb.	16	42 to 58 ft.-lb.	480 to 696 in.- lb.
1 1/4	50 to 75 ft.-lb.			20	50 to 75 ft.-lb.	50 to 75 ft. - lb.
1 1/2	50 to 75 ft.-lb.			24	50 to 75 ft.-lb.	50 to 75 ft.-lb.
1 3/4				28	60 to 90 ft.-lb.	62 to 90 ft.-lb.
2				32	75 to 110 ft.-lb.	75 to 110 ft.-lb.
2 1/2				40	150 to 175 ft.-lb.	110 to 150 ft.-lb.
3				48	150 to 175 ft.-lb.	
4				64	200 to 225 ft.-lb.	

l Flare less tubing connections shall be tightened as follows:
Tighten the MS21921 nut 1/6 to 1/3 turn (1 to 2 flats) Past point of sharp torque rise on all sizes and materials. The l/16 to 1/3 turn (preformed after the Presetting operation) is the final installation torque.

Table 1-6. Torque Values for Studs

STEPPED STUDS				STRAIGHT STUDS			
Types A and B are driven from nut end,				Types X and Y are driven from nut end.			
	Type A					Type X	Type Y
Stud Size				Stud Size			
Nut End	Stud End	Torque Value Pound - Inches		Nut * End	Stud End	Torque Value Pound - Inches	
10-32	1/4-20	30- 40	30- 40	10-32	10-24		30- 40
1/4-28	5/16-18	50- 110	50- 80	1/4-28	1/4-20	50- 95	50- 70
5/16-24	3/8-16	100- 240	100- 160	5/16-24	5/16-18	100- 225	100- 130
3/8-24	7/16-14	175- 475	175- 325,	3/8-24	3/8- 16	175- 375	175- 250
9/16-20	1/2-13	250- 725	250- 525	7/16-20	7/16- 14	250- 650	250- 400
1/2-20	9/16-12	400-1150	400- 850	1/2-20	1/2-13	400-1000	400- 700
9/16-18	5/8-11	600-1650	600-1150	9/16-18	9/16-12	600-1450	500-1050
5/8-18	11/16-11	900-2400	900-1700	5/8- 18	5/8-11	900-2000	700-1400

* For nut torque refer to applicable chart for type of nut used.

c. Installation of Castellated Nuts on Rotating (Dynamic) Parts. When tightening castellated nuts on bolts, it is possible that the cotter pin holes will not line up with the slots in the nuts for the range of recommended installation torques. In such a case, the nut may be over-tightened just enough to line up the nearest slot with the cotter pin hole, but the maximum applied torque must not exceed MAXIMUM ALLOWABLE in table 1-4.

CAUTION

Ensure that stack-up of the bolted joint will not allow the bolt to bottom in the hole.

d. When tightening the bolt head end is necessary, tighten to the high limit of the torque specified. If drag friction is evident during installation, add the drag torque to the torque value specified. Where the maintenance instructions do not specify torque for a bolt installed in a threaded hole, use torque value chart II, 125 ksi tension application.

e. Torque-Tightening Procedures.

(1) Tighten at a uniformly increasing rate until the desired torque is obtained. In some cases, where gaskets or other parts cause a slow permanent set, the torque must be held at the desired value until the material is seated or retorqued after a period of time.

NOTE

When applying torque to a series of bolts on a flange or in an area, select a median value. If some bolts in a series are torqued to a minimum value and others to a maximum, force is concentrated on the tighter bolts and is not distributed evenly. Such unequal distribution of force may cause bolt failure.

(2) It is not desirable to tighten to the final torque value during the first drawdown; uneven tension can cause distortion or overstressing of parts. Seat and torque mating parts by gradually drawing down the bolts or nuts until the parts are seated firmly. Then loosen each one separately and apply final tightening. Tightening, in a diametrically opposite (staggered) sequence is desirable in most cases. Do not exceed listed maximum torque values.

CAUTION

When chilling or heating parts during assembly, do not torque nuts or bolts until the part returns to room temperature. If the part has been heated, the fastener may loosen as the part cools. If the part has been chilled, the fastener may be overstressed as the part expands.

f. Hose and Tube Fitting Assembly Procedures. (Figure 1-4.)

g. Decimal Equivalent Conversions. (Figure 1-5.)

h. Dimensions and Tolerances.

(1) Dimensions in this manual are normally in inches, unless otherwise specified, and decimal fractions thereof Common fractions are used to refer to rivets, cables, raw stock, and other items supplied in fractional sizes, and sometimes for an estimated or nominal dimension which cannot or need not be more precise. Angles are stated in degrees and common fractions.

FITTINGS INTO COMPONENT BOSSES

1. Assembly the fitting by first running the nut over the thread relief between the two threaded sections, and on to the upper thread so that the nut recess faces the thread relief and projects about 1/32 inch over it,

2. Grasp the backup ring by the O.D. and squeeze between thumb and forefinger, Thread the end of the fitting into the inside diameter so that the bevel shaped backup ring has the bowed-out position toward the nut. Do not use any lubricant. Thread the fitting all the way through backup ring until washer is free at the relief section. Pick off any slivers of plastic material that may be cut free by this process.

3. Press the backup ring into the nut recess, Bring the nut down to meet the backup ring at the relief section so that the fitting threads will not interfere with placement of the backup ring.

4. Lubricate the male threads of fitting and packing. Assemble the packing to the fitting and position the nut so that the packing is pressed against the lower threaded section.

5. Install the bulkhead fitting assembly into the boas until packing contacts the boss countersink, Then, holding the nut in position, turn the fitting in from 1-1/2 - 2-1/2 turns, according to the outlet position desired. Tighten the nut to the proper torque.

(2) Tolerances on dimensions in decimal fractions of an inch can be determined by the number of decimal places, unless otherwise specified, as shown below. Tolerances on angles are in common fractions of a degree.

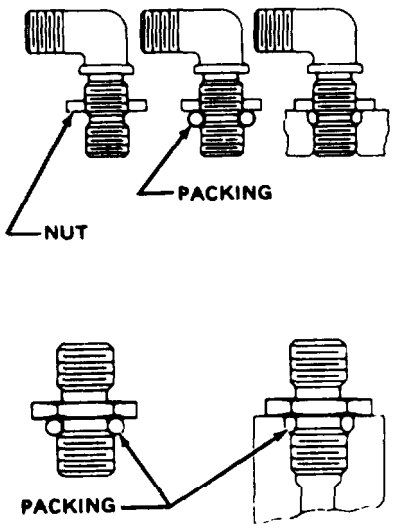
1-29. Reuse of Self-Locking Nuts. The following information provides application and reuse procedures for self-locking nuts. For additional information, refer to TM 55-1500-204-25/1.

WARNING

Self-locking nuts shall not he rewed in application where failure could cause loss of the aircraft or endanger life.

a. General. New self-locking nuts or bolts provide tight connections which will not loosen under vibration. Self -locking nuts or bolts approved for use

Figure 1-4. Hose and Tube Fitting – Assembly Procedures (Sheet 1 of 2)



BULKHEAD FITTING

1. Lubricate the fitting end. Assemble the nut to the fitting until the washer face of the nut lines up with the upper corner of the seal groove.
2. Lubricate the packing and assemble the packing to the groove on the fitting so that it contacts the nut.
3. Screw the fitting and nut simultaneously into the boss until the seal contacts the chamfer at the face of the boss and until the nut contacts the boss.
4. Position the fitting by either turning in as much as 3/4 turn (+270 degrees) or turning out as much as 1/4 turn (-90 degrees). Assemble the line to the fitting to check the alignment of the fitting. Tighten the nut to the proper torque.

UNION

1. Lubricate the packing and assemble the packing to the relief on the union.
2. Thread the union into the box until contact is made with the surface of the boss.
3. Tighten the union to the proper torque value.

Figure 1-4. Hose and Tuba Fitting – Assembly Procedures (Sheet 2 of 2)

on aircraft meet critical specifications as to strength, corrosion-resistance and temperatures. Reuse of self-locking nuts or bolts are limited to those nuts and bolts that meet the minimum requirements established in table 1-7 for drag or breakaway torque values.

(1) Self-locking nuts come in two general types: metallic lock type which are all metal, and nonmetallic which have nonmetallic locking insert. Nonmetallic self-locking nuts should not be subject to temperatures in excess of 250°F.

(2) Self-locking bolts come in three general types: a round pellet, a hex pellet, or a trip type insert is placed in the threaded area to provide the self-locking feature. In addition to checking for breakaway torque values listed in table 1-7, the bolts should be checked for loose or missing inserts.

b. Application. Bolts, studs, or screws of 5/16-inch diameter and over, with cotter pin holes, may be used with self-locking nuts provided the cotter pin holes are free from burrs. Burrs on cotter pin holes tend to tear the nonmetallic inserts. Bolts and screws of 1/4-inch diameter and under, with cotter pin holes, may be used with self-locking nuts only in an emergency for circle red X condition (one time flight). They will be replaced before the next flight with the specified type. Observe torque notes on illustrations and text where applicable to prevent clamp-up on lugs to avoid preloading of the control system components due to improper torque. The nuts which are attached to the structure must be attached in a positive manner to eliminate the possibility of their rotating or misaligning when the tightening is to be accomplished by rotating the bolts or screws. The manner of attachment must permit removal without injury to the structure and the replacement of the nuts. Round or chamfered-end bolts must extend at least the full round or chamfer through the nut. Flat end bolts must extend at least 1/32-inch through the nut.

Fraction	Decimal Equivalent
1/64	0.015625
1/32	0.03125
3/64	0.046875
1/16	0.0625
5/64	0.078125
3/32	0.09375
7/64	0.109375
1/8	0.125
9/64	0.140625
5/32	0.15625
11/64	0.171875
3/16	0.1875
13/64	0.203125
7/32	0.21875
15/64	0.234375
1/4	0.250
17/64	0.265625
9/32	0.28125
19/64	0.296875
5/16	0.3125
21/64	0.328125

Fraction	Decimal Equivalent
11/32	0.34375
23/64	0.359375
3/8	0.375
25/64	0.390625
13/32	0.40625
27/64	0.421875
7/16	0.4375
29/64	0.453125
15/32	0.46875
31/64	0.484375
1/2	0.500
33/64	0.515625
17/32	0.53125
35/64	0.546875
9/16	0.5625
37/64	0.578125
19/32	0.59375
39/64	0.609375
5/8	0.625
41/64	0.640625
21/32	0.65625

Fraction	Decimal Equivalent
43/64	0.671875
11/16	0.6875
45/64	0.703125
23/32	0.71875
47/64	0.734375
3/4	0.750
49/64	0.765625
25/32	0.78125
51/64	0.796875
13/16	0.8125
53/64	0.828125
27/32	0.84375
55/64	0.859375
7/8	0.875
57/64	0.890625
29/32	0.90625
59/64	0.921875
15/16	0.9375
61/64	0.953125
31/32	0.96875
63/64	0.984375

Figure 1-5. Decimal Equivalent Conversions

CAUTION

If any size self-locking nut under 3/8-inch can be run down with the fingers after the locking feature engages the bolt or stud, indicating the locking friction does not exist, the nut or friction device shall be replaced. These values for self-locking nuts over 3/8-inch are to be used only for determining continued serviceability. The values apply only when the nut is being run down on the mating threads prior to reaching the clamp-up point. Standard torque values for final tightening are shown in table 1-4.

NOTE

The final torque value for self-locking nuts must be determined by adding the free running torque (torque wrench reading) to the specified torque value. (The free running torque is the torque required to overcome the friction of the nut running down the bolt thread prior to tightening.)

Table 1-7. Minimum Breakaway Torque (Note 1) For Used All-Metallic and Nonmetallic Self-Locking Nuts

NUT SIZE	MINIMUM BREAKAWAY TORQUE (IN-LBS) (NOTE 1)
FINE THREAD	
10-32	NOTE 2
1/4-28	NOTE 2
5/16-24	6.5
3/8-24	9.5
7/16-20	14.0
1/2-20	18.0
9/16-18	24.0
5/8-18	32.0
3/4-16	30.0
7/8-14	70.0
1-12	90.0
1 1/8-12	117.0
1 1/4-12	143.0
1 3/8-12	180.0
1 1/2-12	210.0
COARSE THREAD	
4-40	NOTE 2
6-32	NOTE 2
8-32	NOTE 2
10-24	NOTE 2
1/4-20	NOTE 2
5/16-16	7.5
3/8-16	12.0
7/16-14	16.5
1/2-13	24.0
9/16-12	30.0
5/8-11	40.0
3/4-10	60.0
7-8-9	82.0
1-8	110.0
1 1/8-7	137.0
1 1/4-7	165.0
1 3/8-6	200.0
1 1/2-6	230.0
1 3/4.5	300.0

NOTE 1: Minimum breakaway torque is defined as the torque necessary to start the nut off the bolt with no axial load on the out and with the bolt completely through the nut.

NOTE 2. Test nut for minimum breakaway torque by attempting to insert a matching bolt by hand. Reuse only those nuts that cannot be tightened down with fingers after the locking action engages bolt or stud. Note that do not meet the minimum breakaway torque a hall not be used.

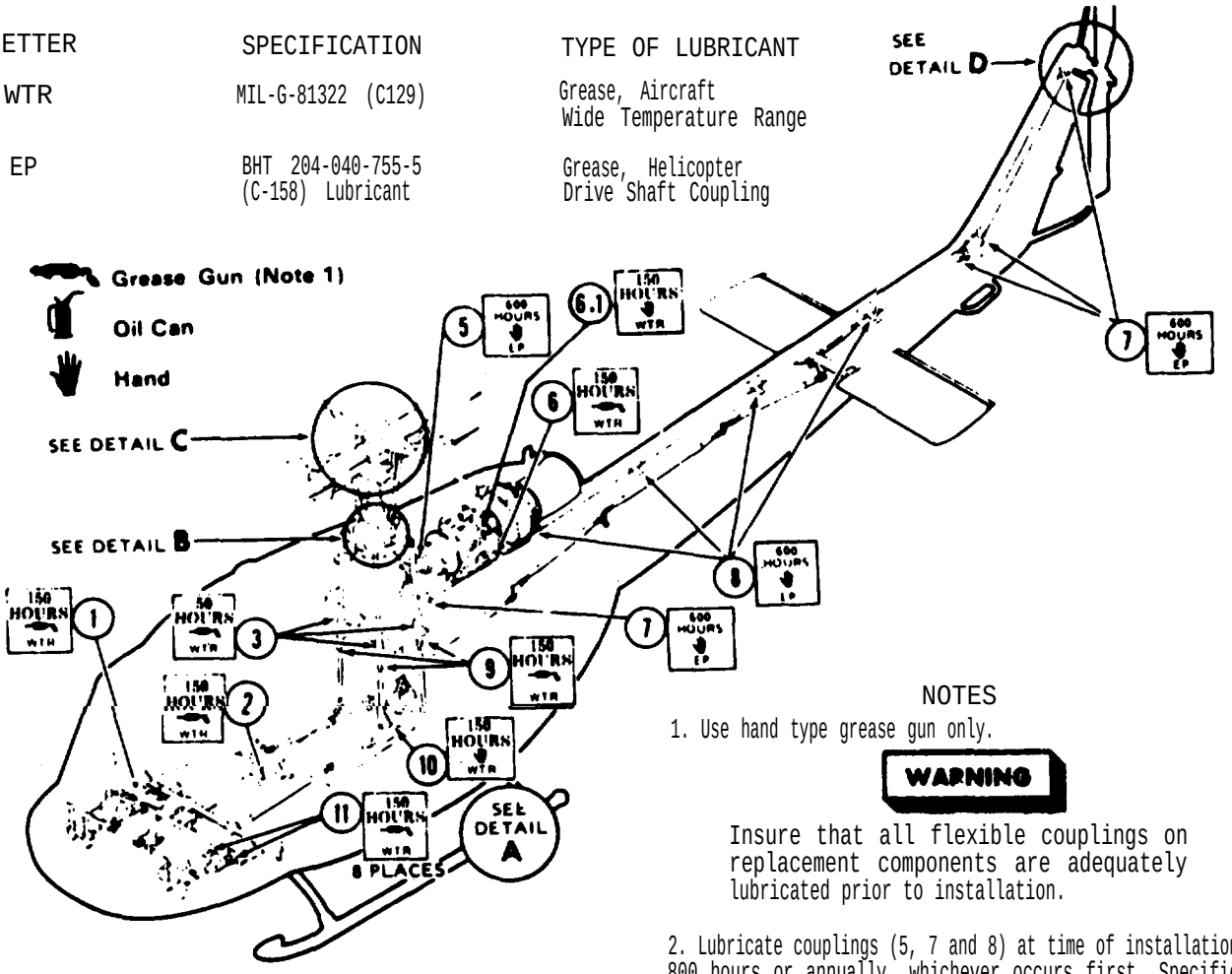
SECTION II. LUBRICATION

1-30. LUBRICATION INSTRUCTIONS.

1-31. Description - , Lubrication Instructions. This section covers the lubrication requirement as shown on Lubrication Chart in this section. See figure 1-6. This chart consists of a main drawing which is a perspective diagram of the helicopter, with enlarged or detailed views where required to show items clearly, The chart shows all parts requiring periodic lubrication. The Lubrication Chart uses symbols and abbreviations to indicate the required lubricant and method of application for each part.

TABLE OF LUBRICANTS

IDENTIFICATION LETTER	SPECIFICATION	TYPE OF LUBRICANT
WTR	MIL-G-81322 (C129)	Grease, Aircraft Wide Temperature Range
EP	BHT 204-040-755-5 (C-158) Lubricant	Grease, Helicopter Drive Shaft Coupling



NOTES

1. Use hand type grease gun only.

WARNING

Insure that all flexible couplings on replacement components are adequately lubricated prior to installation.

2. Lubricate couplings (5, 7 and 8) at time of installation, 800 hours or annually, whichever occurs first. Specified time intervals are for normal conditions. Lubricate more frequently if conditions warrant.

3. Lubricate per instructions in Chapter 6.

4. Disconnect rod end and oscillate power cylinder during lubrication. Do not lubricate power cylinder P/N205-076-099-7.

4.1. Lubricate droop cam slider lightly, Wipe l excess off and out of alots. Slide contacts should have minimum lubrication required to prevent dry contact without contributing to grit buildup. More frequent lubrication may be necessary depending on environrnont and usage factors.

Figure 1-6. Lubrication Chart (Sheet 1 of 4)

LEGEND

1. Tail rotor pedal adjuster gears.
2. Cyclic control rod ends (with grease fittings only).
3. Power cylinder support bearing (Note 4).
4. Deleted
5. Main driveshaft couplings (205-040-004) (Note 2 and 3).
6. Engine mount rods ends (with grease fittings only).

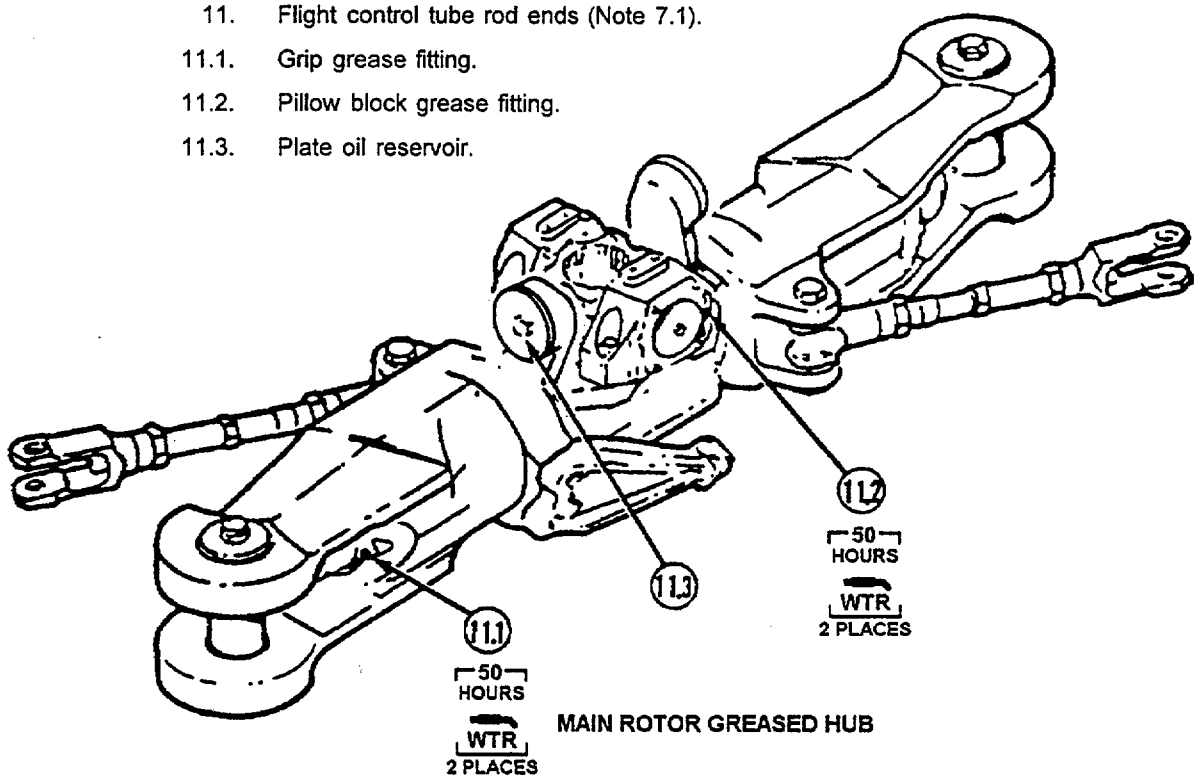
6.1. Droop Cam Slider (Note 4.1).

7. Quill flexible couplings (Note 2 and 3).
8. Tail rotor driveshaft flexible couplings (Note 2 and 3).
9. Servo control tube rod ends (Note 7.1).
10. Cargo suspension latch.
11. Flight control tube rod ends (Note 7.1).

11.1. Grip grease fitting.

11.2. Pillow block grease fitting.

11.3. Plate oil reservoir.



MAIN ROTOR GREASED HUB

CAUTION

If an excessive amount of grease is being used to purge either grip of a greased hub, without an Indication of excessive external leakage, it is possible that grease Is being pumped into the TIT strap cavity. Additionally, If one cavity Is being filled, an out-of-balance condition will exist which could result in a lateral vibration.

NOTE

Purge lubricate after Initial Installation (Ref Paragraph 17) at each 60 hours. At every third lubrication removed plate (11t.3) and clean old grease from cavity prior to lubrication.

Figure 1-6. Lubrication Chart (Sheet 2 of 4)

NOTES

5. Disconnect the push-pull tube clevis and rotate the bearing while lubricating to purge.

6. KSP 9001 bearings do not require greasing.

7. Purge lubricate.

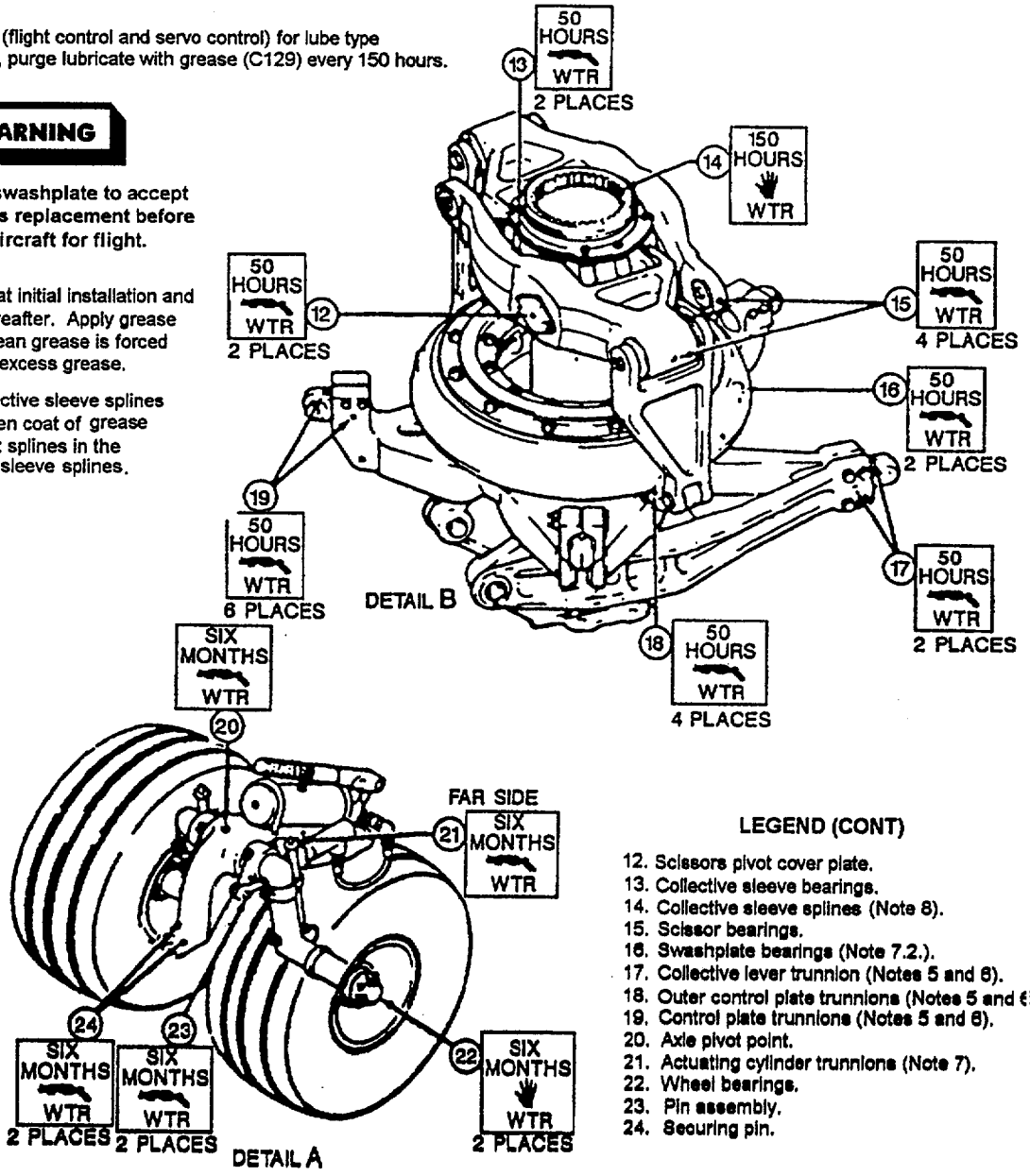
7.1. Check rod ends (flight control and servo control) for lube type bearings. If installed, purge lubricate with grease (C129) every 150 hours.

WARNING

Failure of the swashplate to accept grease requires replacement before releasing the aircraft for flight.

7.2. Purge lubricate at initial installation and at each 50 hours thereafter. Apply grease at each fitting until clean grease is forced past seals. Wipe off excess grease.

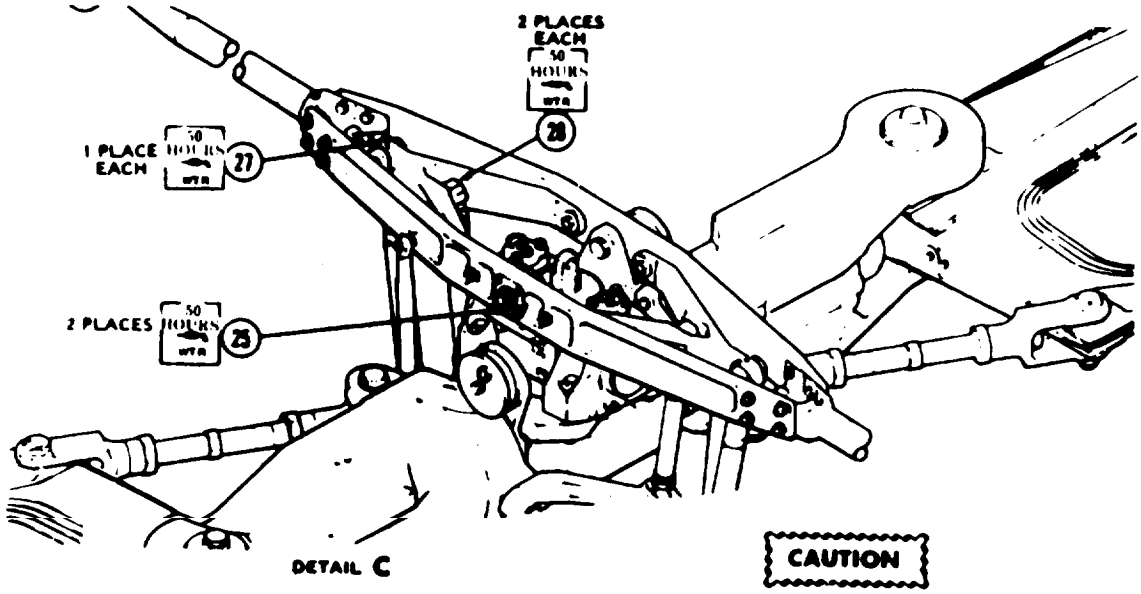
8. Lubricate the collective sleeve splines by applying a light even coat of grease to the top of the mast splines in the area of the collective sleeve splines.

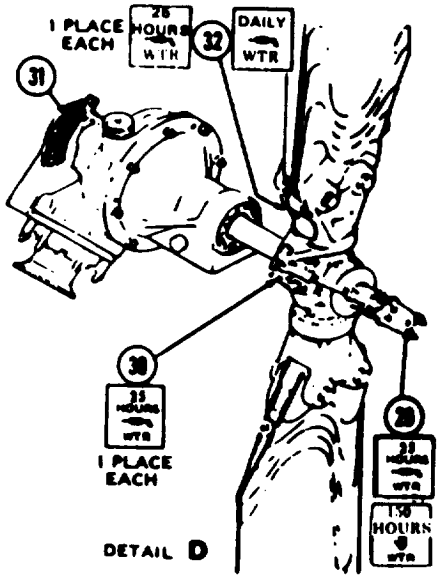


LEGEND (CONT)

12. Scissors pivot cover plate.
13. Collective sleeve bearings.
14. Collective sleeve splines (Note 8).
15. Scissor bearings.
16. Swashplate bearings (Note 7.2.).
17. Collective lever trunnion (Notes 5 and 6).
18. Outer control plate trunnions (Notes 5 and 6).
19. Control plate trunnions (Notes 5 and 6).
20. Axle pivot point.
21. Actuating cylinder trunnions (Note 7).
22. Wheel bearings.
23. Pin assembly.
24. Securing pin.

Figure 1-6. Lubrication Chart (Sheet 3 of 4)





LEGEND (CONT)

25. Stabilizer frame bearing.
26. Deleted.
27. Mixing lever bearing.
28. Pitch change link universal.
29. Crosshead bearing (Note 9).
30. Trunnion bearings (Note 8).
31. Silent chain (204-001-739-3) (Note 10).
32. Grip bearings (Note 8).

CAUTION

To prevent possible build-up of grease in the output sbaft of the 90° gear box, the pitch change rod and bearing should be extended away from the output shaft (full right pedal) during the lubricaton sequence. Excess grease should be wiped off.

NOTES

8. During operation of the aircraft, lubricating grease in the tail rotor hub assembly is forced in an outboard direction by centrifugal force, leaving voids in the lubricating grease at the inboard bearing, Operation in rain can result in water being drawn into these voids. Either condition left unattended can result in a lack of lubrication at the inboard bearing. In view of this, the following lubrication procedures will be used:

a. Purge lubricate tail rotor hub and blade grip bearings after each initial installation and subsequent for tracking, after each 25 flying hours, and following any operation in rain, ice, or heavy snow. Lubrication should be accomplished without disconnecting the tail rotor pitch links. Use a ladder, maintenance stand, and flexible hose as needed to lubricate both inboard and outboard fittings. Move tail rotor pedals back and forth several times to distribute the lubricant,

b. Lubricate the tail rotor grip bearing with a hand grease gun at each daily inspection. If water comes out of the seal during lubrication, purge lubricate.

CAUTION

Do not rotate tail rotor by hand in order to lubricate. Tail rotor may be turned by hand only when completely disconnected from drive train.

9. Hand-pack every phase. Hand grease gun (one shot only) every 25 hours. Use sparingly so that grease is not forced into gearbox.

10. Lubricate silent chain with corrosion preventive (C136) or with a cloth moistened in oil (C166 or C168). Lubrication will be at discretion of local maintenance officer, baaed on environmental conditions.

CAUTION

operation in blowing dust or sand will cause dirt accumulation on a lubricated chain.

Figure 1-6. Lubrication Chart (Sheet 4 of 4).

SECTION III. HANDLING, JACKING, MOORING, HOISTING, AND SLING LOADING

1-32. GROUND HANDLING.

1-33. Description — Ground Handling. The following paragraphs contain information necessary for towing, jacking and leveling, parking, mooring, hoisting, sling loading, application of external power, and attachment of all weather covers. Refer to figure 1-7 for helicopter dimensions and clearances.

NOTE

Installation of structural panels/door are required prior to jacking, towing and hoisting or flight (Refer to figure 2-18).

1-34. TOWING.

CAUTION

Do not move the helicopter for twenty-five (25) minutes after power has been removed from the MD-1 Displacement Gyros and the CN-998/ASN-43 Directional Gyros. If the helicopter must be moved after a shutdown, power should be reapplied to the MD-1 and CN998/AEN-43 Gyros. After five (5) minutes the helicopter may be safely moved with power on.

NOTE

A work aid for moving ground handling gear assemblies to and from parked helicopters can be fabricated locally (paragraph 3-47 and figure 3-11). The device is a small towbar with lugs to fit on the mounting pins of the ground handling gear. The gear can then be pulled or pushed on its own wheels.

1-35. Forward — Towing. The helicopter can be equipped for forward towing by attaching two ground handling gear assemblies to the main landing gear skid. Attach a tow bar to the tow rings provided on the forward end of each landing gear skid tube. Use the following procedure (figure 1 -8).

CAUTION

Do not tow helicopter with a gross weight in excess of 9500 pounds.

CAUTION

If helicopter is moved by bend, do not push on any part of airframe that could result in damage to helicopter, such as open crew doors or elevators.

a. Tie down main rotor blades.

b. Attach tow bar to landing gear skid tow rings and to tractor hook.

CAUTION

The nose of aircraft should be kept low to ground for safe aircraft ground handling. Ground handling wheels should be installed to provide a nose heavy condition if possible and still provide ease of control by personnel guiding the aircraft at tail skid.

c. Install ground handling gear. Position ground handling gear assembly over eye bolt fittings on landing skid. Ground handling wheels may be installed in both fixed pin forward and fixed pin aft positions. Both wheels must be installed with fixed pins in same direction.

CAUTION

Ground handling wheels may be damaged if forward portion of skid gear is not raised by pulling down on tail skid, while extending wheels. Do not exert a downward force exceeding 400 pounds.

d. Station one person at tail skid to maintain helicopter in level position during towing operation, and ensure adequate ground guides are available during movement of helicopter.

WARNING

Do not bend over the ground handling trucks while raising helicopter. Stay in front or rear, but never to the side.

CAUTION

Station one person at tall skid to maintain helicopter In level position during towing operation, and ensure adequate ground guides are available during movement of helicopter.

e. Extend ground handling gear to raise landing gear skids clear of ground.

CAUTION

Do not allow wheels to extend over center.

f. Disconnect ground wire.

g. Tow or push slowly, balancing the helicopter with tail skid.

CAUTION

Damage to ground handling gear may occur if aircraft is lowered quickly, therefore, release pressure slowly.

h. Retract ground handling gear simultaneously to lower helicopter to ground.

(1) To retract wheels, release hydraulic pressure by slowly turning valve handle on pump.

(2) Depress spring-loaded pin and remove ground handling gear assembly from landing gear eyebolt fittings.

i. Install ground wire to receptacle.

j. Remove ground handling gear and tow bar from helicopter.

1-36. JACKING AND LEVELING.

CAUTION

Installation of structural panels/ doors are required prior to jacking, towing, hoisting or flight (figure 2-18).

NOTE

Shackles, PN 204-031-393-1, should be removed before jacking to prevent shackle bolt head from resting on jack cup. Reinstall shackle after jacks are removed.

1-37. Description- Jacking and Leveling. Place jacks under two forward jack pad fittings (1, figure 1-9) located just ahead of landing gear forward cross tubes at each side. Place two aft jacks on pads (3) under fuselage behind landing gear.

1-38. Jacking and Leveling Procedures. Raise the helicopter evenly. To level the helicopter, hang a plumb line from slotted plate (2, figure 1-9) so that plumb bob (4) just clears leveling plate (5). Adjust the jacks under helicopter to align plumb bob exactly over intersection of two lines marked with zero on plate. Observe the following precautions while the helicopter is supported on jacks.

CAUTION

If helicopter is placed on jacks preparatory to removing landing gear skid tubes, take up slack with hoist attached to main rotor retaining nut.

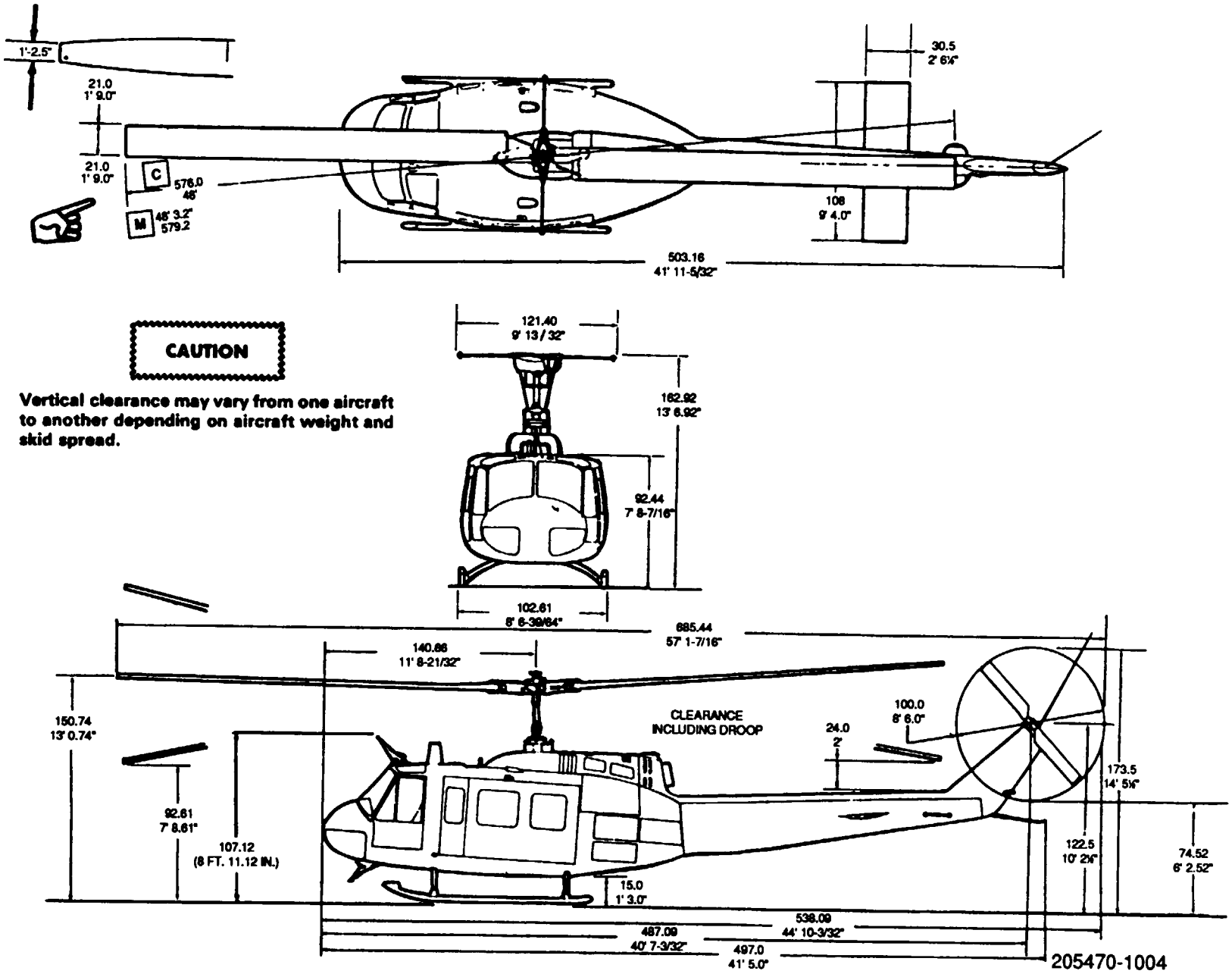
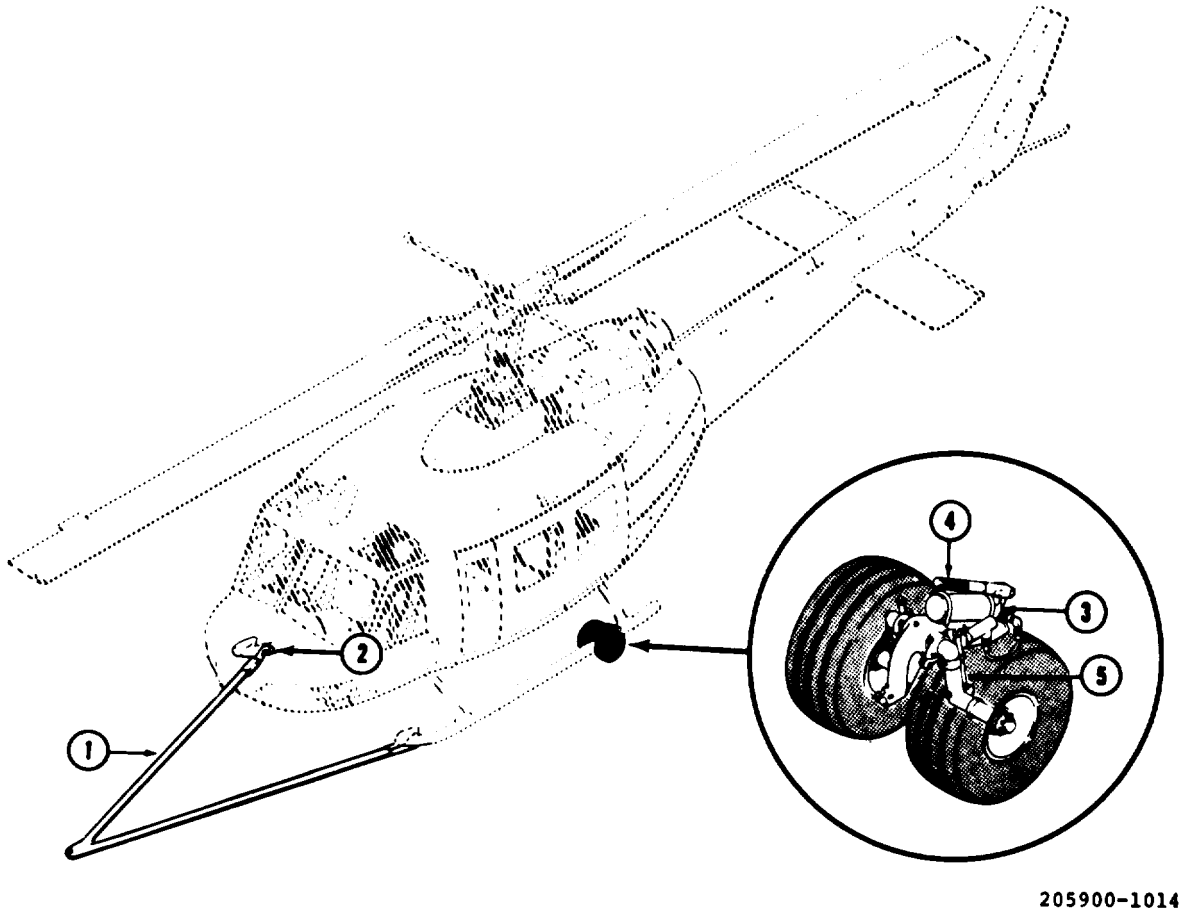


Figure 7-1 Helicopter Dimensions



1. Tow Bar
2. Tow Ring
3. Release valve
4. Pump Assembly
5. Support Cradle and Axle Assembly

Figure 1-8. Aircraft Towing

a. Do not climb on or enter helicopter.

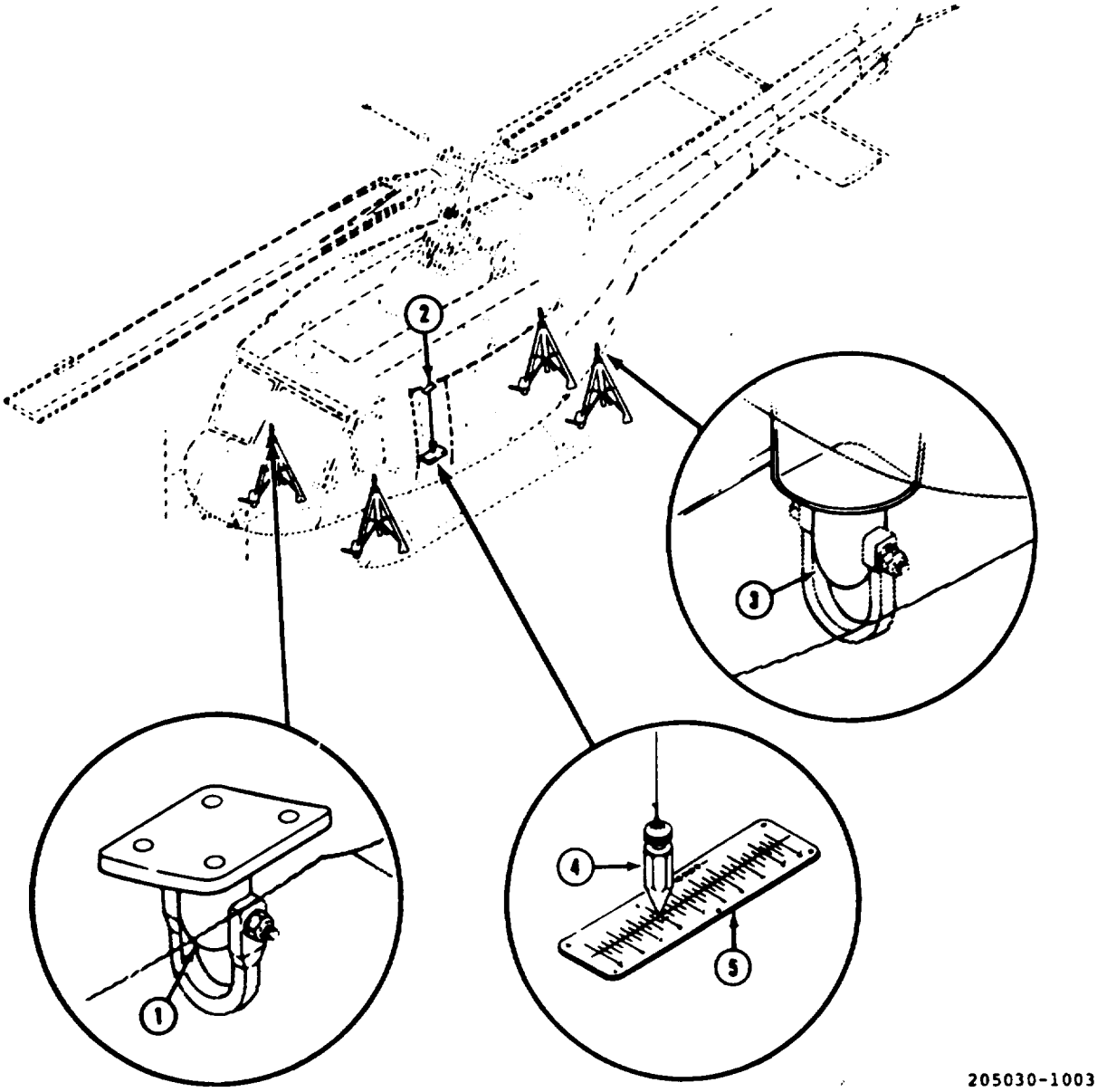
b. All personnel in immediate area shall exercise caution to avoid bumping or otherwise disturbing helicopter while on jacks.

c. Rope off area and prominently display signs to warn: CAUTION AIRCRAFT ON JACKS.

d. When aircraft is on jacks in hangar, recommend the hangar door be closed.

1-39. PARKING.

1-40. Description – Parking. Parking, as used in this manual, is defined as condition in which helicopter will be secured while on the ground. Direction of heading and location of helicopter is normally determined by ease of maintenance and servicing; to allow removal of anyone helicopter from parking area; and to permit ready access of mobile fire fighting equipment within area.



1. forward Jack Pad Fittings
2. Slotted Plate
3. Aft Jack Pods
4. Plumb Bob
S. Leveling Plate

Figure 1-9. Aircraft Jacking and Leveling

1-41. Parking Procedures. Parking arrangements may vary according to each local facility. The following general procedures should be observed

a. Helicopter should be parked not less than 750 feet from ends of center line of nearest runway, and not less than 250 feet from edge of connecting taxi strips.

b. Width of fire lanes between each double row should be slightly greater than rotor span of parked helicopters. This spacing will facilitate removal of any helicopter from parking area, as well as permitting greater ease of movement for mobile fire fighting equipment within area.

c. Fire lines having a minimum width of 50 feet should be provided to cross main fire lanes and isolate blocks of 10 helicopters or less

d. Helicopters parked on concrete ramps or aprons should be placed to utilize mooring rings when available.

e. Statically ground parked helicopters in accordance with TM 55-1500-204-25/1.

f. Under normal conditions park the helicopter as follows:

(1) Park helicopter on a level surface, whenever possible, so that load will be balanced.

(2) Retract or remove ground handling wheels to allow helicopter to rest on landing skids.

NOTE

If helicopter is to remain perked more than 14 days, suitable blocks or shoring should be placed under the skids. These blocks should be sufficient height to prevent the skids from contacting the supporting surface.

(3) Align main rotor blades fore-and-aft, and tail rotor blades parallel to vertical fin,

NOTE

Use 1/2 inch diameter, polyester rope, NSN 4020-00-630-4873 for rotor blade tie-down.

(4) Engage hook of main rotor tiedown (10, figure 1-10) in hole of fitting on end of rotor blade above tail boom. (If necessary, weighted end of tiedown strap can be tossed over blade to bring it down into reach.) Secure rotor by firmly cross-tying strap of tiedown around tailboom. Tie forward blade using the same device as aft blade. Longer ropes will be required for forward blade. Attach ropes to forward end of skid tubes, setting blades in approximate level position.

(5) Attach tail rotor tiedown strap (11) to tail rotor and secure to loop provided on left side of vertical fin.

(6) Install pitot tube cover (7), engine intake fairing cover (8), and exhaust tailpipe cover (9).

NOTE

For additional information refer to TM 1-1520-250-23-1 .

(7) Lock flight controls, check that all switches are OFF and external power disconnected, and close all doors, windows, and access plates.

g. Under turbulent weather conditions, park the helicopter as follows:

CAUTION

Structural damage can occur from turbulent weather conditions. Anchoring and mooring should be accomplished when wind is expected to exceed 45 knots. When possible, helicopter should be evacuated to a safe weather area if a tornado, hurricane, or wind condition above 75 knots is expected.

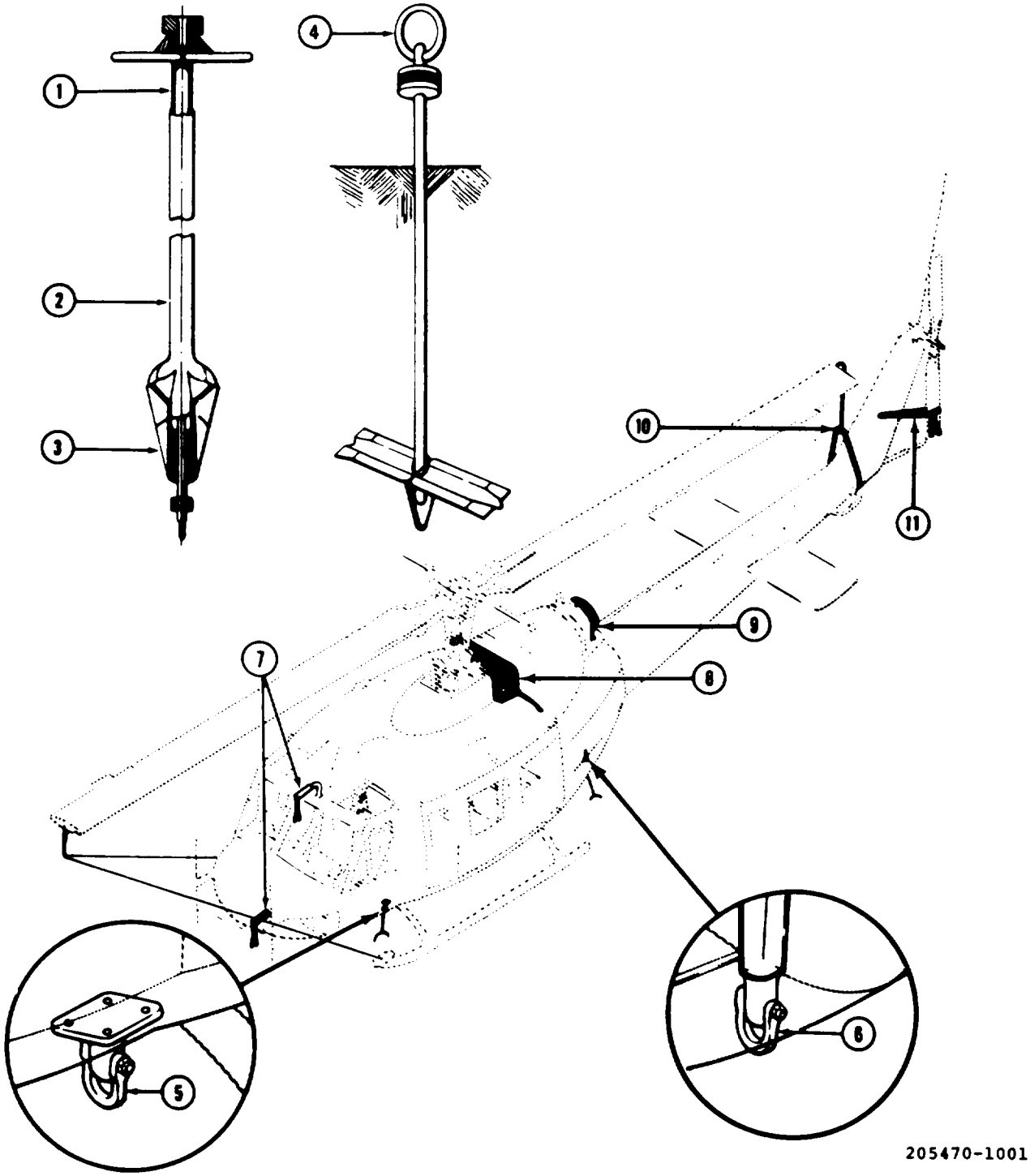
(1) Park helicopter (paragraph 1-41. f)

(2) Moor helicopter (paragraph 1-44).

(3) Fill fuel tanks to capacity if time permits.

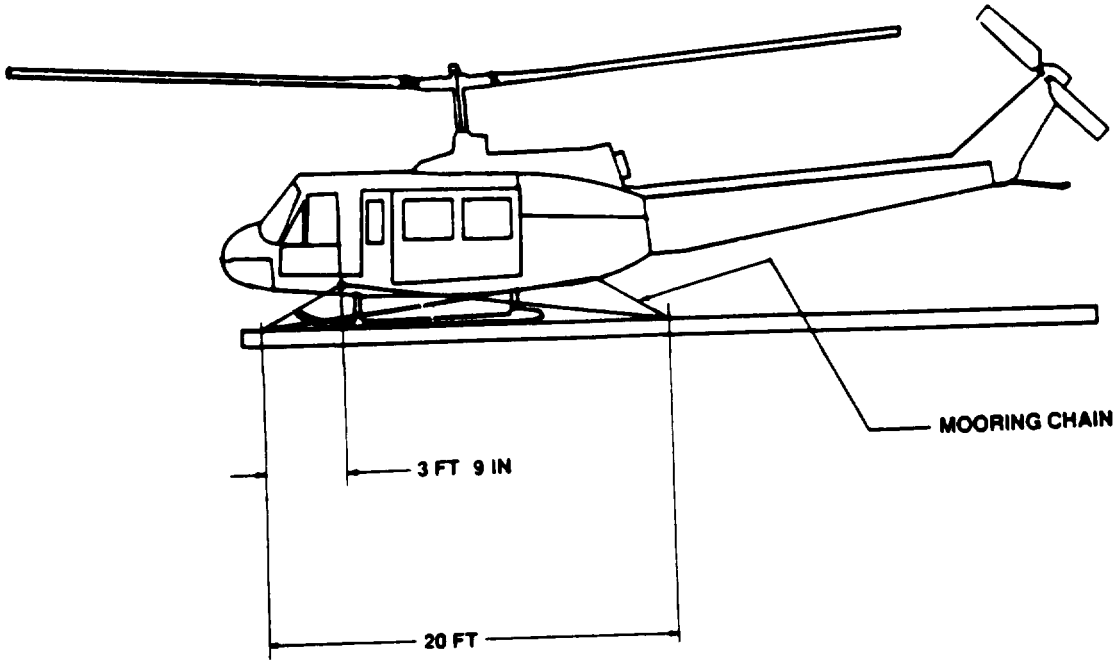
(4) Disconnect battery. Secure all loose equipment. Moor all ground support equipment at safe distance from helicopter.

(5) After high winds have passed, inspect helicopter for damage from flying objects



1. Anchor Rod
2. Driving Rod
3. Arrow
4. Eye
5. Forward Mooring Fitting (2)
6. Aft Mooring Fitting (2)
7. Pitot Tube cover
8. Intake Cover
9. Exhaust Cover
10. Main Rotor Tie Down
11. Tail Rotor Tie Down

Figure 1-10 Mooring



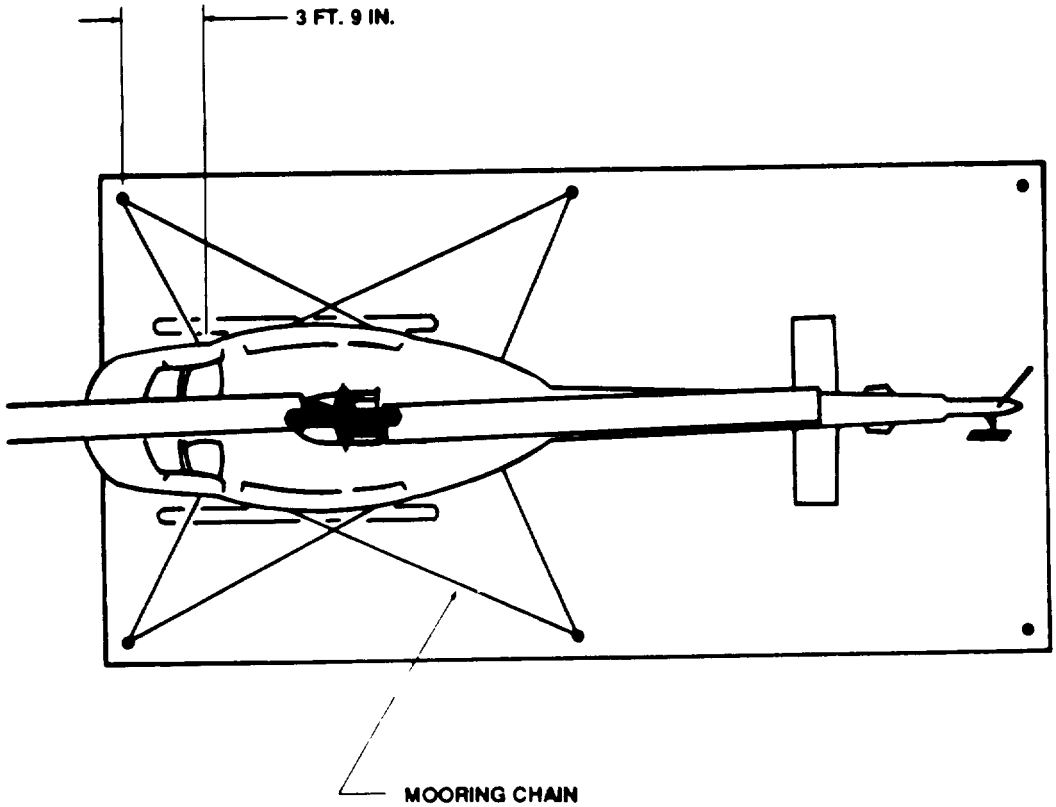


Figure 1-10.1. UH-1 Paved Surface Mooring Configuration

1-42. MOORING.

1-43. Description – Mooring. Mooring is the process of securing the parked helicopter to avoid damage by high winds or turbulent weather. Mooring fittings are provided on jack pad fittings. Where properly spaced rings are not available, mooring can be accomplished with standard mooring kit (1, table 1-3) (figure 1-10).

1-44. Mooring Procedures. The following procedures will be followed.

1-44.1. Mooring, Unpaved Surfaces.

a. Park helicopter on unpaved parking area, headed in direction of highest winds forecast.

b. Screw anchor rod (1, figure 1-10) into arrow (3).

c. Slip driving rod (2) over anchor rod and into socket of arrow.

d. Turn cam of driving rod so that prongs of arrow are not spread by driving.

e. If necessary, loosen surface of ground with ground-breaking pin.

f. Position forward rods approximately one foot ahead of each forward mooring fitting (5) and slightly inboard of skid tubes, Position other rods approximately one foot behind each aft mooring fitting (6),

g. Drive each arrow into ground until driving rod handle is approximately three inches above surface.

h. Rotate driving rod handle approximately 90 degrees and give it a hard blow to spread arrow prongs.

i. Return driving rod to driving position and remove it from anchor rod.

j. Align squared socket of eye assembly (4) with squared end of anchor rod. Fit in place and tighten knurled nut.

k. Set arrow prongs by pulling upon eye assembly.

l. Secure helicopter with quarter-inch cables or 3/8 inch manila rope.

NOTE

When anchor rods are no longer needed, they may be removed by turning eye assemblies counterclockwise leaving arrows in ground.

1.44.2. Mooring Equipment.

a. Chain adjuster, P/N MB-1 NSN 1670-00-212-1149, quantity 8 ea.

b. Chain with hook for MB-1 NSN 4010-00-516-6405 quantity 16.

NOTE

The mooring equipment is not considered flyaway equipment. All active mooring points shall be equipped with this equipment.

1-44-3. Mooring Paved Surface.

a. Position aircraft on mooring pad with longitudinal center line or aircraft directly above and parallel to the longitudinal axis of the pad. The forward jack-points located at F.S. 61.69 should be located approximately three feet nine inches aft of forward mooring points (figure 1-10).

NOTE

Ensure mooring clevises are installed on all four jack-points. A mechanics tool kit will be required.

b. Place hook-ends of mooring chains into mooring fittings, (figure 1-10). Chain placement order is not important. Remove slack from chains with adjusters at mooring points. Adjust only to the point of slack removal.

NOTE

It is recommended that UH-1 helicopters be flown with mooring hardware installed, to permit rapid response to weather emergencies. For additional information refer to TM 1-1520-250-23-1.

1-45. AIRCRAFT COVERS.

1-46. Description — Aircraft Covers. A set of twelve all-weather covers is available for the protection of cabin area and major components. Covers are fastened by cord and snap fasteners and are to be installed in sequence as illustrated (figure 1-11).

1-47. HOISTING.

1-48. Description — Hoisting. The helicopter can be lifted by use of a hoisting clevis (178.1) attached to the main rotor mast. To remove the engine, main rotor, transmission, use maintenance hoist (T53).

1-49. Helicopter Hoisting. Hoist the helicopter as follows:

a. Attach a clevis (178.1) or cable to eye provided on retaining nut at top of main rotor mast (figure 1-12, Detail A). Connect a suitable hoist and take up slack.

CAUTION

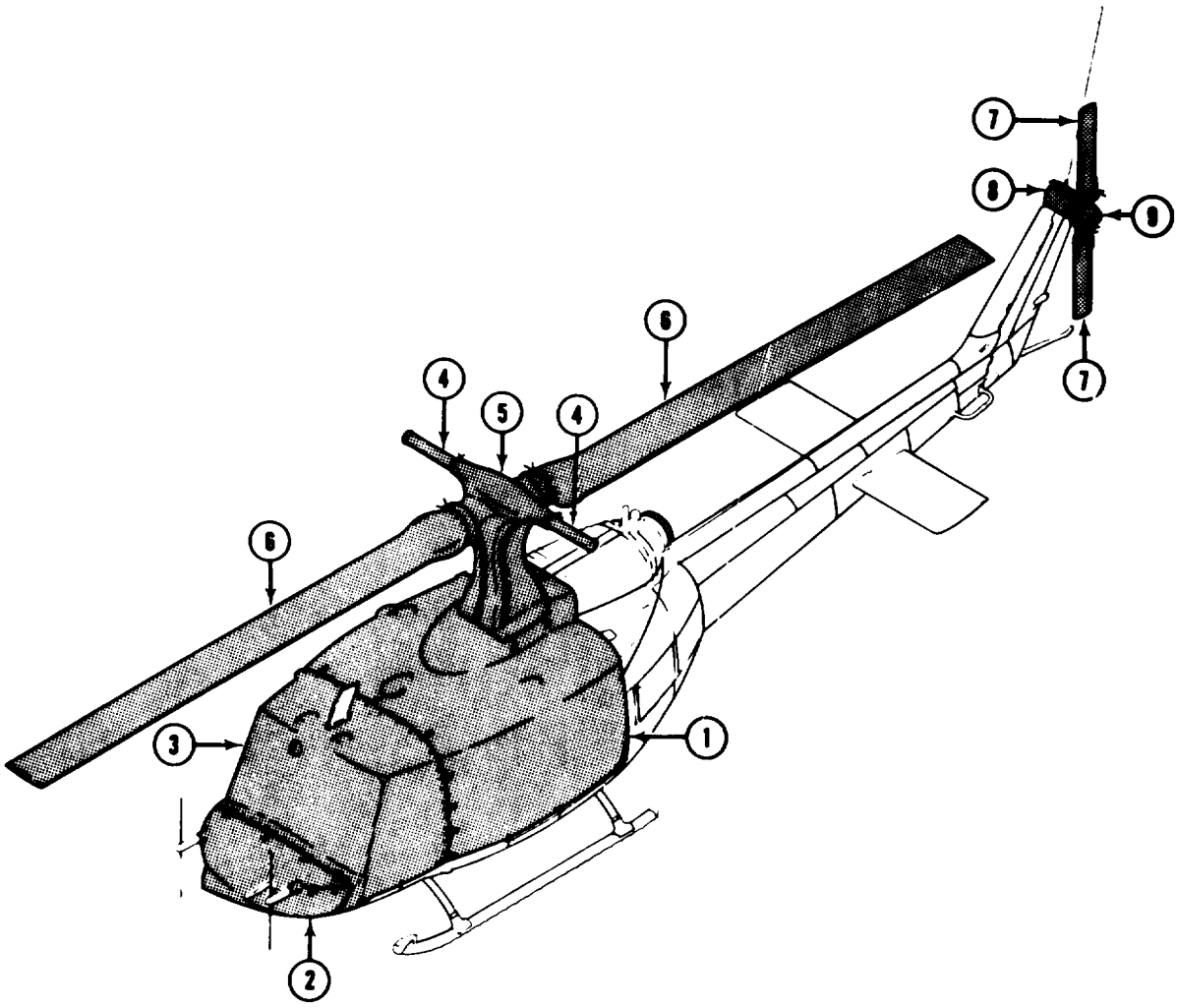
Maximum operating load of hoisting clevis is 10,000 pounds.

b. Station a person at tail skid to steady helicopter when hoisted. If lifting beyond reach from ground, two people and two steadying ropes will be necessary.

c. Hoist slowly with a steady lifting force.

d, If transmission has been removed, attach hoist at pylon lift-link and apply same procedure to lift helicopter.

1-50. Component Hoisting. a. For hoisting or handling tailboom as a separate component use straps or slings at both ends of boom. Use tail skid for steadying boom. Tailbooms may be provided with stowed handling tubes (4, figure 1-12) and reinforced lift point (3, figure 1-12). However, the use of slings or straps is the preferred method for handling *booms.*



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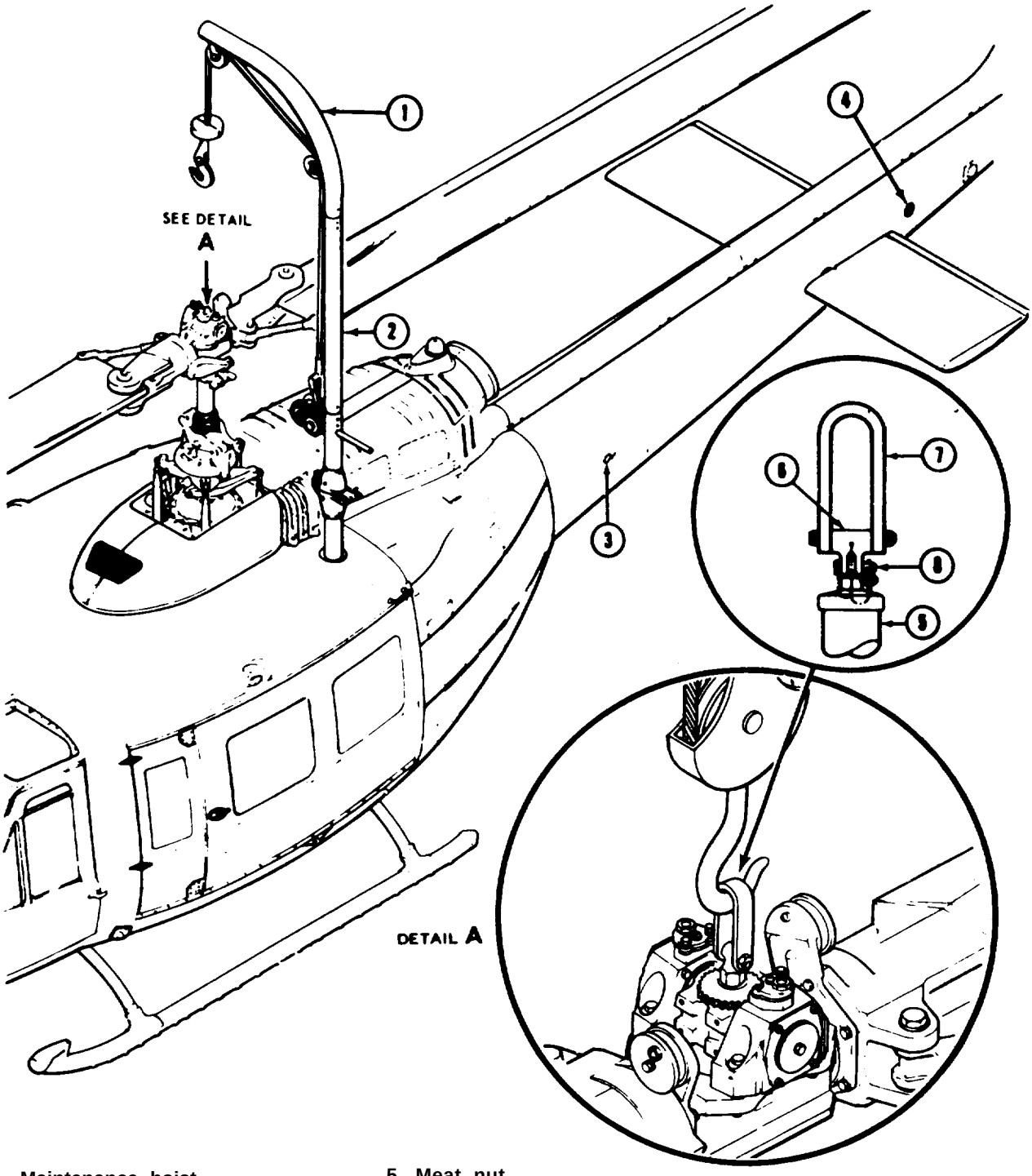
1. Main Cabin Cover
2. Nose Cover
3. Forward Cabin Cover
4. Stabilizer Bar Cover
5. Pylon Cover
6. Main Rotor Blade Cover
7. Tail Rotor Blade Cover
8. 90° Gearbox Cover
9. Tee Head Cover

Figure 1-11. Aircraft All Weather Covers



1. Maintenance hoist
2. Removable section
3. Tailboom lift point (if installed)
4. Stowed handling tubes (if installed)
5. Meat nut
6. Clevis
7. Strap
8. Pin

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Figure 1-12. Helicopter Hoisting

b To hoist engine m ain rotor. or mast and transmission assemblies from the helicopter, Install mainte na nce hoist (T53] as follows

CAUTION

Particular attention should be paid to the maintenance hoist, to ascertain that it IS assembled correctly, Correct assembly should have the hinge halves of the mating casting, P/N 205-070-929-1, P/N 205-070-929-3, and hinge bolt, P/N AN6-60A on outboard side from closed curve of upper tube and the latch bolt, P/N 205-070 -932-1 and knob (4, figure 1 -13) on inboard side [figure 1-13, detail A). Hoist must be centered over component being hoisted,

NOTE

The maintenance hoist (T53) is provided to be mounted on airframe for field use to lift engine, main rotor, or mast and transmission assemblies. Maximum operating load of this hoist is 800 pounds, Hoist consists of a support tube equipped with a hand-operated winch, cable, and hook (figures 1-12 and 1 -13). Support tube has a hinged joint to fold for storage, a 48-inch section which can be removed to reduce height when required, and a selection of attachment holes for upper pulley to allow centering over unit being removed or installed, Mounting allows hoist to be rotated, with load, to reach over engine and pylon area or outboard from left side of helicopter.

(1) Remove cover at rear left side on cabin roof Remove soundproofing blanket section in cabin, and plug button in floor directly below

(2) Lift hoist to position and insert lower support lube down through roof and engage pin at lower end in support fitting in cabin floor In this procedure, hoist tube can be partially folded at hinge joint and a person on ground or roof walkway can handle upper support tube in such manner as to assist person on engine service deck or roof who IS lowering hoist into place

(3) Raise upper end of hoist to normal position and secure latchbolt on hinge joint

(4) Turn hoist to center its hook over component to be lifted If necessary, change position of upper pulley to another attachment hole of support tube

1-51. SLING LOADING.

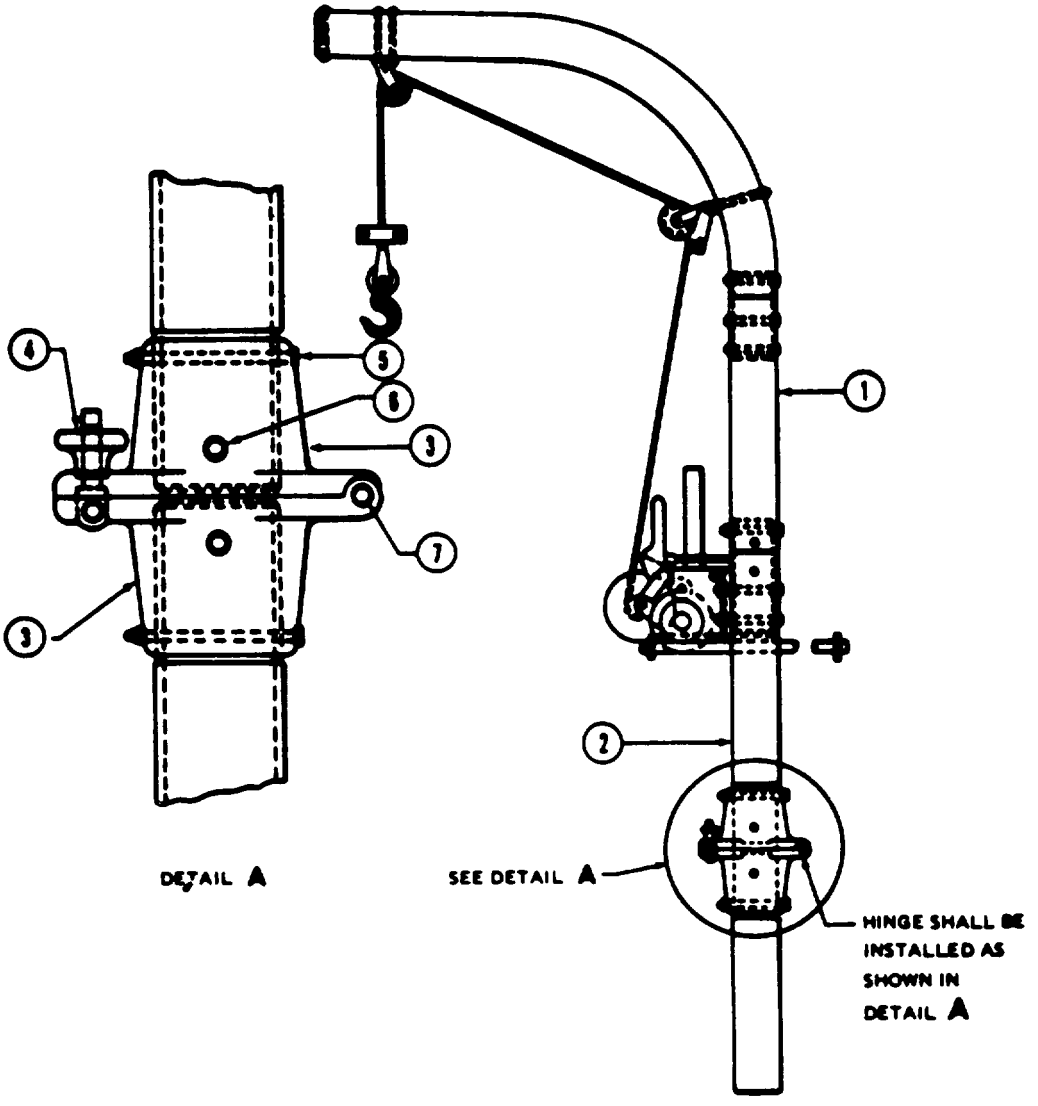
1-52. Description – Sling Loading. Refer to FM55 413 for helicopter sling loading

1-53. APPLICATION OF EXTERNAL POWER.

1-54. Description -- Application of External Power. External power receptacle (12, figure 1 -1) for 28. volt DC IS in lower left side of fuselage, below electrical equipment compartments Access IS through a small door, which IS equipped with a limit switch to light EXTERNAL POWER caution panel when door IS open and power connected When applying power from external sources, batter y swltch shall be ON.

1-54.1. EHX Description-Application of External Power. In addition to the DC external power receptacle described in paragraph 1-54 and 1-55, this aircraft has an AC external power receptacle. This receptacle (12, Figure 1-1) for 3 phase, 115 volt, 400 Hertz AC is just forward of the DC plug in lower left-hand side of fuselage, below electrical equipment compartments. Access is through a small door, which is equipped with a micro switch to light External Power caution panel when door is open, (same circuit as DC receptacle).

1-55. Electrical Power Application. Open access door to external power receptacle (12 figure 1-1) and plug in external power source



1. Upper tube assembly
2. Lower tube assembly
3. Clamshell
4. Latch bolt knob
5. AN5-52A bolt
6. AN5-55A bolt
7. AN6-60A bolt

Figure 1-13. Helicopter Hoist

SECTION IV. INSPECTION REQUIREMENTS

1-56. GENERAL INFORMATION.

This section contains complete requirements for special inspections, overhaul and retirement schedule, and standards of serviceability applicable to the aircraft. The inspections prescribed in this chapter shall be accomplished at specified periods by aviation unit maintenance activities with the assistance of intermediate maintenance activities when required. Complete Daily, Intermediate, and Periodic inspections are contained in Preventive Maintenance Daily Inspection Checklist (TM 55-1520-21 0-PMD) and Phased Maintenance Checklist (TM 55-1520-210-PM).

1-57. STANDARDS OF SERVICEABILITY.

Standards of serviceability to be utilized in day-to-day inspection and maintenance of the aircraft can be found as fits, tolerances, wear limits, and specifications in the aircraft maintenance manuals. Standards of serviceability for transfer of aircraft are contained in TM 1-1500-328-25.

1-58. SPECIAL INSPECTION.

1-59. Description — Special Inspection. The special inspection contains the complete requirements for all components to be inspected at required intervals for maintenance of this helicopter,

1-60. Definition and General Information — special Inspection. This section supplements the scheduled inspections as outlined in the Preventive Maintenance Daily Inspection Checklist, TM 55-1520-210-PMD and Phased Maintenance Checklist, TM 55-1520-210-PM. This section also includes inspection of items which are required to be inspected at intervals not compatible with airframe operating time or airframe inspection intervals. Areas of inspection are shown on figure 1-14. Refer to DA PAM 738-751 for applicable forms, records, and worksheets required for these inspection intervals. Typical inspection items are:

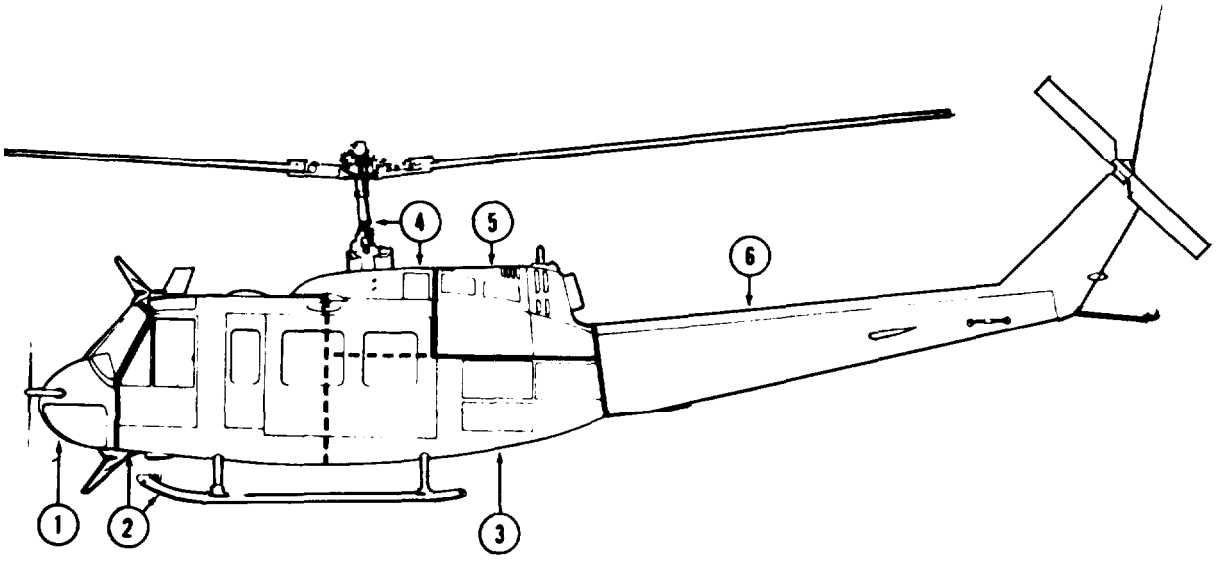
a. An inspection which is contingent upon specific conditions or incidents that arise, and only because of these conditions or incidents, immediate inspection is required to ensure safe flight, Typical of these conditions are hard landings, overspeed, and sudden stoppage. Detail information relative to an accident or incident should be provided with a component removed for conditional inspection to assist in evaluation of the component.

b. Inspection of components or airframe on a calendar basis: first aid kits, weight and balance check, aircraft inventory, etc.

c. Refer to DA PAM 738-751 for applicable forms, records, and worksheets.

d. For Special 25 hour inspection, refer to TM 1-1500-328-23. I

1-61. Requirements — Special Inspection. The requirements of this section shall include items which qualify under the criteria in paragraph 1-60 (Definition and General Information - Special Inspection), i.e., hard landings, sudden stoppage, overspeed, etc. The requirements shall be grouped under area headings only and shall be inserted in a columnar listing on the inspection checksheet format, in such a manner as to permit local reproduction of entire section.



AREA No. 1	**Nose Area**	All surfaces, components, and equipment in nose compartment and on exterior forward of crew doors.
AREA No. 2	Cabin and Landing Gear	All surfaces, components, and equipment inside cabin. and on cabin exterior between forward sides of crew doors and aft cabin walls and pylon island structure. Includes complete landing gear, but does not include forward fuel cell sumps on cabin underside.
AREA NO. 3	Center **Fuselage Area**	All surfaces, components. and equipment in fuselage below ***engine*** **deck level. between cabin area and tail** boom attachment **bulkhead. Includes fuel cells (also** forward cells under cabin floor), compartment in pylon island below main transmission, and compartments accessible through side doors on fuselage.
AREA NO. 4	Pylon Area	All surfaces, components, and equipment of the main rotor components, from top of mast to bottom of transm ission. Includes main rotor, mast and rotating controls, transmission with accessories and mounts, and main (input) driveshaft.
AREA ***NO. 5***	Engine Area	All **surfaces.** components, and equipment associated with engine installation. located above engine work deck and within engine cowling, tailpipe fairing, and intake fairing.
AREA NO. 6	Tail Boom Area	All surfaces. components, and equipment located in or on the tailboom and vertical fin structure. Includes tail rotor, synchronized elevator, ● nd control linkages; also the complete drive train of shafting and gearboxes between main transmission and tail rotor.

Figure 1-14. Area Inspection Diagram

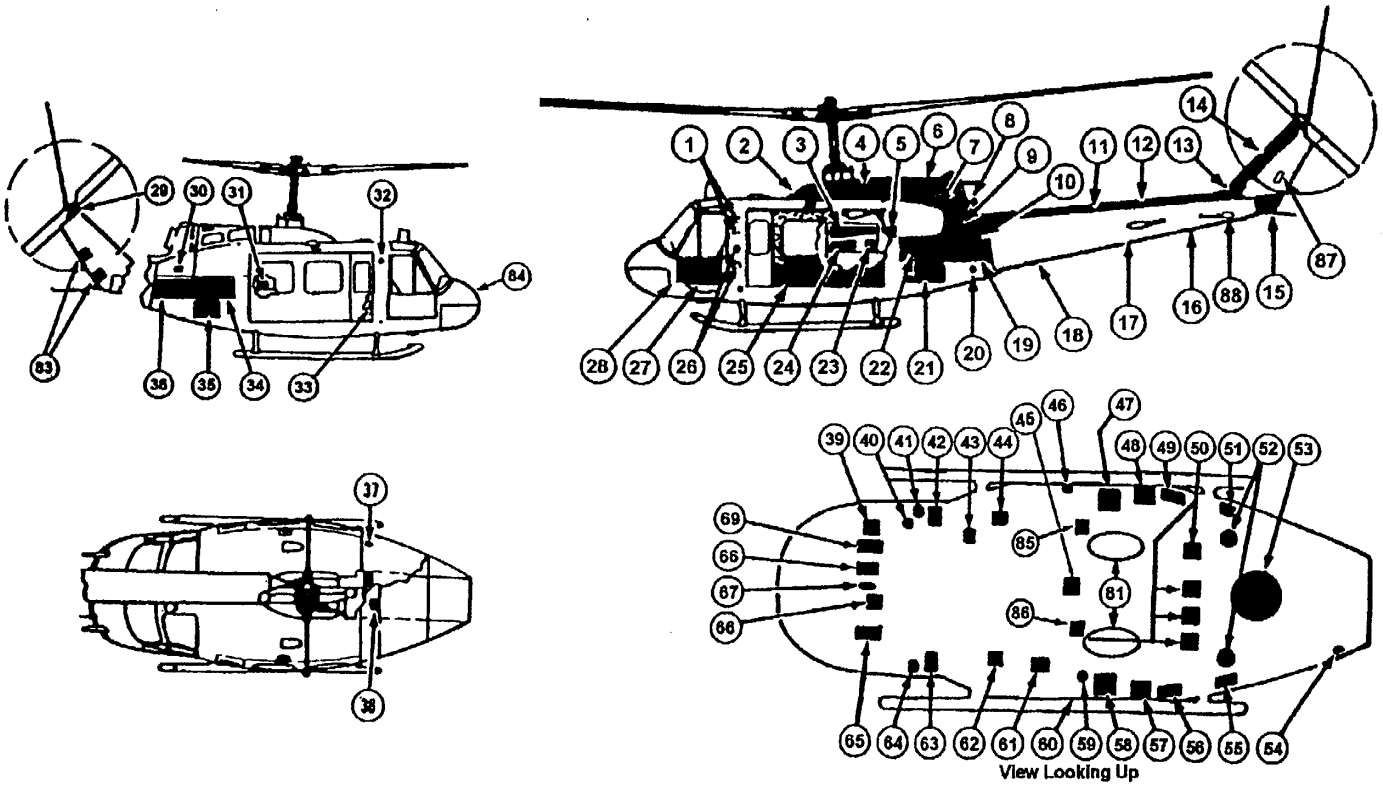
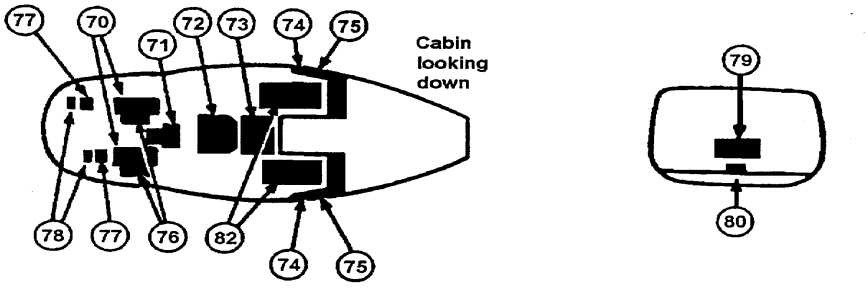


Figure 1-14.1. Model UH-1HN and EH-1HIX Access and Inspection Provisions (Sheet 1 of 2)



1. Stowage Access Door
2. Transmission Fairing
3. Pylon Access Door
4. Inlet Screens
5. Fire Extinguishing Access Door
6. Upper Engine Cowl
7. Lower Engine Cowl
8. Tailpipe Fairing (Upper)
9. Driveshaft and Electrical Disconnect Access Door
10. Tailpipe Fairing (Lower)
11. Forward Tail Rotor Shaft Access
12. Aft Tail Rotor Shaft Access
13. Intermediate (42') Gearbox Access
14. Vertical Fin Driveshaft Access
15. Vertical Fin Fairing
16. General Access
17. Flight Controls Access Door
18. Flight Controls Access Door
19. Electrical Controls Access Door
20. External Power Access Door
21. Electronic Equipment Access Door
22. General Access Door
23. Fuel Shutoff Valve Access
24. Lower Pylon Access Door
25. Cargo Door
26. Emergency Door Release Cover Plate
27. Lower Window Access Door
28. Crew Door
29. Tail Rotor Chain Access Cover
30. Driveshaft Access Door
31. General Access Door
32. General Stowage Access Door
33. General Access Cover Plate
34. Cargo Hook Mirror Access Door
35. General Access Door
36. General Access Door
37. Engine Oil Tank Access Door
38. Fuel Cell Access Door
39. Flight Controls Access Door
40. Flight Controls Access Door
41. Flight Controls Access Door
42. Flight Controls Access Door
43. Flight Controls Access Door
44. General Access Door
45. Fuel Lines Access Door
46. External Stores Jettison Cable
47. External Stores Disconnect Access Door
48. Fuel Lines Access Door
49. Ammunition Chute Access Door
50. Fuel lines Access Doors (4 ea)
51. Cabin Heater Duct Access Door
52. Fuel Lines Access Door
53. General Access Door
54. General Access Door
55. Cabin Heater Duct Access Door
56. Ammunition Chute Access Door
57. Fuel Lines Access Door
58. External Stores Disconnect Access Door
59. Fuel Lines Access Door
60. External Stores Jettison Cable Access Door
61. General Access Door
62. Cabin Heater Duct Access Door
63. Cabin Heater Duct Access Door
64. Flight Controls Access Door
65. Flight Controls Access Door
66. Flight Controls Access Door
67. Antenna Access Cover
68. General Access Door
69. Flight Controls Access Door
70. Controls Access Door
71. Controls Access Door
72. General Access Door
73. General Access Door
74. Auxiliary Fuel Tank Fittings Cover Plate
75. Gun Chute Tunnel Cover Plate
76. Dual Collective Stick Cover
77. Dual Cyclic Stick Access
78. Cyclic Stick Electrical Access Door
79. Hydraulic Controls Access Door
80. Armament Provisions Access Cover
81. Fuel Pump Access Panel
82. Fuel Cell Access Doors
83. Tail Boom Access Doors
84. Battery Access Door
85. Fuel Lines Access Door
86. Fuel Line Access Door
87. Vertical Fin Access Cover RIS
88. Tail Boom Access Cover

Figure 1-14.1. Model UH-1H and EH-1HIX Access and Inspection Provisions (Sheet 2 of 2)

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily Intermediate, etc,) SPECIAL	PAGE NO. 1	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STA-TUS	RECORDED ON WORKSHEET
ALL Areas	AFTER A HARD LANDING			
		a. Inspect landing gear skid tubes and crosstubes for damage or more than normal deflection. Inspect aft crosstube mounting area for damage. b. Check all cowling and doors for proper fit and alignment. Misaligned cowling may indicate a distorted fuselage, resulting in major stresses and damage to components. c. Remove all cowling necessary to perform a complete visual inspection. d. Inspect airframe structure with a ten power magnifying glass at the transmission mounting points. Particular attention should be given to the rubber mount attachment points. Inspect lift link and attaching parts. Inspect engine mount legs for bends and cracks. e. Inspect tail skid tube and mounting for damage. Inspect tail boom internally and externally for cracks, distortion, and loose rivets. Make complete inspection of area where tail boom is attached to forward fuselage section. This includes all attachment fittings, and the long horns, beam caps, skins, webs, bulkhead flanges, and other structural members. Check torque on attachment bolts to determine if yielding has occurred. f. Carefully inspect the flight control system from pilot controls to rotor head for bent or damaged tubes, bell cranks, supports, and damaged bearings. Particular attention should be given to the mast control rods and collective sleeve assembly. g. Using a hydraulic test stand, pressurize hydraulic control system and check for leaks, interference or binding, and satisfactory operation. h. Inspect mast for indentation caused by hard contact and static stop for flattened or distorted condition. If installed, inspect hub moment springs, supports, and plate assembly for distorted condition. i. Inspect main rotor blades for contact with tail boom. If damage is found, refer to inspection. AFTER SUDDEN STOPPAGE MAIN ROTOR.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 1a	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		j. Inspect tail rotor blades for damage. If damage is found, refer to inspection AFTER SUDDEN STOPPAGE — TAIL ROTOR. k. Inspect fuel and oil systems for damage. Before flight, pressurize fuel and oil systems and check for leaks. l. Inspect engine. Refer to TM 55-2840-229-23 for inspection after excessive G loads m. Inspect wire strike protection system (WSPS) as follows: (1) Lower Assembly (a) Inspect for obvious damage to WSPS. (b) Inspect attachment area for damage. (2) Windshield Deflector and Upper WSPS Assembly (a) Inspect for obvious damage to WSPS. (b) Inspect attachment area for damage.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 2	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		n. Inspect the two mission antennas for damage due to excessive flexing or ground contact. Pay particular attention to the antenna attachment fittings. Remove antenna mount cover and carefully inspect the mount, clevis, and actuator for damage. o. Visually inspect SKCP series Drivershaft for the following conditions: (1) Bolt contact with adjacent plate(s). (2) Plate contact with end fitting(s). (3) Interconnect contact with end fitting(s). (4) Contact of fail-safe surface(s). If any one of the above conditions are found, replace shaft. Return shaft to service if no damage is found.		
All Areas		**AFTER A HARD LANDING: IF DAMAGE TO CENTER FUSELAGE STRUCTURE OR TAILBOOM IS SUCH THAT A MAJOR REPAIR, REPLACEMENT, OR ALIGNMENT IS NECESSARY, REPLACE THE FOLLOWING COMPONENTS:** **NOTE** **Hard landings, for the purpose of the evaluation criteria outlined below, may be defined as any incident in which the impact of the helicopter with the ground causes severe pitching of the main rotor, allowing static stops to severely contact the mast; or pitching resulting in cracking the aft lugs of the transmission lower case. This definition is confined only to those incidents not involving sudden stoppage.** **a. Hard Landing Evaluation Criteria Established for Transmissions:** **(1) Remove the transmission and return to depot for evaluation overhaul with complete report of incident.** **b. Hard Landing Evaluation Criteria Established for Input Driveshafts:** **(1) Remove input driveshaft and return to depot for evaluation overhaul with complete report of incident.**		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 3	NO. OF PAGES 29
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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		c. **Hard Landing Evaluation Criteria Established for Mast:** (1) If inspection reveals yielding, deformation, or other obvious damage in the area of mast assembly which would be contacted by the main rotor static stops or hub spring plate assembly, the mast assembly should be considered unserviceable and nonreparable and condemned locally. (2) If post inspection does not reveal the discrepancies above, the component should be returned to depot for evaluation overhaul with complete report of incident. d. **Components Not Requiring Evaluation Criteria Due to Hard Landings:** (1) Thorough engineering investigation has determined hard landings, as defined above, do not adversely affect the following components. If thorough visual inspection does not reveal any discrepancies or obvious damage to components listed below, they may be retained in service for continued usage. (a) Main rotor blades. (b) Tail rotor blades. (c) Main rotor hub. (d) Tail rotor hub. (e) (42 Degree) gearbox. (f) (90 Degree) gearbox. (g) Tail rotor driveshafts. (h) Driveshaft hanger assemblies. (i) Stabilizer bar assembly. (j) Swashplate. (k) Scissors and sleeve assembly.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 4	NO. OF PAGES 29
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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
All Areas		**AFTER A HARD LANDING: IF EXCESSIVELY HARD CONTACT OF MAIN ROTOR HUB STOP OR HUB SPRING PLATE ASSEMBLY AGAINST MAST WAS EXPERIENCED, REPLACE AND ALIGN THE FOLLOWING COMPONENTS:** a. Main rotor blades and attachments. b. Main rotor hub and plate assembly. c. Hub moment springs and support assembly. d. Transmission and mast assembly. e. Transmission to fuselage lift link. f. Conduct engine-to-transmission alignment check.		
All Areas		**AFTER A HARD LANDING IF DAMAGE IS FOUND IN ROTATING CONTROLS, REPLACE THE FOLLOWING COMPONENTS:** a. Stabilizer bar. b. Main rotor pitch horns. c. Collective sleeve assembly. d. Swashplate and Support assembly. e. All connecting controls and control bolts. f. Conduct engine-transmission alignment check.		
		SUDDEN STOPPAGE (POWER ON OR POWER OFF) Sudden stoppage (helicopter) is defined as an instantaneous shock load applied to the drive train and rotor systems either POWER ON or POWER OFF. Shock loads result from: a. Blade(s) striking a movable object. b. Blade(s) striking an immovable object.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 5	NO. OF PAGES 29
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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		c. Seizures which occur as a foreign object is destroyed when it passes through a drive train component.		
		d. Engine Compressor Stall.		
		After a sudden stoppage event has occurred, one of the following special inspections shall be conducted depending on the origin of the shock load.		
		SUDDEN STOPPAGE — MAIN ROTOR BLADE STRIKE		
4		**a. No Visible Damage to Either Blade.**		
		(1) Wipe upper and lower surfaces of main rotor blades with a clean, soft cloth and inspect both surfaces for cracks, distortion or bond separation.		
		(2) Visually inspect hub assembly, hub moment springs, supports, plate assembly, and mast for damage.		
		(3) If no damage is found, inspection is complete. If damage is found in either of the above inspections proceed to paragraph b. below:		
		(4) Visually inspect SKCP series driveshaft for the following conditions:		
		(a) Bolt contact with adjacent plate(s).		
		(b) Plate contact with end fitting(s).		
		(c) Interconnect contact with end fitting(s).		
		(d) Contact of fail-safe surface(s).		
		If any one of the above conditions are found, replace shaft. Return shaft to service if no damage is found.		
4&6		**b. Minor Damage to Either Blade.**		
		NOTE		
		This category includes both repairable damage and skin tears whether repairable or not.		
		(1) Inspect and replace the following items if damage is found:		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 5a	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		NOTE **If damage is found on any of these components, the tail rotor grip assemblies and tail rotor blade attach bolts must be scrapped.** (a) Stabilizer bar tubes and frame for distortion/ cracks. (b) Main rotor hub pillow block attach bolts and drag brace jamnuts and attach bolts for security.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 6	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(c) Flight control system, from the rotor to servo cylinder, for bent or damaged tubes. (d) Scissors levers drive links for damage, (e) Swashplate gimbal mounting for damage. (f) Swashplate retaining plate for damage. (g) Structure at transmission mounting points (use ten-power magnifying glass) for cracks. (h) Lift link and structure for damage, security and distortion. (i) Main driveshaft. (j) Mast. (k) Transmission sump oil filter or debris monitor, chip detector(s) and external oil filter for metal particles. 1 Positive indications are cause for replacing transmission. 2 If no metal particles are found, continue operation for 5 hours, then repeat inspection. If no positive indications are found, resume normal operation. (l) Swashplate trunnions. (m) 42 Degree and 90 degree gearbox chip detectors for metal particles. (n) Tail rotor driveshafts and hanger assemblies for obvious damage. 1 Deleted. 2 Repair/replace driveshaft and hanger assemblies as required. 3 Inspection complete.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 7	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
All Areas		c. **Major Damage to Either Blade.** **NOTE** **This category is restricted to nonreparable damage other than skin tears. For skin damage, see Minor Damage Inspection.** (1) Replace the following: (Disposition as noted). (a) Main Rotor Hub Assembly (Overhaul). (b) Main Rotor Blades (Scrap). (c) Mast (Overhaul). (d) Swashplate (Overhaul). (e) Scissors and sleeve assembly (Scrap). (f) Control tubes (Scrap). (g) Stabilizer bar and damper assembly (Scrap). (h) Control rods (rotor to scissors levers) (Scrap). (i) Transmission (Overhaul). (j) Engine. (Refer to TM 55-2840-229-23 for required inspection.) (k) Tail rotor hub assembly and blade attach bolts (Scrap). (2) Inspect and repair/replace the following as required: (a) Tail rotor blades. (b) 42 and 90 Degree gearboxes (Inspect for damage to gears and input/output couplings). (c) Tail rotor hanger assemblies (Inspect for internal and curvic coupling damage). (d) Aircraft structure.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 8	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(e) Tail rotor driveshaft. (f) Main driveshaft (Inspect for internal and curvic coupling damage). (3) Refer to TM 55-2840-229-23 for engine inspection. (4) Inspection complete. SUDDEN STOPPAGE — TAIL ROTOR BLADE STRIKE		
6		a. No Visible Damage to Either Blade. (1) Inspect doublers for bonding separation, attachment area for distortion. (2) Scrap tail rotor grip assemblies and tail rotor blade attach bolts. (3) Inspect tail rotor rotating controls for damage. (4) Inspect 42 degree and 90 degree gearbox chip detectors for metal particles. (5) Tail rotor driveshafts and hangers for obvious damage. (6) Visually inspect SKCP series driveshaft for the following conditions: (a) Bolt contact with adjacent plate(s) (b) Plate contact with end fitting(s). (c) Interconnect contact with end fitting(s). (d) Contact of fail-safe surface(s). **If any one of the above conditions are found, replace shaft. Return shaft to service if no damage is found.** (7) **If no damage is found, inspection complete. If damage is found proceed to paragraph b. below.**		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 9	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
4&6	b.	If blade damage exceeds limits in para 5-117 or if tail rotor hub assembly cannot be Dynamically Balanced. **(1)** Scrap tail rotor hub assembly, tail rotor blade attach bolts and damaged blade. **(2)** Replace 42 degree and 90 degree gearboxes and return for overhaul **(3)** Inspect and replace the following items if damage is found: (a) Opposite blade. (b) Tail rotor rotating controls. (c) Tail rotor driveshafts. (d) Tailrotor hanger assamblies (inspect for internal spline and curvic coupling damage). (e) Transmission internal oil filter or debris monitor, chip detector(s) and external oil filter and for metal particles: 1 Positive indications are cause for replacing transmission. 2 If no metal particles are found, continue operation for 5 hours, then repeat inspection. If no positive indications are found, resume normal operation. (f) Main driveshaft. (g) Tailboom attachment points. (h) Mast assembly, hub moment springs, support assembly, plate assembly, and hub assembly. (i) Main rotor rotating controls and stabilizer bar assembly. (j) Main rotor blades. (k) Main rotor hub pillow block attach bolts and drag brace jamnuts for security.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 9a	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(4) Deleted. (5) Inspection complete. SUDDEN STOPPAGE — INTERNAL FAILURE OF DRIVE TRAIN COMPONENT		
4&6		a. Replace the following: (Disposition as noted.) (1) Transmission (Overhaul). (2) Mast assembly (Overhaul). (3) 42 Degree gearbox (Overhaul). (4) 90 Degree gearbox (Overhaul). (5) Engine (Refer to TM 55-2840-229-23 for required inspection). (6) Tail rotor hub assembly and blade attach bolts (Scrap). (7) Main rotor hub assembly (Overhaul). (8) Main rotor hub movement springs, support assembly, and plate assembly (Overhaul). (9) Replace main rotor hub spring plate assembly attachment bolts.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 10	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
All Areas		b. **Inspect and repair/replace the following as required:** (1) Main rotor blades. (2) Main rotor rotating controls and stabilizer bar assembly. (3) Tail rotor blades. (4) Main BHT driveshaft (inspect for internal and curvic coupling damage). (4.1) Visually inspect SKCP series Driveshaft for the following conditions: (a) Bolt contact with adjacent plate(s). (b) Plate contact with end fitting(s). (c) Interconnect contact with end fitting(s). (d) Contact of fail-safe surface(s). If any one of the above conditions are found, replace shaft. Return shaft to service if no damage is found. (5) Tail rotor driveshafts. (6) Tail rotor hanger assemblies (inspect for internal and curvic coupling damage). (7) Aircraft structure. c. Inspection complete. **SUDDEN STOPPAGE — COMPRESSOR STALL** **Engine compressor stall (surge) is characterized by a sharp rumble or a series of loud, sharp reports, severe engine vibration and a rapid rise in exhaust gas temperature (egt) depending on the severity of the surge.** **NOTE** **Stall inspection is not required for noise caused by bleed band cycling or surge below 85 percent N1 that is not accompanied by a rapid rise in EGT.** a. Perform Engine Compressor Stall Inspection in accordance with TM 55-2840-229-23. a.1 Visually inspect Main Driveshaft. a.2 Main BHT Driveshaft (Inspect for internal and curvic coupling damage. a.3 SKCP Series Inspect for the following conditions: (1) Plate contact with end fitting(s). (2) Interconnect contact with end fitting(s). (3) Contact of fail-safe surface(s). If any one of the above conditions are found, replace shaft, Return shaft to service if no damage is found. b. Inspect 90 degree gearbox for damage to gears, unusual wear pattern on either coast or drive side of gears and damage to input/output coupling internal and curvic coupling splines.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 11	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(1) No damage to 90 degree gearbox. Visually inspect remaining tail rotor driveshaft components. If no damage is found, inspection complete. (2) Damage to 90 degree gearbox or other drive train component. Perform inspection requirements listed below. Replace the following items if damage is found. (a) Tail Rotor Blades (b) Scrap Tail Rotor Hub Assembly (c) 42 degree gearbox (inspect for damage to gears, unusual wear pattern on either coast or drive side of gears and damage to input/output coupling internal and curvic coupling splines). **NOTE** If 42 degree gearbox inspection reveals damage or abnormal gear wear pattern, it will require a gear wear pattern inspection of the tail rotor drive quill of the main transmission. (d) Tail rotor hanger assemblies (inspect for internal spline and curvic coupling damage). (e) Tail rotor driveshafts. (f) Deleted. (g) Transmission sump oil filter, or debris monitor, chip detector(s) and external oil filter for metal particles. 1 Positive indications are cause for replacing transmission. 2 If no metal particles are found, continue operation for five hours and then repeat inspection. If no positive indications are found, resume normal operation. (h) Mast assembly. (i) Aircraft structure including tailboom attachment area and vertical fin.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 11a	NO. OF PAGES 29
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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(J) Remove main rotor pillow blocks from main rotor yoke and visually inspect for obvious damage to bushings. **NOTE** This inspection requirement shall be accomplished as follows. 1 Remove hub from aircraft. 2 Remove four pillow block attachment bolts. 3 Mark pillow blocks and yoke for reassembly in same position. 4 Lift pillow blocks and trunnion off as an assembly. Do not disassemble these components. 5 Prior to incorporation of MWO 55-1520-242-50-1 and after bushing inspection, reinstall pillow block/trunnion assembly using corrosion preventive compound (C91) over the entire shank of bolts. Torque bolts **77 to 79 ft. lbs.**, apply a small bead of sealing compound (C242 or equivalent) around the base of bolt head, washers and the interface between the bushing sleeve and yoke, sealing compound is required to prevent moisture from entering bolt cavity. 6 After incorporation of MWO 55-1520-242-50-1 and after bushing inspection, reinstall pillow block/trunnion assembly using corrosion preventive compound (C91) over the entire shank of bolts. Torque bolts **65 to 80 ft. lbs.** Apply a small bead of sealing compound (C242)		

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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		around the base of bolt head, washers and the interface between the bushing sleeve and yoke. Sealing compound is required to prevent moisture from entering bolt cavity. (k) Inspection complete.		
4		MAST BUMPING a. Visually inspect the mast area where the static stop or hub spring plate assembly would contact the mast. If no surface deformation of the mast has occurred, the inspection is complete. b. If there is visual evidence of surface deformation of the mast due to static stop or hub spring plate assembly contact: (1) Evaluate the condition of the mast per the damage limits in Chapter 6. (2) Inspect and replace the following items if damage is found: (a) Main rotor hub trunnion cap attach bolts and drag brace jamnuts and attach bolts for security. (b) Flight control system, from rotor to servo cylinder, for bent or damaged tubes and rod end bearings. (c) Structure at transmission mounting points. (d) Lift link and structure for damage, security and distortion. (e) Transmission sump oil filter, external oil filter, and chip detector for metal particles. (f) Main driveshaft. (g) Tail rotor driveshafts and hanger assemblies for obvious damage. (h) Tail rotor drive quill. (i) Top forward section of fuselage.		

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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(j) Tail rotor driveshaft cover. (k) Hub moment springs, support assembly, and plate assembly per damage limits in Chapter 5. (l) Hub spring plate assembly attachment bolts for security. **AFTER WIRE STRIKE** a. Lower WSPS Assembly (1) Inspect for obvious damage to WSPS. (2) Inspect attachment area for damage. b. Windshield Deflector and Upper WSPS Assembly (1) Inspect for obvious damage to WSPS. (2) Inspect attachment area for damage. c. Windshield Wiper Deflector (WWD) (1) Inspect for obvious damage to WWD. (2) Inspect attachment area for damage. **AFTER LOWER WSPS GROUND CONTACT** a. Inspect for obvious damage. b. Inspect attachment area for damage. c. Remove panel and inspect structure and directional control tubes and bellcranks for damage. d. Replace Breakaway Tip Assembly NOTE **Loss of Breakaway Tip or damage not affecting structural integrity of installation are not causes for grounding of aircraft. However, replacement of tip and damage repair shall be accomplished as soon as practical.**		

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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
4&6		**AFTER MAIN ROTOR OVERSPEED** Inspection and/or replacements are required after any report that main rotor has exceeded 339 rpm. When 356 rpm has been exceeded, additional requirements apply. **MAIN ROTOR OVERSPEED LESS THAN 356 RPM** **a.** Inspect the following: **(1)** Main rotor blades for damage, bond separation, and distortion. **(2)** Tail rotor blades for damage, bond separation, and distortion. **b.** Inspection complete. **MAIN ROTOR OVERSPEED EXCEEDING 356 RPM** **a.** Remove main rotor hub and return to overhaul facility for evaluation. **b.** Visually inspect main retention bolts and drag brace bolts for shear offset. **c.** MB Inspect main rotor blades as follows: **(1)** Visually inspect blade skin. Any wrinkle or deformation is cause for blade removal and return to a higher echelon maintenance activity. **(2)** Visually inspect for evidence of looseness of inertia weight inside blade spar. If blades have visible screws through the leading edge abrasion strip to attach inertia weight inside spar, inspect for loose screws or distorted holes. If screws are covered by the abrasion strip, remove tip cap to inspect weight. Tighten loose balance weight retention nuts to **40 to 50** inch-pounds with 1/4 inch studs, **80 to 100** inch-pounds (with 5/16 inch studs).		

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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(3) Blades which pass these inspections are acceptable for further service. Forward blades which do not pass inspection to higher maintenance echelon with complete report of discrepancies. c.1 CB Inspect main rotor blades for damage, bond separation, and distortion. d. Inspect tail rotor blades as follows: (1) If inspection reveals bond separation around tip block or crack in tip block through tip weight holes, remove blades and return to overhaul for evaluation. (2) If inspection reveals laminate or grip plate separation condemn the blade locally as nonreparable. e. Replace tail rotor retention bolts (4). f. If thorough inspection reveals no discrepancies the tail rotor hub and blade assembly may be rebalanced and retained in service. g. Perform a thorough visual inspection of the following components, which may continue in service if no discrepancy or obvious damage is found. Replace any damaged components. (1) Transmission. (2) 42 Degree gearbox. (3) 90 Degree gearbox. (4) Mast. (5) Input driveshaft. (6) Tail rotor driveshaft. (7) Driveshaft hanger assemblies. (8) Stabilizer bar assembly.		

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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(9) Swashplate. (10) Scissors and Sleeve assembly. (11) Tail rotor hub. **AFTER OVERTORQUE** Overtorque is defined as any incident in which torsional loads are introduced into the helicopter dynamic system in excess of 50 psi as determined on the engine torquemeter (calibrated) NOTE **Use calibrated torque for overtorque limits. The following table will aid in converting indicated torque to calibrated torque, when the numbers are extrapolated beyond the scale in TM 55-1520-210-10, chapter 7, torque available chart.** Calibration Factor: Multiply Indicated Torque By: 64 .96 63 .97 62 .98 61 1.00 60 1.02 59 1.04 58 1.06 Example: Indicated torque 60 psi, with calibration factor of 58 (60 × 1.06 = 63.6) (psi calibrated).)		
4		**OVERTORQUE FROM 50 THROUGH 54 PSI** a. Inspect transmission as follows: (1) Inspect main transmission magnetic plugs. (2) Inspect main transmission oil filter, external oil filter, and transmission oil screen. (3) If metal particles are found indicating internal failure, remove transmission and return to overhaul for evaluation. (4) If magnetic plugs and oil screen show no evidence of internal failure, continue to operate the transmission for five hours and repeat steps (1) and (2). (5) If metal particles or any evidence of internal failure are found after five hours of operation return the transmission to overhaul for evaluation. (6) If no evidence of internal failure is indicated, normal operations should be resumed.		
4&6		b. Perform a thorough visual inspection of the following components, which may continue in service if no discrepancy or obvious damage is found. Replace any damaged components. (1) Main rotor blades.		

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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(2) Main rotor hub, hub spring plate assembly, and attachment bolts. (3) Tail rotor blades. (4) Tail rotor hub. (5) 42 Degree gearbox. (6) 90 Degree gearbox. (7) Tail rotor driveshafts. (8) Driveshaft hanger assemblies. (9) Stabilizer bar assembly. (10) Swashplate. (11) Scissors and sleeve assembly. (12) Input BHT driveshaft. (12.1) Visually inspect SKCP series Driveshaft for the following conditions: (a) Bolt contact with adjacent plate(s). (b) Plate contact with end fitting(s). (c) Interconnect contact with end fitting(s). (d) Contact of fail-safe surface(s). If any one of the above conditions are found, replace shaft. Return shaft to service if no damage is found. (13) Mast, hub springs, and support assembly. (14) Transmission. **OVERTORQUE FROM 54 THROUGH 61 PSI**		
4&6		a. Inspect transmission as follows: (1) Perform steps a. (1) through (6) as listed under overtorque from 50 through 54 psi.		

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AREA NO.	REQUIRE-MENT EVERY	ITEM	STA-TUS	RECORDED ON WORKSHEET
		b. Remove and replace main rotor pillow block bolts. c. Perform a thorough visual inspection of the following components, which may continue in service if no discrepancy or obvious damage is found. Replace any damaged components. (1) Main rotor blades.		

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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(2) Main rotor hub.		
		(3) Tail rotor blades.		
		(4) Tail rotor hub.		
		(5) 42 Degree gearbox.		
		(6) 90 Degree gearbox.		
		(7) Tail rotor driveshaft.		
		(8) Driveshaft hanger assemblies.		
		(9) Stabilizer bar assembly.		
		(10) Swashplate.		
		(11) Scissors and sleeve assembly.		
		(12) Input driveshaft.		
		(13) Mast, hub springs, and support assembly.		
		(14) Transmission (all part numbers).		
		OVERTORQUE IN EXCESS OF 61 PSI		
4&6		a. Return the following assemblies to overhaul for evaluation.		
		(1) Transmission assembly.		
		(2) Input driveshaft assembly (BHT and SKCP).		
		(3) Main rotor blades.		
		(4) Main rotor hub assembly, hub spring plate assembly, and attaching bolts.		
		(5) Mast assembly.		
		(6) Hub springs and support assembly.		
		b. Perform a thorough visual inspection of the following components, which may continue in service if no discrepancy or obvious damage is found. Replace any damaged components.		

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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(1) Tail rotor blades. (2) Tail rotor hub. (3) 42 Degree gearbox. (4) 90 Degree gearbox. (5) Tail rotor driveshaft. (6) Driveshaft hanger assemblies. (7) Stabilizer bar assembly. (8) Swashplate. (9) Scissors and sleeve assembly. **NOTE** **It is imperative that component removal record of dynamic components should reflect overtorque as reason for removal.** Engine Inspection Requirements: When the engine has exceeded overtorque limits, refer to TM 55-2840-229-23. **LIGHTNING STRIKE INSPECTION.** **NOTE** **Because of the variability of observed magnetic fields due to lighting strikes and normal flights, as well as the inaccuracies of magnetometers, quantitative pass-fail criteria for levels of magnetism are not established. Only relative measurements should be made. Additional clarification may be obtained by using the magnetometer on a similar component of a non-lighting struck aircraft for comparison to levels of magnetism that exist due to normal flight. It is desirable that both aircraft have had similar recent flight profiles, as well as flight hours.**		

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AREA NO	REQUIRE-MENT EVERY	ITEM	STA-TUS	RECORDED ON WORKSHEET
All		**a. General Requirements:** **(1)** Whenever the aircraft is struck by lightning: **(a)** Inspect the fuselage interior and exterior, the landing gear, the rotor systems and static ground wire for burn marks, cracks, pitting or other signs of high temperature stress, to determine the lightning entry and exit points. **(b)** Trace the path of the lightning strike to the extent possible using a magnetometer. **(c)** Check the magnetic compass for accuracy (the degree of inaccuracy may serve as an indicator of the severity of the strike).		

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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(d) Inspect wiring in tunnel areas and exposed areas for burns. (e) Inspect antennas for burns and pitting. (f) Inspect all electrically operated components and lighting systems for damage. (g) Inspect communications and navigation equipment for damage. (h) If preceding steps a. through g. reveal major damage has occurred, proceed as follows: (i) Bench test all avionics and electrical systems and components. (j) Perform a Megger check and continuity check on all wiring and cables. (k) Perform a Voltage Standing Wave Ratio (VSWR) check on all antennas, antenna cables, and connectors. (l) Perform specific inspections/replacements as required. (m) Perform a ground run operational check on the aircraft. Functionally check the flight control system, and all avionics, electrical, lighting, communication, and navigation systems. (n) Repair any damage and replace damaged components as required using standard maintenance practices. b. **Specific Requirements:** (1) Whenever lightning strike is evident on main rotor system: (a) CB Inspect for lightning strike per paragraph 5-34.5. (b) MB Inspect blades for damage such as burns, pitting, skin separation, etc. If damage is evident, locally scrap damaged blade(s).		

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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
6		(c) Remove hub assembly and return for overhaul. (d) Replace all bearings (or next higher assembly if required) in the fixed and rotating control system located above the servo cylinders. (e) Remove swashplate assembly, mast assembly, hub springs, support assembly, and transmission assembly, and return for overhaul. (f) Check (BHT or SKCP) driveshaft for residual magnetism. If BHT driveshaft is magnetized remove, disassemble, and visually inspect for damage. Remove engine and return for overhaul. If SKCP driveshaft is magnetized, remove and inspect for damage. Remove engine and return for overhaul. (g) If strike occurred on stabilizer bar, replace bar in question. Inspect the remainder of the stabilizer assembly for damage. **(2) Whenever lightning strike is evident on tail rotor system:** **(a) Inspect blades for damage such as burns, pitting, skin separation, etc. If damage is evident, locally scrap damaged blade(s).** **(b) Tail rotor hub: Scrap locally.** (c) Remove and condemn pitch change links, crosshead bearing, and control quill bearings. **(d) Inspect crosshead, control quill components, and control rod for any indications of arcing. Replace as necessary.** **(e) Remove both the 42 degree and 90 degree gearboxes and return them for overhaul.** **(f) Check hangers for residual magnetism. Replace any magnetized hanger bearings.** **(g) If all hangers are magnetized, remove transmission and return for overhaul.**		

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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		(h) Check (BHT or SKCP) driveshaft for residual magnetism. If BHT driveshaft is magnetized remove, disassemble and visually inspect for damage, remove engine and return for overhaul. If SKCP driveshaft is magnetized, remove and inspect for damage, remove engine and return for overhaul. **AFTER AIRCRAFT IS FLOWN INTO AREA WITH BLOWING SAND AND/OR LOOSE GRASS ENVIRONMENT. (REFER TO TM 55-2840-229-23).** **NOTE** **If FOD screen and sand and dust separator are installed, remove upper halves to accomplish this inspection. If blockage is evident, the lower half of the separator must be removed to ensure complete removal of grass or foreign material.** **NOTE** **If the Improved Particle Separator (IPS) is installed, remove any foreign objects from top screen or side of vortex tube panels. Blowing sand can penetrate through vortex tubes and if engine is not running, will not be scavenged overboard. In these circumstances sand can settle in bottom plenum of IPS. The top of IPS should be removed and all sand removed from IPS bottom half.**		

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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
5		AFTER ENGINE OVER-TEMPERATURE. Periorm an engine over-temperature inspection. (Refer to TM 55-2840-229-23.) **NOTE** **If engine cannot be operated without exceeding egt limits as specified in TM 55-2840-229-23, Engine Operating Limits Table, this is indication of engine malfunction or instrument error. Refer to troubleshooting (TM 55-2840-229-23) to determine cause and correct action, as overtemperature inspection may not be required.** ENGINE OIL OVER TEMPERATURE LIMITS. (REFER TO TM 55-2840-229-23)		
5		AFTER ENGINE OVERSPEED. **NOTE** Refer to Chapter 6, for engine to rotor gear ratio.		
5		(Refer to TM 55-2840-229-23) ENGINE OVERSPEED LIMITS EXCEEDED.		
5		(Refer to TM 55-2840-229-23)		

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AREA NO.	REQUIRE-MENT	ITEM	STA-TUS	RECORDED ON WORKSHEET
		ENGINE POST-INSTALLATION Inspection a. Check installation of power control linkage in accordance with Chapter 4, Section VII. b. Perform exhaust gas temperature (EGT) system test. (Refer to TM 55-2840-229-23 and TM 55-4920-401-13&P.) c. Perform a Daily Inspection. **NOTE** **The following paragraph d need not necessarily be performed if the engine has merely been removed and reinstalled for reasons other than engine maintenance. However, the engine should be inspected for leaks and security of mounting provisions, hoses and accessories prior to flight.** d. Perform inspection before and after initial check run. (Refer to TM 55-2840-229-23.) e. Perform a compass swing check if the engine has been replaced (Refer to TM 1-1500-204-23-4.) f. Perform an engine vibration test. (Refer to TM 55-2840-229-23.) g. Perform a limited test flight. **NOTE** **V-band clamp torque check is not required when engine has been removed and reinstalled for other maintenance.** h. Check torque of tail pipe and fire wall "V" band clamps again after test flight or engine ground run. i. Remark torque pressure indicator **NOTE** **Not required when engine has been removed and reinstalled for other maintenance.** **NOTE** **If engine performance appears to deviate from desirable limits, perform adjustment of fuel control. (Ref to TM 55-2840-229-23.)**		

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AREA NO.	REQUIRE-MENT EVERY	ITEM		STA-TUS	RECORDED ON WORKSHEET
5		**ON INITIAL INSTALLATION OF A NEW OR OVERHAULED ENGINE OR WHEN MAINTENANCE HAS BEEN PERFORMED THAT AFFECTS THE FUEL FLOW, AIRFLOW OR GAS PATH OF THE ENGINE.** Perform a new baseline TEAC. A new baseline HIT is also required when a new standard TEAC is to be established. Refer to TM 55-2840-229-23.			
5		**ENGINES DROPPED DURING HANDLING.** Refer to TM 55-2840-229-23.			
5		**AFTER EMERGENCY FUEL HAS BEEN USED.** Refer to TM 55-2840-229-23 and TB 55-9150-200-24.			

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AREA NO.	REQUIREMENT EVERY	ITEM	STA-TUS	RECORDED ON WORKSHEET
ALL Areas		**AFTER A HARD LANDING**		
1		**AFTER OVERFLOW OF BATTERY AND/OR BATTERY SUMP JAR (IF SUMP JAR IS INSTALLED).**		
		a. Sheet metal surfaces and overlaps, both internal and external, for damage. b. Rivets, bolts, screws, and other hardware in area, internally and externally, for damage. c. Hidden areas in vicinity of battery and sump jar for damage d. All metal parts throughout contaminated area for damage.		
2		**EVERY 120 DAYS.** Perform load test on multi-armament structural support assemblies PIN 1560UH1-768-1 and -3. (installed on aircraft). a. Disconnect multi armament structural support assembly (strut) from pylon support assembly by removing hexagon nut, flat washer, and machine bolt. Position strut away from pylon support assembly. b. Attach tension end (hook) of mechanical force gage (spring scale) through bolt hole of strut. c. Apply a slow steady pull axially on spring scale until friction damper assembly of strut begins to slip. After movement is observed, ensure a force of between 50 and 150 pounds is required to sustain movement d If the proper load range is not obtained, refer to Chapter 16 and adjust strut damper to obtain proper load. e. Connect multi-armament structural support assembly (strut) to pylon support assembly by installing machine bolt, flat washer, and hexagon nut.		

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AREA NO.	REQUIREMENT EVERY	ITEM	STA-TUS	RECORDED ON WORKSHEET
ALL Areas		**AFTER A HARD LANDING**		
		f. Repeat procedure for remaining structural supports.		
		PRIOR TO INSTALLATION OF OUTSIDE AIR TEMPERATURE GAUGE.		
		Each time the outside air temperature gauge is replaced, test the replacement gauge (TM 11500204234).		
2		**12 MONTHS.**		
		Magnetic compass for discoloration of liquid and proper calibration; re-compensate if necessary (TM 11500204234).		
		Remote compasses for calibration (TM 11500204234). Should compensation be necessary, refer to higher level of maintenance.		
		Check Bleed Air Heater/Muff Heater Overheat Switch for loose wires, corrosion and damage. Perform electrical operational check on the Bleed Air Heater/Muff Heater system. Inspect for proper switch actuation points per Chapter 13.		
2		**12 MONTHS OR NEAREST SCHEDULED INSPECTION.**		
		a. Inspect and test OAT/FAT gage IAW (TM 11500204234).		
		b. Inspect Hanger Bearings for evidence of grease leakage, corrosion overheating (discoloration of adjacent metal), and roughness.		
2		**24 MONTHS.**		
2		**EVERY 24 MONTHS OR NEAREST SCHEDULED INSPECTION, ACCOMPLISH THE FOLLOWING:**		
		Perform functional checks of piton static system and instruments.		

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ALL Areas		**AFTER A HARD LANDING**		
	4, 5	Remove left and right pylon access doors. Using a clean cloth, wipe water deposits from pylon structural members. Reaching aft onto forward engine deck through rear of pylon structures wipe water from engine deck.		
	1	Check pitot static system for moisture (drain plug removed).		
	6	Purge lubricate tail rotor grip assemblies.		
All Areas		**AFTER THE HELICOPTER HAS BEEN SUBJECT TO SALT WATER OR SALT WATER SPRAY.** Wash entire helicopter with fresh water, particularly inside of engine compartment doors. Wash all compartments which were exposed to salt water. Make a detail check of all surfaces for corrosion. Apply corrosion preventive compound (C87) to exposed nonpainted, anodized, or cadmium plated assemblies. Clean engine compressor in accordance with TM 55284022923.		
	4	MB HELICOPTERS WHICH ARE BEING OPERATED UNDER SALT LAEN ATMOSPHERIC ENVIRONMENTAL CONDITIONS WILL REQUIRE THE FOLLOWING MINIMUM DAILY BLADE INSPECTION. Using a mild soap detergent, wash blades daily. Rinse with clean water and dry. All aircraft down for maintenance or nonflyable storage are not subject to blade wash and inspection.		
	1	EVERY 25 HOURS OR 30 DAYS, WHICHEVER OCCURS FIRST, ACCOMPLISH THE FOLLOWING: Perform preventive maintenance checks and services on the nickel cadmium battery (TM 11-6140-203-23).		
		AFTER THE AIRCRAFT HAS REMAINED INACTIVE FOR SEVEN (7) CONSECUTIVE DAYS. Process the aircraft into the appropriate storage category (appendix E).		
	6	**EVERY 25 HOURS.** Inspect silent chain, while installed, using three power magnifying glass and adequate light source.		
	4	Visually inspect main rotor blades for evidence of debonding of the leading edge abrasion strip and the trim tab. CB		

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AREA NO.	REQUIREMENT EVERY	ITEM	STA-TUS	RECORDED ON WORKSHEET
ALL Areas	AFTER A HARD LANDING			
		NOTE **Tension check is not required If cable tension has not been adjusted or components have not been replaced.**		
	6	5 to 10 flight hours after replacement of either the TIR sprocket, TIR control chain, T/R speed rig cables, T/R control cables or any combination thereof, or after any maintenance action resulting in adjustment of the tail rotor control cable tension (adjustment of turnbuckles) check tail rotor cable tension and adjust as required.		
	1	EVERY 100 HOURS OR 120 CALENDAR DAYS, WHICHEVER OCCURS FIRST, ACCOMPLISH THE FOLLOWING: Perform preventive maintenance checks and services on the nickel cadmium battery (TM 11614020323).		
	3	EVERY 100 HOURS OR 120 CALENDAR DAYS, WHICHEVER OCCURS FIRST, ACCOMPLISH THE FOLLOWING (SOLID STATE REGULATORS). Check voltage regulator setting; adjust for temperature as required.		
	3	EVERY 25 HOURS OR 30 DAYS, WHICHEVER OCCURS FIRST, ACCOMPLISH THE FOLLOWING (CARBON PILE REGULATORS). Check voltage regulator setting; adjust for temperature as required.		
	4	EACH 50 HOURS OF OPERATION OR 30 DAYS, WHICHEVER OCCURS FIRST. [C Clean main rotor blades in accordance with cleaning instructions MB agraph 5-119). Inspect main rotor blades in accordance with paragraph 5-31a.(1) through a.(6). Clean tail rotor blades in accordance with cleaning instructions (paragraph 5-119). Inspect tail rotor blades in accordance with paragraph 5-117a. through d. only and paragraph 5-117 h.(4) .		
	4	EVERY 50 HOURS OF OPERATION. Visually inspect lift link and attaching points for security, cracks and damage.		
	2	EVERY 6 MONTHS. Weight check CF3BR fire extinguisher (TM 11-5002-042-3 series). Inspect and test connector receptacle (ground) in accordance with TM 11-5002-042-3 series. Inspect and test dosed circuit refueling receptacle bus conductor (ground strap) in accordance with TM 55-1500-323-24).		

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AREA NO	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
3		**AFTER INITIAL INSTALLATION OF RESCUE HOIST ASSEMBLY ON AIRCRAFT** **a. Inspect cable cutter assembly for corrosion and condition of primer charge.** **b. Check and record date of manufacture of primer charge.**		
3		**AFTER MULTIPLE AND CONSECUTIVE CABLE EXTENSIONS (4 OR MORE) AT ONE TIME UNDER NO LOAD (HIGH PERFORMANCE HOIST)** **Apply a 200 pound load with cable extended 250 feet to again properly seat cable elements.**		

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AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
3		**EVERY 300 HOURS** Perform a play check between the Hydraulic Servo Lever Assembly (Sloppy Link) on all three servos (TM 55-1520-210-23-2).		
All Areas		**AIRCRAFT IN FLYABLE STORAGE** Perform preventive maintenance (reference Appendix E).		
4, 5		**IMMEDIATELY AFTER EXPOSURE TO WATER FROM AIRFRAME OR ENGINE WASHING; OR AT NEXT DAILY INSPECTION AFTER EXPOSURE TO RAIN, SNOW SLEET OR ICE** Remove left and right pylon access doors. Using a clean cloth, wipe water deposits from pylon structural members. Reaching aft onto forward engine deck through rear of pylon structure, wipe water from engine deck.		
6		**AFTER HELICOPTER HAS BEEN OPERATED IN RAIN, ICE, OR HEAVY SNOW** Purge Lubricate Tail Rotor Hub and Blade Grip Bearings. **NOTE** Lubrication may be deferred until aircraft arrives at final destination. If several flights are flown in rain or snow, purge lubrication of the tail rotor hub and blade grip bearings may be performed after the last flight of the day or mission day.		
5, 6		**AFTER PARKED AIRCRAFT IS EXPOSED TO SLEET, FREEZING RAIN, OR SNOW.** **NOTE** This inspection applies only to aircraft with Improved Particle Separator installed and parked without covers installed. Prior to starting engine, remove upper half of separator and inspect for ice and/or snow. Any accumulation of these elements should be removed to prevent damage to engine.		
5, 6		**AFTER THE HELICOPTER HAS BEEN EITHER PARKED OR OPERATED IN RAIN, ICE OR HEAVY SNOW**		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily, Intermediate, etc.) SPECIAL	PAGE NO. 27a	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		NOTE Inspection does not apply to aircraft with selfpurge type separators, improved particle separators or if aircraft was parked with protective cover installed. Open engine inlet area and remove upper air filter assembly. Inspect and clean particle separator parts (P/N 1-010-500-05 and -06 only).		
4		AFTER INSTALLATION OF MAIN ROTOR HUB Delete paragraph a. Deleted. b. Purge lubricate after initial installation (Ref to paragraph 1-7) and each 50 hours.		
4		AFTER TRANSMISSION OIL OVER TEMP a. Troubleshoot transmission oil system to determine cause. b. Replace transmission, mast, oil cooler and external oil filter if cause is due to transmission internal failure. c. If cause is due to oil system external to transmission and oil temperature did not exceed 130°C for 15 minutes, drain and refill transmission oil system. d. If temperature exceeded above limits, replace transmission and mast. If abnormal contamination is present, also replace oil cooler and external oil filter.		
4		AFTER COMPLETE LOSS OF TRANSMISSION OIL a. Troubleshoot transmission oil system to determine cause. b. Replace transmission and mast, if engine power was applied after complete loss of oil. Also replace oil cooler and external oil filter if abnormal contamination is present.		
4		AFTER INSTALLATION OF STATIC STOP PLATE ASSEMBLY (P/N 204-011-207-105) Torque shall be rechecked after 5 to 10 hours of operation whenever a new plate is installed or whenever the bolts are loosened, removed, replaced, or otherwise disturbed in anyway.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily Intermediate, etc.) SPECIAL	PAGE NO. 27B	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
6		**AFTER INSTALLATION OF TAIL ROTOR** Between five hours and ten hours of flight after installation of tail rotor, retorque tail rotor retaining nut (**300 to 400** inch-pounds). Do not back-off nut, retorque by turning in the tightening direction only.		
6		**AFTER INSTALLATION OF TAIL BOOM** Retorque (apply torque force in the tightening direction only) attachment bolts after first flight.		
6		**AFTER AOAP NOTIFICATION OF HIGH CONCENTRATIONS OF COPPER, ALUMINUM, IRON, SLUDGE, OR A COMBINATION OF THESE IN THE 90° GEARBOX.** a. Inspect the tail rotor control tube for wear and excessive grease. b. Inspect tail rotor control quill assembly for wear. c. Drain, flush with operating oil to eliminate sludge. Repeat if necessary. d. Resample oil per AOAP instructions. (Refer to TB 43-0106).		
5		**EACH 12-1/2 HOURS** Aircraft without ODDS engine spectro-metric oil analysis. (Refer to TB 43-0106).		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily Intermediate, etc.) SPECIAL	PAGE NO. 28	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
4 & 6		**EACH 25 HOURS** Aircraft without ODDS, oil analysis: Hydraulic system, main transmission, 42 degree, and 90-degree gearboxes. (TB 43-0106). Aircraft with ODDS, oil analysis: Hydraulic System, Engine, Main Transmission, 42 degree, 90 degree gearboxes. (TB43-0106 and TB1-1520-243-20-25).		
All Areas		**WHEN AVAILABLE INFORMATION INDICATES EXPOSURE TO RADIO ACTIVITY ACCOMPLISH THE FOLLOWING (TM 3-220).** a. Survey helicopter for level of radioactivity. b. Decontaminate helicopter as required.		
All Areas		**UPON TRANSFER AND UPON RECEIPT OF A HELICOPTER, UPON EXPIRATION OF 12 MONTHS ELAPSED TIME SINCE LAST INVENTORY AND UPON PLACING HELICOPTER IN STORAGE AND UPON REMOVING FROM STORAGE (NOT REQUIRED WHEN AIRCRAFT IS PLACED IN OR REMOVED FROM FLYABLE STORAGE). INVENTORY HELICOPTER FOR AVAILABILITY OF INVENTORIABLE PROPERTY (REFERENCE DA PAM 738-751 HELICOPTER NEED NOT BE INVENTORIED WHILE IN STORAGE).**		
All Areas		Weigh helicopter per AR 95-3 and/or TM 55-1500-342-23 after installation, removed or relocation of equipment and/or major modification which results in an unknown change in the basic weight and balance; after report of unsatisfactory flight characteristics. Accomplish necessary weight and balance data (DD Forms 365).		
All Areas		**EVERY 24 MONTHS:** Weigh aircraft per AR 95-3.		
All		**EVERY 600 HOURS OR ANNUALLY, WHICHEVER OCCURS FIRST, ACCOMPLISH THE FOLLOWING:** a. Lubricate tail rotor driveshaft flexible couplings. b. Check splines for wear, nicks, and overheating. c. Visually check flexible coupling seal for proper installation, cuts and tears. d. Inspect tail rotor driveshaft hanger bearing support fittings for scratches, corrosion, hole elongation, or wear.		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily Intermediate, etc.) SPECIAL	PAGE NO. 29	NO. OF PAGES 29
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AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		EVERY 600 HOURS		
2		**AFTER ELECTRICAL EQUIPMENT, ENGINE CHANGE, OR MAJOR STRUCTURAL EQUIPMENT CHANGES LIKELY TO AFFECT THE COMPASS** **Magnetic and remote compass - Check for accuracy. Swing compass (TM 1-1500-204-23-4 PG 4-24 through 4-30).**		
4		**EVERY 600 HOURS OR ANNUALLY, WHICHEVER OCCURS FIRST** Main input driveshaft disassembled and coupling internal splines inspected and lubricated (not required on P/N SKCP2281 series assembly).		
5		**EVERY 600 HOURS** Hot end inspection on T53-L-13BA engine part number 1-000-060-10A (TM 55-2840-229-23).		
4		**EVERY 600 HOURS (BASED ON BLADE TIME)** Inspect main rotor blade for secure ballast weight.		

AIRCRAFT INSPECTION CHECKSHEET			TYPE OF INSP (Daily Intermediate, etc.) SPECIAL	PAGE NO. 29A	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.			INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		EVERY 75 HOURS (Helicopters without ODDS)		
4		Remove transmission sump oil filter (wafer disc screens) and electrical chip detector and check for contamination; then clean.		
4		**EVERY 50 HOURS LUBRICATE MAIN ROTOR GREASE HUB (MIL-G-81322).**		
5		**EVERY 300 HOURS OR EACH TIME THE ENGINE IS REPLACED (MIL-L-7808 OIL ONLY) (HELICOPTERS WITHOUT ODDS).**		
		NOTE **Aircraft equipped with ODDS are not required oil replacement due to normal operation.**		
		Engine oil tank and oil cooler drained and refilled. If engine is replaced due to internal failure, flush all airframe mounted engine oil lines, engine oil tank and engine oil cooler. Helicopters with ODDS are not required oil replacement due to normal operation. If engine is replaced due to internal failure, flush all airframe mounted lines, engine oil tank, lubriclone and replace oil cooler. Replace engine lubricant.		
5		**EVERY 900 HOURS OR EACH TIME THE ENGINE IS REPLACED (MIL-L-23699 OIL ONLY) (HELICOPTERS WITHOUT ODDS).**		
		NOTE **Aircraft equipped with ODDS are not required oil replacement due to normal operation.**		
		Engine oil tank and oil cooler drained and refilled. If engine is replaced due to internal failure, flush all airframe mounted engine oil lines, engine oil tank and engine oil cooler. Helicopters with ODDS are not required oil replacement due to normal operation. If engine is replaced due to internal failure, flush all airframe mounted lines, engine oil tank, lubriclone and replace oil cooler. Replace engine lubricant.		
4		**EVERY 300 HOURS OR EACH TIME THE TRANSMISSION IS REPLACED (MIL-L-7808 OIL ONLY) (HELICOPTERS WITHOUT ODDS).** Transmission and transmission cooler drained. Transmission oil pump screen inspected for metal particles and other contaminates. If transmission is replaced due to internal failure, flush all lines, replace oil cooler, disassemble and clean thermal valve. Clean screens and replace transmission lubricant.		
		(Continued on next page)		

AIRCRAFT INSPECTION CHECKSHEET	TYPE OF INSP (Daily Intermediate, etc.) SPECIAL	PAGE NO. 29B	NO. OF PAGES 29
AIRCRAFT AND SERIAL NO.	INSPECTION NO.	DATE OF INSPECTION	

AREA NO.	REQUIREMENT EVERY	ITEM	STATUS	RECORDED ON WORKSHEET
		Helicopters with ODDS are not required oil replacement due to normal operations. If transmission is replaced due to internal failure, flush all lines, transmission oil cooler, disassemble and clean thermal valve. Clean screens and replace transmission lubricant.		
4		**EVERY 900 HOURS OR EACH TIME THE TRANSMISSION IS REPLACED (MIL-L-23699 OIL ONLY) (HELICOPTERS WITHOUT ODDS).**		
		NOTE **Aircraft equipped with ODDS are not required oil replacement due to normal operation.**		
		Transmission and transmission cooler drained. Transmission oil pump screen inspected for metal particles and other contaminates. If transmission is replaced due to internal failure, flush all lines, replace transmission oil cooler, disasemble and clean thermal valve. Clean screens and replace transmission lubricant.		
		Helicopters with ODDS are not required oil replacement due to normal operations. If transmission is replaced due to internal failure, flush all lines, replace transmission oil cooler, disassemble and clean thermal valve. Clean screens and replace transmission lubricant.		
4		**EVERY 12 MONTHS INSPECT THE MAGNESIUM CLEVIS END OF THE DROOP COMPENSATOR JACKSHAFT ASSEMBLY FOR CORROSION AND SECURITY.**		
5		**EVERY 12 MONTHS OR ANYTIME A FIRE WARNING SENSOR IS INSTALLED OR REINSTALLED.**		
		Fire detection system for correct operation and fire detection loops for proper grounding.		
6		**EVERY 3600 HOURS.**		
		Elevator Horn for corrosion, fretting and overall condition.		
5		**EVERY 1200 HOURS.**		
		Hot end inspection on T53-L-13B Engine, PN 1-000-060-22, TM 55-2840-229-23.		
6		**EVERY 1200 HOURS OR 24 MONTHS.** Inspect holes in adapter, studs, and base of 90 - degree gearbox for corrosion.		

SECTION V. OVERHAUL AND RETIREMENT SCHEDULE

1-62. INTRODUCTION.

This section lists units of operating equipment that are to be overhauled or retired at the period specified. Removal of equipment for overhaul may be accomplished at the inspection nearest the time when overhaul is due unless otherwise specified in TM 1-1500-328-23.

WARNING

TM 1-1500-328-23 should be referred to concerning mutilation/destruction of items when they have reached the established life expectancy (finite life) before the items are forwarded for property disposal.

1-63. OVERHAUL INTERVAL.

1-64. Description - Overhaul Interval. The maximum authorized operating time on calendar interval of parts prior to removal for overhaul at category of maintenance authorized in accordance with the Maintenance Allocation Chart (Table 1-8 and Appendix B).

1-65. RETIREMENT SCHEDULE.

1-66. Description - Retirement Schedule. The operating time or calendar interval specified for removal, condemnation and disposal of parts in accordance with TM 1-1500-328-23 (Table 1-8).

NOTE

Items replaced on a calendar basis (for the purpose of overhaul or retirement) will not be listed on 2408-16 Component Installation and Removal Record, but will be listed on DA Form 2408-18, Equipment Inspection List, for scheduling purposes.

Table 1-8. Overhaul and Retirement Schedule

AREA	OVERHAUL INTERVAL (HOURS)	RETIREMENT INTERVAL (HOURS)	ITEM AND PART NUMBER	
			Main Rotor	
4				
		2500	Main Rotor Blade Assembly	204-011-250-5/113
		10,000	Composite Main Rotor Blade	205-015-150-101
		7200	Main Rotor Yoke	204-011-102-17
	1200		Main Rotor Hub Assembly	204-012-101-139/141
		5000	Plate Assembly	204-011-207-105
		5000	Bolt	MS21250H06006
		2400	Inboard Strap Fitting	204-012-102-1/5
		2400	Outboard Strap Fitting	204-012-103-1
		2400	Strap Pin	204-012-104-1,-3,-5
		2400	Retention Strap	2601399, 204-012-112-5 204-012-122-1/5
		3600	Clevis	204-011-142-3
		3600	Clevis	204-011-179-1
		15000	Center Frame Assembly	204-011-307-1
		5 YRS	Stabilizer Bar Tube	204-011-328-11
		2400	Retention Strap	2606650
		2400	Strap Fitting Inboard Main	204-012-102-9
		2400	Strap Assy Main Rotor	204-310-101-101
		2400	Strap Assy Main Rotor	2601139
		5000	Support Assembly	204-011-208-101

Table 1-8. Overhaul and Retirement Schedule (Cont)

AREA	OVERHAUL INTERVAL (HOURS)	RETIREMENT INTERVAL (HOURS)	ITEM AND PART NUMBER	
4			Transmission	
	1100		Transmission Assembly	204-040-016-1,-3
	2000		Transmission Assembly	204-040-016-5
4	1500		Main Input Quill Assembly	205-040-263-3,-111
	1500		Mast Assembly	204-040-366-9,-15
		1500	Mast Bearing	AMM9122-44-101
		1500	Bearing	204-040-136-7,-9
		1500	Bearing	212-040-136-1
		1500	Mast Assembly	204-011-450-105
		1500	Mast Assembly	204-011-450-7
			Tail Rotor & Drive System	
		1100	Blade Assembly	204-011-702-11
		1200	Blade Assembly	204-011-702-15
6		300	Grip Assembly	204-011-728-1
6		300	Grip Assembly	204-011-728-19
6		2500	Grip Assembly	205-011-711-101
		1500	Yoke Assembly	204-011-722-5
	1500		Gearbox, 42˚	204-040-003-7,-13, -19,-23,-29
		3000	Slider, Tail Rotor	204-010-720-3
		********600	Bearing Hanger	204-040-623-5 or PAM9107NPPA2702
	1200		Gearbox, 90˚	204-040-012-7
	600		Gearbox, 90˚	204-040-012-1
			Main Rotor Mast Controls	
	1200		Swashplate & Support Assy	204-011-400-11
		3300	Support	204-011-404-1
		3600	Support	204-011-404-5
		500	Pin	204-011-446-3
		4800	Collective Lever	212-010-403-5
		1000	Collective Lever	204-011-438-1
		3600	Scissors Assembly	204-011-406-1/9/13/15
4	1100		Scissors and Sleeve Assy	204-011-401-1/7/9
4	1200		Scissors and Sleeve Assy	204-011-401-11

Table 1-8. Overhaul and Retirement Schedule (Cont)

AREA	OVERHAUL INTERVAL (HOURS)	RETIREMENT INTERVAL (HOURS)	ITEM AND PART NUMBER	
5	2400		Engine	T53-L-13B
			NOTE	
			Deleted	
		600	Rotor Controls Parts Kit (See figure 1-15)	204-1629-2
			Synchronized Elevator	
		3600	Elevator Assembly	205-030-856-19,-21
		4800	Elevator Horn Assembly	205-001-914-1/-25

Table 1-8. Overhaul and Retirement Schedule (Cont)

Area	Overhaul Interval	Retirement Interval	Item And Part Number	
		450	Muff Heater Blower Bearings or Oil Cooler Turbine Bearings	J33C32, H33C32 J33C32, H33C32 P203NPPFS50160 15819-11, 62032RSJC3QLA P9101NPPFS50160 P9101PPFS50160 P9013NPPFS50160 P9013PPFS50160
2		24 Months	Seat Covers Raschel Knit	AL 1018-11-00 & AL 1040-11-00
		24 Months	Deleted	
		24 Months	Mission Operator Seat (Bottom)	AL 1018-10-00
		24 Months	Mission Operator Seat (Back)	AL 1027-27-00
		********* 10 Years	Inertia Reel	015-870145-3-16

NOTE

All retirement life items will have a DEMIL code of “L” and will be mutilated IAW DOD 4160.21-M-1, Defense Demilitarization manual.

* Deleted.

** Deleted.

*** Deleted.

**** Deleted.

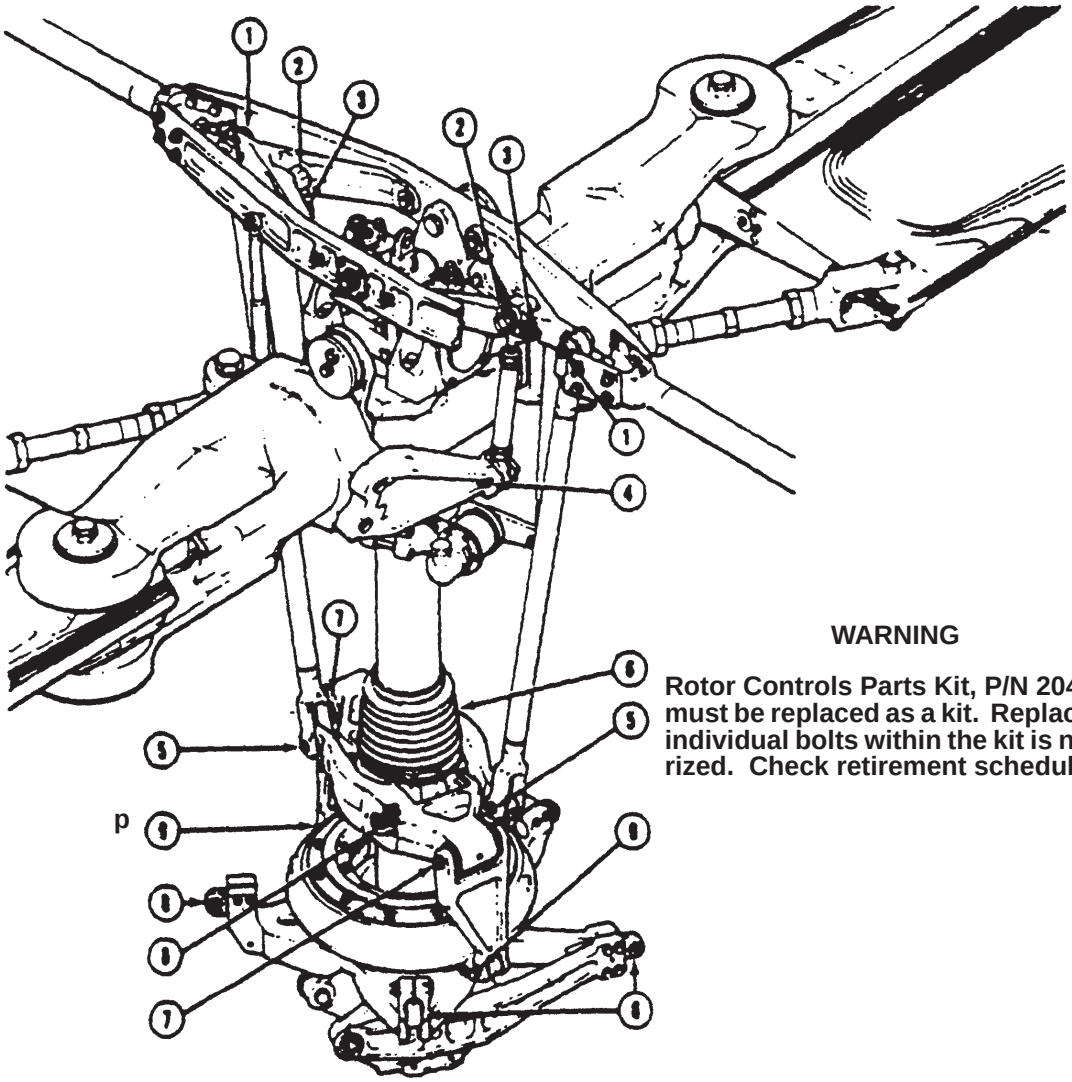
***** Deleted.

****** Deleted.

******* Deleted.

******** The hanger bearing has a shelf life of 5 years.

********* Retirement interval starts with inertia reel replacement.



WARNING

Rotor Controls Parts Kit, P/N 204-1629-2, must be replaced as a kit. Replacement of individual bolts within the kit is not authorized. Check retirement schedule.

1. Bolt, NAS1305-27D
   Mixing Lever to Scissor Tube (2 places)
2. Bolt, NAS1306-34D
   Universal to Mixing Lever (2 places)
3. Bolt, NAS1306-27D
   Pitch Link to Universal (2 places)
4. Bolt, NAS1306-32D
   Pitch Horn to Pitch Link (2 Places)
5. Bolt, NAS1305-27D
   Scissor Tube to Scissors (2 Places)
6. Bolt, NAS464P8-90
   Scissors Pivot (2 Places)XC
7. Bolt, NAS464P8-69
   Scissors to Drive Link (2 Places)
8. Bolt, AN175-16 (3 Places)
   Cyclic Tubes to Swashplate
   (2 Places) Collective Tube to Collective Lever (1 Place)
9. Bolt, NAS1305-30D
   Drive Link to Swashplate (2 Places)

Figure 1-15. Rotor Controls Parts Kit

SECTION VI. FLIGHT SAFETY CRITICAL AIRCRAFT PARTS

1-67. FLIGHT SAFETY CRITICAL AIRCRAFT PARTS.

a. The UH-1 Flight Safety Critical Aircraft Parts (FSCAP) included in this manual will be restricted to those listed below in Table 1-9. Flight Safety Critical Aircraft Parts. Warnings will not be included throughout the manual. All FSCAP's require special handling during maintenance, and compliance with all maintenance procedures is mandatory.

b. Flight Safety Critical Aircraft Parts.

(1) A FSCAP is defined as a part, assembly, or installation procedure with one or more critical characteristics that, if not conforming to the design data or quality requirements, could result in the destruction of, or serious damage to, the helicopter and/or serious injury or death of crew members.

(2) A critical characteristic is any dimension, tolerance, finish, material, manufacturing, assembly or other feature which, if nonconforming or missing, could cause failure or malfunction of the critical item.

(3) Table 1-9 identifies critical aircraft parts, assemblies, or installations under the FSCAP program requiring special handling during maintenance. This table lists all current flight safety parts, some of which may not be repairable at field level.

PART NUMBER	NOUN
1009790	CYLINDER, SERVO ASSEMBLY
1560-UH-1-752-1	CHAIN, ROLLER
1615-UH-1-100-1	CLEVIS, ROD END
204-001-011-13	CONNECTING LINK. WIG
204-001-011-17	COLLECTIVE PITCH CONTROL LINK
204-001-018-27	CONNECTING LINK, RIG
204-001-027-23	CONNECTING LINK, RIG
204-001-027-5	CONNECTING LINK, RIG
204-001-148-I	BELLCRANK
204-001-I 85-5	ARM ASSEMBLY, FLIGHT
204-001-351-1	BELLCRANK
204-001-353-I	CONNECTING LINK, RIG
204-001-354-I	CONNECTING LINK, RIG
204-001-514-1	SUPPORT, CYCLIC CONT
204-001-559-I	BELLCRANK
204-001-603-I	LEVER, CONNECTIVE CO
204-001-779-5	QUADRANT, CONTROL, TA
204-001-793-5	SUPPORT ASSEMBLY, QU
204-001-795-5	SUPPORT ASSEMBLY, QUADRANT
204-001-799-1	ARM ASSEMBLY, CYLINDER
204-001-800-1	BELLCRANK

Table 1-9. Flight Safety Critical Aircraft Parts (1 of 11)

PART NUMBER	NOUN
204-001-809-1	BELLCRANK
204-001-825-3	BRACKET, PULLEY, TAIL
204-001-957-1	CONNECTING LINK, RIG
204-010-404-3	COLLAR, SHAFT
204-010-420-1	NUT, PLAIN, ROUND
204-010-437-7	NUT, PLAIN, ROUND
204-010-479-17	PLATE SET, COLLECTIVE
204-010-481-1	NUT, PLAIN, SPLINE
204-010-719-1	NUT, PLAIN, ROUND
204-010-720-3	SLIDER, TAIL ROTOR
204-010-740-5	T/R CONTROL ASSY. QUILL
204-010-742-9	T/R CONTROL TUBE
204-011-003-21	SPAR, MAIN ROTOR BLADE
204-011-003-23	SPAR, MAIN ROTOR BLADE
204-011-102-17	YOKE ASSEMBLY, MAIN ROTOR
204-011-105-1	TRUNNION ASSEMBLY
204-011-108-1	PILLOW BLOCK
204-011-108-3	PILLOW BLOCK
204-011-116-1	NUT
204-011-119-1	BEARING, PLAIN, ROD END
204-01 I-I 20-5	PITCH HORN ASSEMBLY
204-011-121-113	MAIN ROTOR GRIP
204-011-121-5	GRIP ASSEMBLY, MAIN
204-011-127-1	LINK ASSEMBLY, MAIN
204-011-128-1	UNIVERSAL, CONTROL L
204-011-135-3	BUSHING, SLEEVE
204-011-136-103	CLEWS, ROD END
204-011-137-1	TURNBUCKLE BODY
204-011-143-1	ROD, THREADED END
204-011-151-1	BOLT ASSEMBLY, MAIN

Table 1-9. Flight safety Critical Aircraft Parts (2 of 11).

PART NUMBER	NOUN
204-011-166-1	BOLT, CLOSE TOLERANCE
204-011-166-3	BOLT, SHEAR
204-01 I-1713	BOLT, EXTERNALLY REL
204-011-179-1	CLEVIS, ROD END
204-011-180-1	FITTING, DRAG BRACE
204-011-250-113	BLADE, ROTARY WING
204-011-250-5	BLADE, ROTARY WING
204-011-301-1	LEVER ASSEMBLY, STAB
204-011-304-1	SUPPORT ASSEMBLY, ST
204-011-307-1	CENTER FRAME ASSEMBLY
204-011-326-7	STABILIZER, ROTARY WING
204-011-400-1	SWASHPLATE, CONTROL
204-011-400-11	SWASHPLATE, CONTROL
204-011-400-3	SWASHPLATE, CONTROL
204-011-400-7	SWASHPLATE, CONTROL
204-011-400-9	SWASHPLATE, CONTROL
204-011-401-11	SCISSORS AND SLEEVE
204-011-401-7	SCISSORS AND SLEEVE
204-011-401-9	SCISSORS AND SLEEVE
204-011-402-13	SWASHPLATE, CONTROL
204-011-403-1	RING ASSEMBLY, OUTER
204-011-404-5	SUPPORT ASSY, SWASHPLATE
204-011-405-9	HUB ASSEMBLY, COLLECTIVE
204-011-406-13	SCISSORS ASSEMBLY
204-01 1407-I	UNK ASSEMBLY, SWASHPLATE
204-011-408-105	SLEEVE, COLLECTIVE
204-01 1430-I	BEARING. BALL ANNUAR
204-01I-438-1	LEVER ASSEMBLY, PYLON
204-011-450-107	MAST ASSEMBLY

Table 1-9. Flight Safety Critical Aircraft Parts (3 of 11).

PART NUMBER	NOUN
204-01 l-450-7	MAST ASSEMBLY
204-011-461-1	BOLT, SHEAR
204-011463-l	BOOT, SHEAR
204-01 l-702-15	BLADE ASSEMBLY, TAIL ROTOR
204-01l-71 1-1	CROSSHEAD ASSEMBLY
204-011-721-1	SPACER, RING
204-01 l-722-5	YOKE ASSEMBLY, ROTOR
204-011-723-1	NUT, PWN, ROUND
204.01 l-730-1	BUSHING, MACHINE THR
204-01 1-737-i	TAIL ROTOR TRUNNJON
204-011-762-11	CONNECTING LINK. RIG
204-011-763-1	BEARING, PLAIN, ROD END
204-011-801-121	HUB, ASSEMBLY, TAIL ROTOR
204-011-801-17	HUB, ROTOR, HELICOPTER
204-012-101-137	HUB, MAIN ROTOR
204-012-101-139	HUB ASSEMBLY, MAIN
204-012-101-141	HUB, ROTOR
204-012-101-19	HUB ASSEMBLY, ROTARY
204-012-101-3	HUB, ROTARY WING
204-012-101-31	HUB ASSEMBLY, MAIN R
204-012-101-5	HUB, ROTARY WING
204-012-102-5	FITTING, STRAP
204-012-103-1	FITTING, STRAP
204-012-104-5	STRAP PIN
204-012-112-5	STRAP ASSEMBLY
204-012-122-l	STRAP ASSEMBLY
204-012-122-5	STRAP ASSEMBLY
204-012-122-7	STRAP ASSEMBLY
204-030-929-3	TUBE

Table I-9. Flight Safety Critical Aircraft Parts (4 of II).

PART NUMBER	NOUN
204-040-003-13	GEARBOX ASSEMBLY, TA
204-040-003-19	GEARBOX ASSEMBLY, T
204-040-003-29	GEARBOX ASSEMBLY, TA
204-040-003-33	QUILL ASSEMBLY, GEAR
204-040-003-35	QUILL ASSEMBLY, GEAR
204-040-003-37	GEARBOX ASSEMBLY, T
204-040-003-7	GEARBOX, TAIL ROTOR
204-040-012-1	GEARBOX ASSEMBLY
204-040-012-11	QUILL ASSEMBLY, GEAR
204-040-012-13	GEARSHAFT, BEVEL
204-040-012-7	DRIVE UNIT, ANGLE
204-040-012-9	QUILL ASSEMBLY, TAIL
204-040-016-1	TRANSMISSION ASSEMBLY
204-040-016-3	TRANSMISSION ASSEMBLY
204-040-016-5	TRANSMISSION ASSEMBLY
204-040-103-7	GEARSHAFT, BEVEL
204-040-104-13	GEARSHAFT, BEVEL
204-040-105-21	GEARSHAFT, BEVEL
204-040-108-7	GEAR, SPUR
204-040-115-1	NUT, SELF-LOCKING, SPECIAL
204-040-115-3	NUT, SELF-LOCKING, SPECIAL
204-040-117-3	ADAPTER, MAST DRIVEN
204-040-121-5	GEARSHAFT, SPUR
204-040-190-101	RING, BEARING, INNER
204-040-207-13	QUILL ASSEMBLY, TAIL
204-040-213-9	QUILL ASSEMBLY, O-SET ACC DR
204-040-324-5	SHAFT, MAIN GEAR TRA
204-040-330-3	GEARSHAFT, SPUR
204-040-331-5	CASE, TRANSMISSION

Table 1-9. Flight Safety Critical Aircraft Parts (5 of 11).

PART NUMBER	NOUN
204-040-349-9	PLATE ASSEMBLY
204-040-353-23	CASE ASSEMBLY, TRANS
204-040-354-9	CASE ASSEMBLY, TRANS
204440-359-I	CASE ASSEMBLY, TRANS
204-040-360-101	PLANETARY ASSEMBLY, UPPER
204-040-362-15	QUELL ASSEMBLY, BEVEL GEAR
204-040-365-31	DRIVE AND SUMP ASSEMBLY
204-040-366-15	MAST ASSEMBLY, TRANS
204-040-366-9	MAST ASSEMBLY, TRANS
204-040-367-1	QUILL ASSEMBLY
204-040-397-I	SPIDER ASSEMBLY
204-040-400-7	PINION
204-040-400-9	GEARSHAFT, BEVEL
204-040-401-7	, GEAR,BEVEL
204-040-402-9	SHAFT, TAIL ROTOR
204-040-418-13	CASE ASSEMBLY, GEAR
204-040-425-1	SLEEVE ASSEMBLY, TAIL
204-040-500-10	GEARSHAFT, BEVEL
204-040-500-7	GEARSHAFT, BEVEL
204-040-500-9	GEARSHAFT, BEVEL
204-040-513-1	CASE ASSEMBLY, TAIL
204-040-600-11	HANGER ASSEMBLY, DRI
204-040-600-7	HANGER ASSEMBLY, DRI
204-040-600-9	HANGER ASSEMBLY, DRI
204-040-603-11	GEAR, SPUR
204-040-603-7	COUPLING, MALE SPHER
204-040-603-9	SPHERICAL DRIVESHAFT
204-040-604-5	COUPUNG DRIVESHAFT
204-040-618-3	TUBE. TAIL ROTOR

Table 1-9. Flight Safety Critical Aircraft Parts (6 of 11).

PART NUMBER	NOUN
204-040-349-9	PLATE ASSEMBLY
204-040-353-23	CASE ASSEMBLY, TRANS
204-040-354-9	CASE ASSEMBLY, TRANS
204440-359-I	CASE ASSEMBLY, TRANS
204-040-360-101	PLANETARY ASSEMBLY, UPPER
204-040-362-15	QUELL ASSEMBLY, BEVEL GEAR
204-040-365-31	DRIVE AND SUMP ASSEMBLY
204-040-366-15	MAST ASSEMBLY, TRANS
204-040-366-9	MAST ASSEMBLY, TRANS
204-040-367-1	QUILL ASSEMBLY
204-040-397-I	SPIDER ASSEMBLY
204-040-400-7	PINION
204-040-400-9	GEARSHAFT, BEVEL
204-040-401-7	, GEAR,BEVEL
204-040-402-9	SHAFT, TAIL ROTOR
204-040-418-13	CASE ASSEMBLY, GEAR
204-040-425-1	SLEEVE ASSEMBLY, TAIL
204-040-500-10	GEARSHAFT, BEVEL
204-040-500-7	GEARSHAFT, BEVEL
204-040-500-9	GEARSHAFT, BEVEL
204-040-513-1	CASE ASSEMBLY, TAIL
204-040-600-11	HANGER ASSEMBLY, DRI
204-040-600-7	HANGER ASSEMBLY, DRI
204-040-600-9	HANGER ASSEMBLY, DRI
204-040-603-11	GEAR, SPUR
204-040-603-7	COUPLING, MALE SPHER
204-040-603-9	SPHERICAL DRIVESHAFT
204-040-604-5	COUPUNG DRIVESHAFT
204-040-618-3	TUBE. TAIL ROTOR

Table 1-9. Flight Safety Critical Aircraft Parts (6 of 11).

PART NUMBER	NOUN
204-040-618-5	TUBE, TAIL ROTOR
204-040-619-3	ADAPTER, TAIL ROTOR DRIVE
204-040-620-3	SHAFT ASSEMBLY, TAIL
204-040-620-5	SHAFT ASSEMBLY. TAIL
204-040-620-7	SHAFT ASSEMBLY, TAIL
204-040-620-9	SHAFT ASSEMBLY, TAIL
204-040-623-5	BEARING, BALL, ANNUAL
204-040824-I	BOLT,INTERNAL WR
204-040-686-1	D R I V E SHAFT, HELICOP
204-040-687-5	COUPLING, MAIN DRIVE
204640-700-I	PINION, MAIN INPUT, T
204-040-700-101	PINION. MAIN INPUT. T
204-040-701-10:3	GEAR, BEVEL
204-040-716-5	COUPLING SET
204-040-762-1	GEAR, SPUR
204-040-763-1	GEAR, SPUR
204-040-784-103	PLANETARY ASSEMBLY, UPPER
204-040-785-3	SPIDER, LOWER. MAIN T
204-040-786-I	PLATE, RETAINING, BEA
204-040-809-3	CLAMP, TAIL ROTOR DRIVE
204-040-811-1	CLAMP, COUPLING
204-040-812-3	ADAPTER, KAFLEX INSTA
204-040-813-I	BOLT, EXTERNALLY REL
204-040-813-101	BOLT, INTERNALLY REL
204-060-102-11	SUPPORT, STRUCTURAL
204460-152-I	FITTING ASSEMBLY
204-060-161-1	TRUNNION, LEFT HAND
204-076-052-Q	SERVOCYLINDER
204-076-053-I 1	SERVOCYLINDER

Table 1-9. Flight Safety Critical Aircraft Parts (7 of 11).

PART NUMBER	NOUN
204-076-053-15	SERVOCYLINDER ASSEMBLY
204-076-201-5	HOUSING, BEARING, SER
204-076-267-1	CONNECTING LINK, RIGID
204-076-267-3	CONNECTING LINK, RIGID
204-076-267-5	CONNECTING LINK, RIGID
204-076-317-7	HOUSING, BEARING UNI
204-076-428-5	BEARING, PWN, ROD E
204-076-511-17	CYLINDER ASSEMBLY
204-076-511-19	CYLINDER ASSEMBLY
204-076-511-21	CYLINDER ASSEMBLY
204-076-511-Q . .	SERVOCYLINDER
204-l 629-2	PARTS KIT, ROTOR CON
204-310-101-101	CONNECTING LINK, RIGID
205-001-011-1	CONNECTING LINK, RIGID
205-001-011-13	CONNECTING LINK, RIGID
205-001-011-17	CONNECTING LINK, RIGID
205-001-011-33	CONNECTING LINK, RIGID
205-001-011-5	CONNECTING LINK, RIGID
205-001-011-9	CONNECTING LINK, RIGID
205-001-012-19	CONNECTING LINK, RIGID
205-001-012-25	CONNECTING LINK, RIGID
205-001-013-1	CONNECTING LINK, RIGID
205-001-014-1	CONNECTING LINK, RIGID
205-001017-l	CONNECTING LINK, RIGID
205-001-017-7	CONNECTING LINK, RIGID
205-001-017-9	CONNECTING LINK, RIGID
205-001-018-5	CONNECTING LINK, RIGID
205-001-019-1	CONNECTING LINK, RIGID
205-001-019-3	CONNECTING LINK, RIGID

Figure 1-9. Flight Safety Critical Aircraft Parts (8 of 11).

PART NUMBER	NOUN
205-001-701-1	SUPPORT ASSEMBLY
205-001-704-1	LEVER ASSEMBLY, ANTI
204-001-706-9	CABLE ASSEMBLY
205-001-709-1	BRACKET ASSEMBLY, PU
205-001-714-1	SUPPORT ASSEMBLY, BE
205-001-715-1	CONNECTING LINK, RIGID
205-001-720-1	WIRE ROPE ASSEMBLY
205-001-720-6	CABLE ASSEMBLY
205-001-728-1	BELLCRANK ASSEMBLY
205-001-902-5	LEVER, ELEVATOR CONT
205-001-905-1	BELLCRANK
205-001-906-1	BELLCRANK
205-001-908-1	IDLER ASSEMBLY, CONT
205-001-914-1	HORN, ELEVATOR
205-001-914-25	HORN, ELEVATOR
205-001-914-5	HORN ASSEMBLY, ELEVATOR
205-001-915-1	IDLER ASSEMBLY
205-011-710-101	NUT, TAIL ROTOR GRIP RETENTION
205-011-711-101	GRIP, ASSEMBLY, TAIL ROTOR
205-011-711-103	GRIP, ASSEMBLY, TAIL ROTOR
201-015-150-101	BLADE, ROTARY WING
205-030-475-1	FITTING
205-030-475-2	FITTING
205-030-713-65	BULKHEAD, TAILBOOM ATTACH
205-030-856-19	ELEVATOR, AIRCRAFT
205-030-856-21	ELEVATOR, AIRCRAFT
205-031-806-1S	TAILBOOM LONGERONS
205-031-806-25S	TAILBOOM LONGERONS
205-031-806-3S	TAILBOOM LONGERONS

Table I-9. Flight safety Critical Aircraft Parts (9 of 11).

PART NUMBER	NOUN
206-031-554-3	SUPPORT, STRUCTURAL
206-062-102-1	LEG, ENGINE MOUNT, LO
209-010-112-3	BOLT, PITCH HORN, MAIN
212-010-300-103	STABILIZER BAR ASSEMBLY
212-010-311-101	STABILIZER TUBE, ROTARY
212-010-403-5	LEVER, MAIN ROTOR
212-010-404-1	CONNECTING LINK, RIG
212-010-712-1	LINK ASSEMBLY, TAIL ROTOR
212-040-500-7	GEAR, BEVEL
540-001-905-1	SUPPORT, STRUCTURAL
540-011-102-5	YOKE ASSEMBLY, MAIN
540-011-109-5	HOUSING ASSEMBLY, MAIN
540-011-112-5	PIN, GROOVED, HEADLESS
540-011-112-7	PIN, GROOVED, HEADLESS
540-011-113-1	FITTING, RETENTION
540-011-117-1	CLEVIS, ROD END
540-011-117-3	CLEVIS, ROD END
540-011-118-1	BARREL ASSEMBLY, DRA
540-011-119-19	BOLT ASSEMBLY, MAIN ROTOR RETENTION
540-011-153-17	YOKE EXTENSION, MAIN ROTOR
540-011-154-5	GRIP ASSEMBLY, MAIN
540-011-162-1	BOLT, SHEAR
540-011-192-1	TRUNNION, MAIN ROTOR
540-011-404-5	RING ASSEMBLY, OUTER
540-011-449-3	BEARING, BALL, STACK
540-011-456-1	SLEEVE, COLLECTIVE, A
540-011-459-1	PIN, SHOULDER
540-012-125-3	SLEEVE
MS14181-08044	BOLT, SHEAR
PAM9107NPPA270	BEARING, BALL, ANNULA
SKCP2281-103	SHAFT, DRIVE, TRANSMI

Table 1-9. Flight Safety Critical Aircraft Parts (11 of 11).

CHAPTER 2

AIRFRAME

SECTION I. FUSELAGE

2-1. FUSELAGE.

2-2. Description - Fuselage. The fuselage assembly consists of two main sections: the forward section and aft section (tailboom). The forward section includes the cabin area, power plant, main rotor and landing gear. The aft section includes the tailboom, elevator, driveshafts, gearboxes, and tail rotor (figure 2-1).

2-3. FUSELAGE STRUCTURE.

NOTE

Refer to maintenance allocation chart, Appendix B to determine maintenance responsibility for specific structural repairs.

NOTE

Graphite pencils should not be used for marking aircraft structures or structural components. (Refer to TM 1-1500-344-23).

2-4. General Information. Paragraphs 2-5 through 2-14 provides general information necessary for repair of fuselage structure. For repairs which require qualified authority or engineering approval contact; Headquarters US Army Aviation and Missile Command ATTN: AM-SAM-RD-AE-I-D-U Redstone Arsenal, AL 35898-5000.

2-5. Type of Construction (Figures 2-1 and 2-2).

a. Forward Section Construction. Two main beams with transverse bulkheads, make up the primary structure. The primary structure provides support for the cabin section, fuel cells, transmission, landing gear, engine, and tailboom. The forward section employs aluminum alloy and fiberglass skins, aluminum alloy honeycomb panels, and titanium work decks and firewalls.

b. Aft Section Construction. The aft section (tailboom) is a semimonocoque structure, employing aluminum and magnesium alloy skins, longerons, bulkheads, and stringers. The vertical fin consists of aluminum alloy forward and aft spars, aluminum alloy trailing edge extrusion, and aluminum alloy ribs and skins.

2-6. Investigating Damage.

a. Remove grease, dirt, and paint in area of damage so that the extent of damage can be determined.

b. Inspect structure for dents, scratches, abrasions, punctures, cracks, distortion and corrosion. Deep scratches, nicks, and abrasions shall be treated as cracks. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

c. Inspect all riveted and bolted joints in vicinity of damaged area for sheared, loose, or missing rivets and bolts. Inspect for elongated rivet and bolt holes. If there is any doubt whether a rivet or bolt has failed, remove the fastener for inspection.

d. Inspect all adjacent structure for secondary damage that may have resulted from a shock load transmitted from the primary damage.

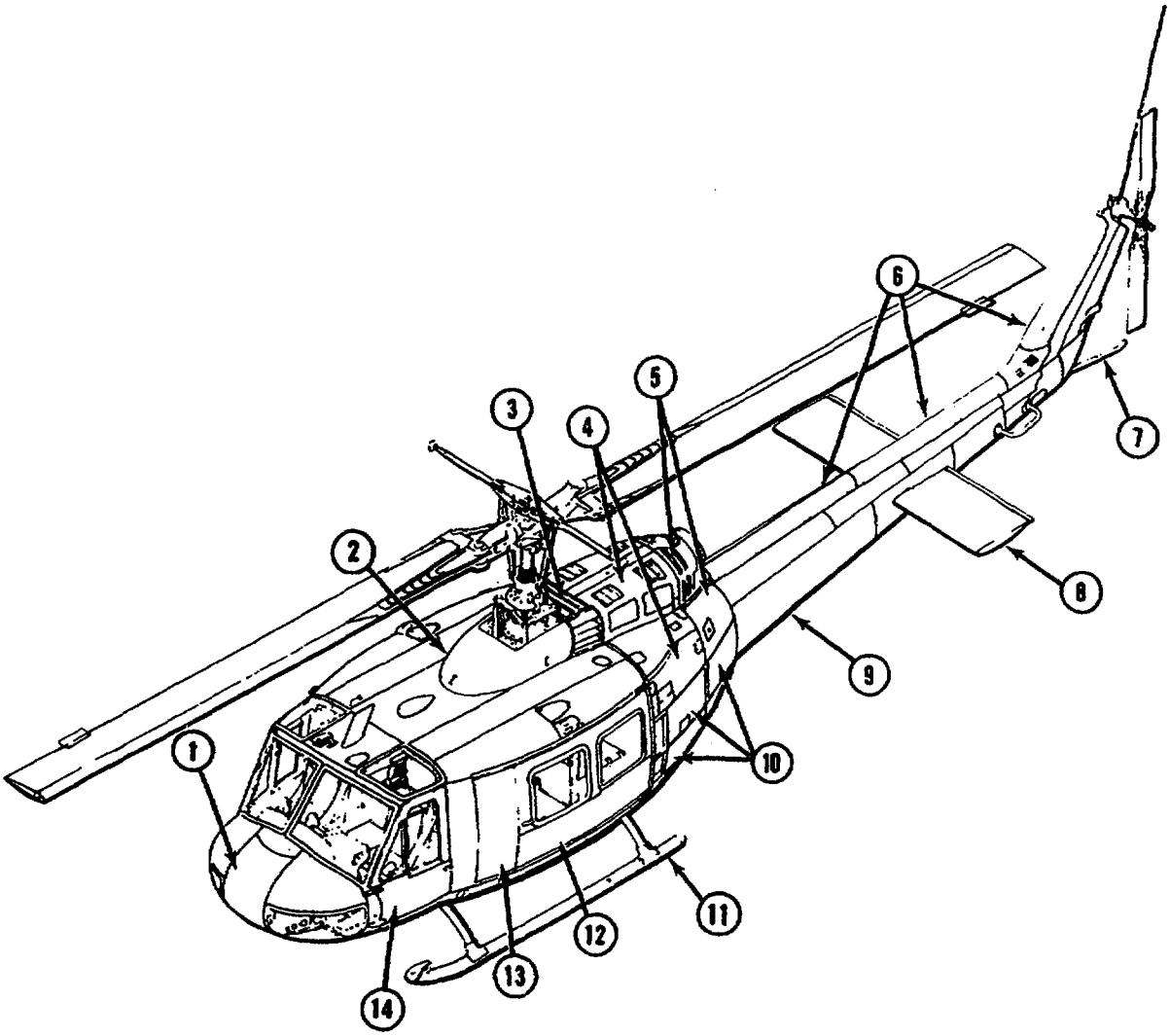
2-7. Classification of Damage and Types of Repair. After the extent of damage has been determined, the damage should be classified as negligible, repairable, or damage necessitating replacement of parts. Definitions of damage classification and types of repairs are as follows:

a. Negligible damage is that damage which may be allowed to exist as is, or corrected by some simple procedure without placing restrictions on flight.

b. Repairable damage is damage exceeding negligible damage limits, but not so severe as to warrant replacement.

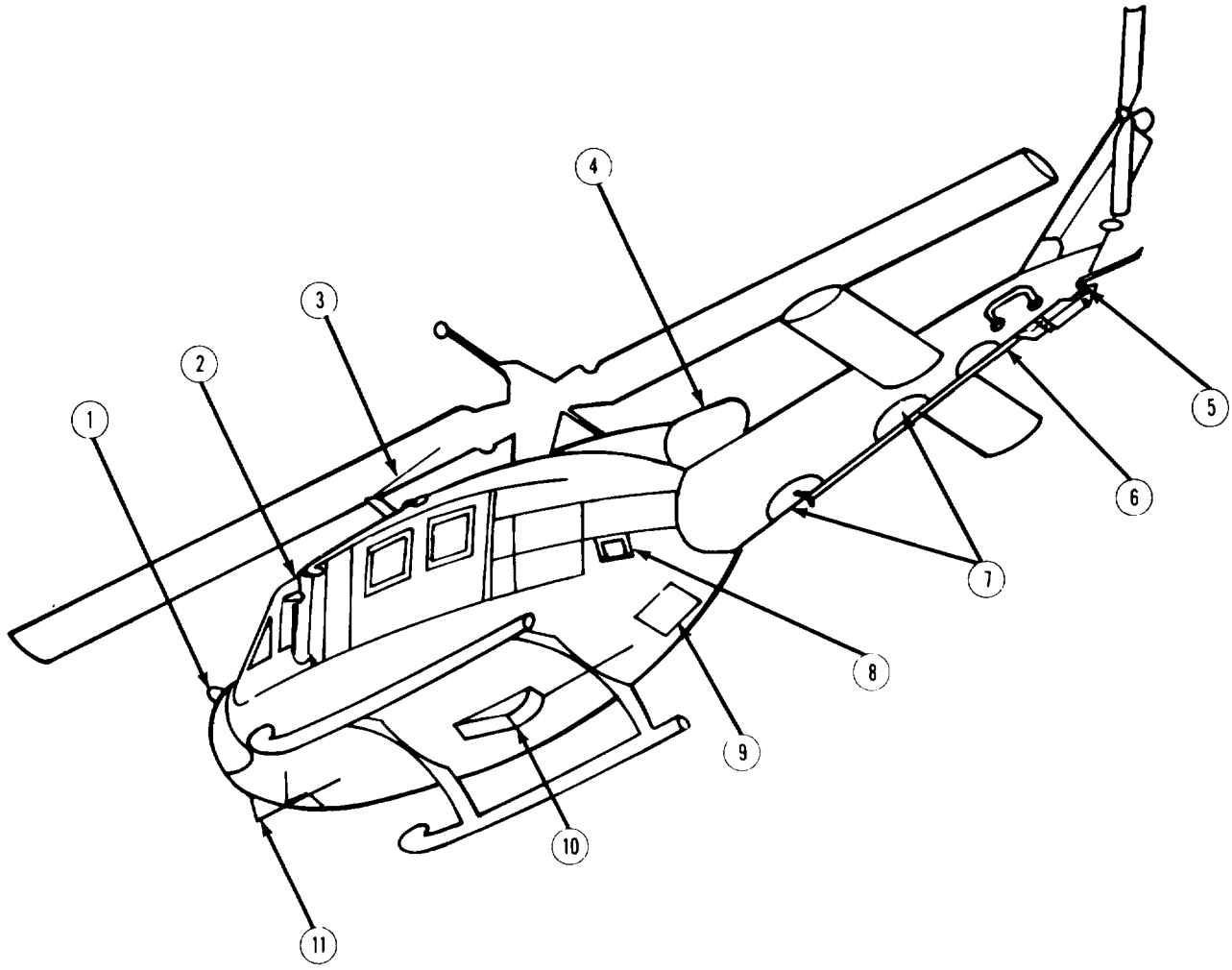
c. Damage necessitating replacement of parts, is damage which cannot be repaired by any practical means, or that damage which exceeds the limits specified as repairable.

d. Mechanical damage includes but not limited to; abrasions, cracks, nicks, dents, scratches, distortion and wear. Corrosion damage is usually identified by a scaly or blistered appearance, powdery deposits, and etching or pitting of metal surface (paragraph 2-14)



1. Nose compartment door
2. Transmission fairing
3. Engine intake fairing
4. Engine cowling
5. Tailpipe fairing
6. Driveshaft covers
7. Tail skid
8. Synchronized elevator
9. Tailboom
10. Fuselage compartment doors
11. Landing gear
12. Sliding cargo door
13. Hinged panel door
14. Crew door

Figure 2-1. Helicopter Assembly



1. RADAR WARNING ANTENNA , FWD.
2. FM HOMING ANTENNA
3. FM MISSION ANTENNA
4. IR EXHAUST SUPPRESSOR
5. RADAR WARNING ANTENNA, AFT.
6. JAMMING ANTENNA
7. RADAR ALTIMETER ANTENNAS
8. AC EXTERNAL PLUG
9. OIL COOLER IR SHIELD
10. INTERCEPT ANTENNA
11. FM COMMUNICATION ANTENNA

Figure 2-1.1. EH-IH Helicopter Assembly.

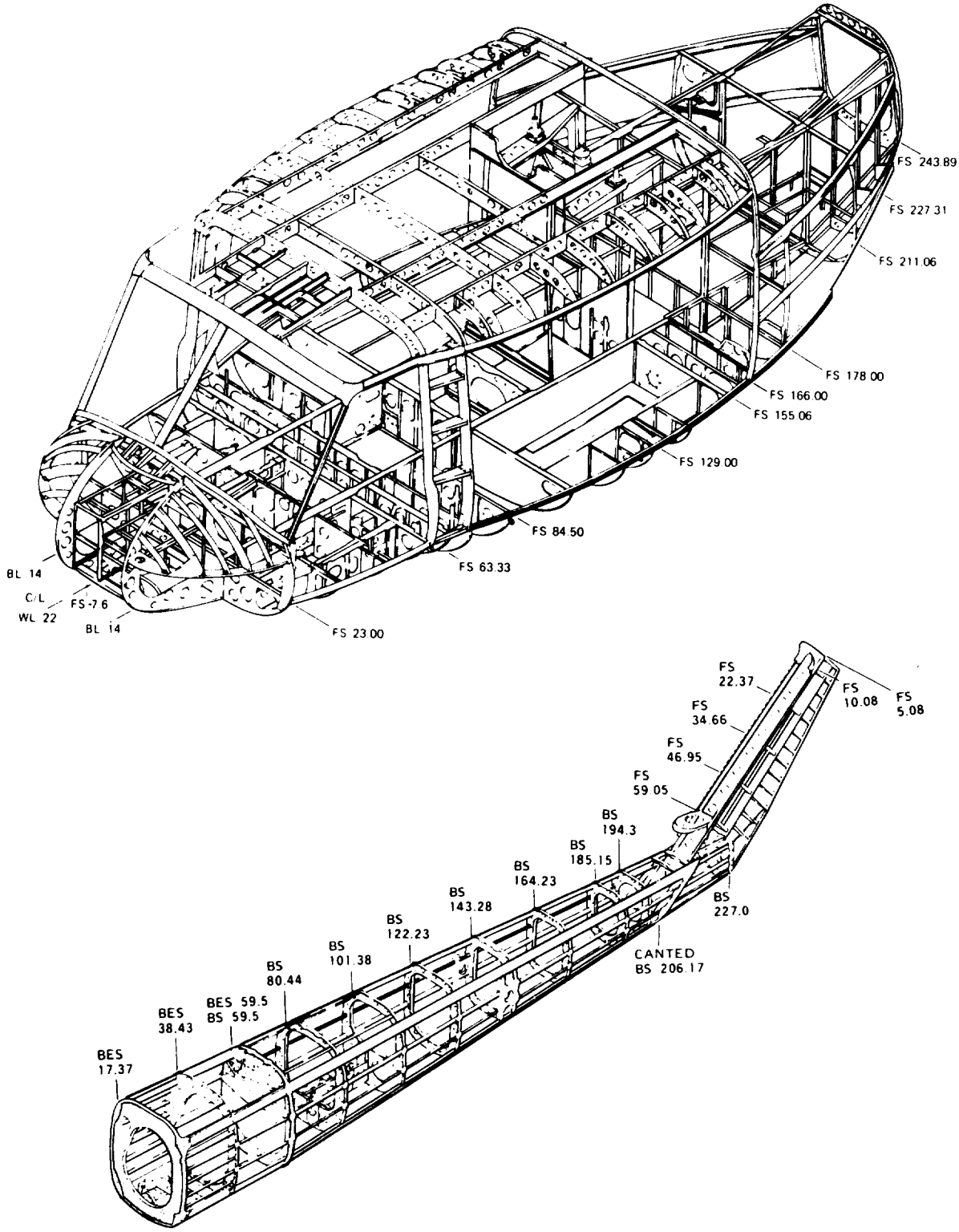


Figure 2-2. Fuselage Structure

e. Riveted repairs, The finished aluminum alloy parts and magnesium alloy sheets used in the helicopter are heat treated. Only rivets and/or bolted repairs shall be permitted. For instructions on the use and installation of rivets, refer to TM 55-1500-204-25/1.

f. Welded repairs. For weld repair information on components, such as tailpipe and spot welds, refer to TM 55-1 500-204-25/1. For welded repair procedures for the tailpipe, refer to paragraph 4-1.

2-8. Support of Structure During Repair. a. Assembled Helicopter.

(1) Support helicopter on landing gear.

(2) If landing gear removal is required, accomplish the following steps:

(a) Fabricate wooden, padded supports, contoured to fore and aft and transverse main structural members.

(b) Lift helicopter and remove landing gear. (Refer to Chapter 1, for hoisting instructions.)

(c) Position supports under structure and lower helicopter,

b. Support of Tailboom.

(1) Support tailboom on suitable cradle.

(2) Attach forward support to tailboom attach holes, using same size bolts used in installing tailboom on the forward fuselage. Locate aft support under bulkhead at station 206.17.

2-9. Location of Leveling Points. (Refer to paragraph 1-36 for leveling instructions.)

2-10. Principal Dimensions. See figure 1-7 for principal dimensions.

2-11. Reference Lines. See figure 2-3 for major reference lines. Definitions of reference lines follows:

a. Fuselage Station Lines. Fuselage station lines (FS) are vertical reference lines against the helicopter which are used to locate major assemblies and parts of the structure. FS numbers indicate the distance in inches from a line of origin, located approximately 7.60 inches aft of the most forward nose contour and designated as Station O.

b. Boom Station Lines. Boom station lines (BS) are reference lines perpendicular to the centerline of the tailboom. Boom Stations indicate the distance in inches from a line of origin, located approximately 59.5 inches forward of boom station 59.5 (figure 2-2).

c. Boom Extension Station Lines. Boom extension station lines (BES) are reference lines same as boom station lines, except BES lines indicate the distance in inches from a line of origin approximately 17.37 inches forward of the most forward surface of the boom structure (figure 2-2). BES lines terminate at BES 59.5.

d. Water Lines. Water lines (WL) are horizontal reference lines (viewed from the side or front of helicopter) used to locate major assemblies and parts of the structure by a number indicating the distance in inches from a line of origin located below the lower skin contour and designated as Water Line O.

e. Buttock Lines. Buttock lines (BL) are vertical reference lines used to locate major assemblies and parts of the structure by a number indicating the distance in inches on each side of the helicopter centerline, which is designated as Buttock Line O (figure 2-3, sheet 2).

f. Fin Station Lines. Fin station lines (FS) are reference lines perpendicular to the centerline of the fin. Fin stations indicate the distance in inches from a line of origin approximately 5.0 inches above the tail rotor gearbox fitting (figure 2-2).

2-12. Structural Repair Materials. Structural repair materials are listed in table 2-1.

Table 2-1. Structural Repair Materials

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
1	Aluminum Alloy Sheet, 0.008 inch thick, 2024-T3	QQ-A-250/5 (81348)	
2	Aluminum Alloy Sheet, 0.012 inch thick, 2024-T3	QQ-A-250/5 (81348)	9535-00-167-2274
3	Aluminum Alloy Sheet, 0.012 inch thick. 2024-T4	QQ-A-250/5 (81348)	
4	Aluminum Alloy Sheet, 0.012 inch thick, 7075-T6	QQ-A-250/13 (81348)	9535-00-236-7091
5	Aluminum Alloy Sheet, 0.016 inch thick, 2024-T3	QQ-A-250/5 (81348)	9535-00-232-0543
6	Aluminum Alloy Sheet, 0.020 inch thick, 2024-T3	QQ-A-250/5 (81348)	9535-00-167-2277
7	Aluminum Alloy Sheet, 0.020 inch thick, 2024-T4	QQ-A-250/5 (81348)	
8	Aluminum Alloy Sheet, 0.020 inch thick, 7075-T6	QQ-A-250/13 (81348)	9535-00-086-9808
9	Aluminum Alloy Sheet, 0.025 inch thick, 2024-T3	QQ-A-250/5 (81348)	9535-00-167-2278
10	Aluminum Alloy Sheet, 0.025 inch thick, 2024-T4	QQ-A-250/5 (81348)	
11	Aluminum Alloy Sheet, 0.025 inch thick, 7075-T6	QQ-A-250/13 (81348)	9535-00-086-9864
12	Aluminum Alloy Sheet, 0.032 inch thick, 2024-T3	QQ-A-250/5 (81348)	9535-00-086-9729
13	Aluminum Alloy Sheet, 0.032 inch thick, 2024-T4	QQ-A-250/5 (81348)	9535-00-086-9729
14	Aluminum Alloy Sheet, 0.032 inch thick, 7075-T6	QQ-A-250/13 (81348)	9535-00-249-5811

Table 2-1. Structural Repair Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
17	Aluminum Alloy Sheet, 0.040 inch thick, 2024-T3	QQ-A-250/5 (81348)	9535-00-167-2280
18	Aluminum Alloy Sheet, 0.040 inch thick, 7075-T6	QQ-A-250/13 (81348)	9535-00-084-4581
19	Aluminum Alloy Sheet, 0.050 inch thick, 2024-T3	QQ-A-250/5 (81348)	9535-00-232-0569
20	Aluminum Alloy Sheet, 0.050 inch thick, 2024-T4	QQ-A-250/5 (81348)	
21	Aluminum Alloy Sheet, 0.050 inch thick, 7075-T6	QQ-A-250/13 (81348)	9535-00-086-9465
22	Aluminum Alloy Sheet, 0.063 inch thick, 2024-T3	QQ-A-250/5 (81348)	9535-00-232-0378
23	Aluminum Alloy Sheet, 0.100 inch thick, 2024-T3	QQ-A-250/5 (81348)	9535-00-288-0675
24	Aluminum Alloy Sheet, 0.125 inch thick, 2024-T4	QQ-A-250/5 (81348)	
25	Aluminum Alloy Tubing, 0.095 inch thick, 4 inch diameter, 2024-T3	QQ-A-200/3	4710-00-278-6376
25.1	Aluminum Alloy Tubing, 0.033 inch thick, 4 inch diameter, 2024-T3	QQ-A-200/3C	
26	Aluminum Honeycomb 0.250 inch thick, 5052	MIL-C-74380-1 (81349)	5680-00-926-4648
27	Aluminum Honeycomb, 0.375 inch thick, 5052	MIL-C-74380-1 (81349)	5680-00-926-4649
28	Aluminum Honeycomb, 0.500 inch thick, 5052	MIL-C-74380-1 (81349)	5680-00-926-4650
29	Aluminum Honeycomb, 0.750 inch thick, 5052	MIL-C-74380-1 (81349)	5680-00-926-4651
30	Cellophane, PD600	(82348)	8135-00-753-4546
31	Fiberglass, 181 weave	MIL-C-9084 (81349)	
32	Fiberglass, Type E	Refer to Item 31	

Table 2-1. Structural Repair Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
33	Fiberglas, Type VIII	Refer to Item 31	
34	Magnesium Alloy Sheet and Plate, 0.025 inch thick, AZ31B-H24	QQ-M-44	9535-00-575-5983
35	Magnesium Alloy Sheet and Plate, 0.032 inch thick, AZ31B-H24	QQ-M-44	9535-00-542-4705
36	Magnesium Alloy Sheet and Plate, 0.040 inch thick, AZ31B-H24	QQ-M-44	9535-00-542-4704
37	Nylatron, 0.062 inch thick	Fed. Spec. LP410 (81348)	9390-00-013-8960
38	Plexiglas Sheet 0.080 inch thick	MIL-P-8184 (81349)	9330-00-634-8631
39	Plexiglas Sheet 0.100 inch thick	MIL-P-8184 (81349)	9330-00-634-8632
40	Plexiglas Sheet Acrylic 0.080 inch thick	MIL-P-5425 (81349)	
41	Plexiglas Sheet Acrylic 0.125 inch thick, Type II	MIL-P-5425 (81349)	9330-00-202-1890
42	Plexiglas Sheet Acrylic Modified 0.125 inch thick	MIL-P-8184 (81349)	9330-00-634-8633
43	Plexiglas Sheet Acrylic Modified 0.150 inch thick, 55	MIL-P-8184 (81349)	9330-00-634-8634
44	Plexiglas Sheet Acrylic Modified 0.187 inch thick, 55	MIL-P-8184 (81349)	9330-00-634-8636
45	Rivet, Blind, Flush Head	CR2263-4-1 (11815)	
46	Rivet, Blind, Flush Head	NAS1739B6-3 (80058)	
47	Rivet, Blind, Structural Pull Stem, Protruding Head	MS20600-B4-W1 (80205)	5320-00-582-3273
48	Rivet, Blind, Universal Head	CR2249-4 (11815)	
49	Rivet, Blind, Universal Head	NAS1738B4 (80058)	

Table 2-1. Structural Repair Materials (Cont)

ITEM NO.	DESCRIPTION	REF. NO. AND FSCM	NSN
50	Rivet, Blind, Universal Head	CR2249-5 (11815)	
51	Rivet, Blind, Universal Head	NAS1738B5 (80058)	
52	Rivet, Blind, Universal Head	NAS1738B6-3 (80058)	
53	Rivet, Solid, Aluminum Alloy, Flat Head	MS20426AD3 (96906)	
54	Rivet, Solid, Aluminum Alloy, Flat Head	MS20426AD4 (96906)	
55	Rivet, Solid, Aluminum Alloy, Flat Head	MS20426AD5 (96906)	
56	Rivet, Solid, Aluminum Alloy, Universal Head	MS20470AD4 (96906)	
57	Rivet, Solid, Aluminum Alloy, Universal Head	MS20470AD5 (96906)	
58	Rivet	MS20600AD4 (96906)	
59	Steel Sheet, 0.040 inch thick, 4130 COND-N	MIL-S-18729 (81349)	9515-00-528-4783
60	Steel Sheet, 0.063 inch thick, 4130 COND-N	MIL-S-18729 (81349)	9515-00-683-9294
61	Steel Sheet, Corrosion Resistant, 0.016 inch thick	AMS-5510	
62	Steel Sheet, Stainless, 0.032 inch thick, Condition N-155	AMS-5532	
64	Tape, Vinyl No. 473	(76381)	8030-00-514-0981
65	Tedlar, PVF #40S	(82348)	
66	Titanium, 0.016 inch thick	MIL-T-9046	

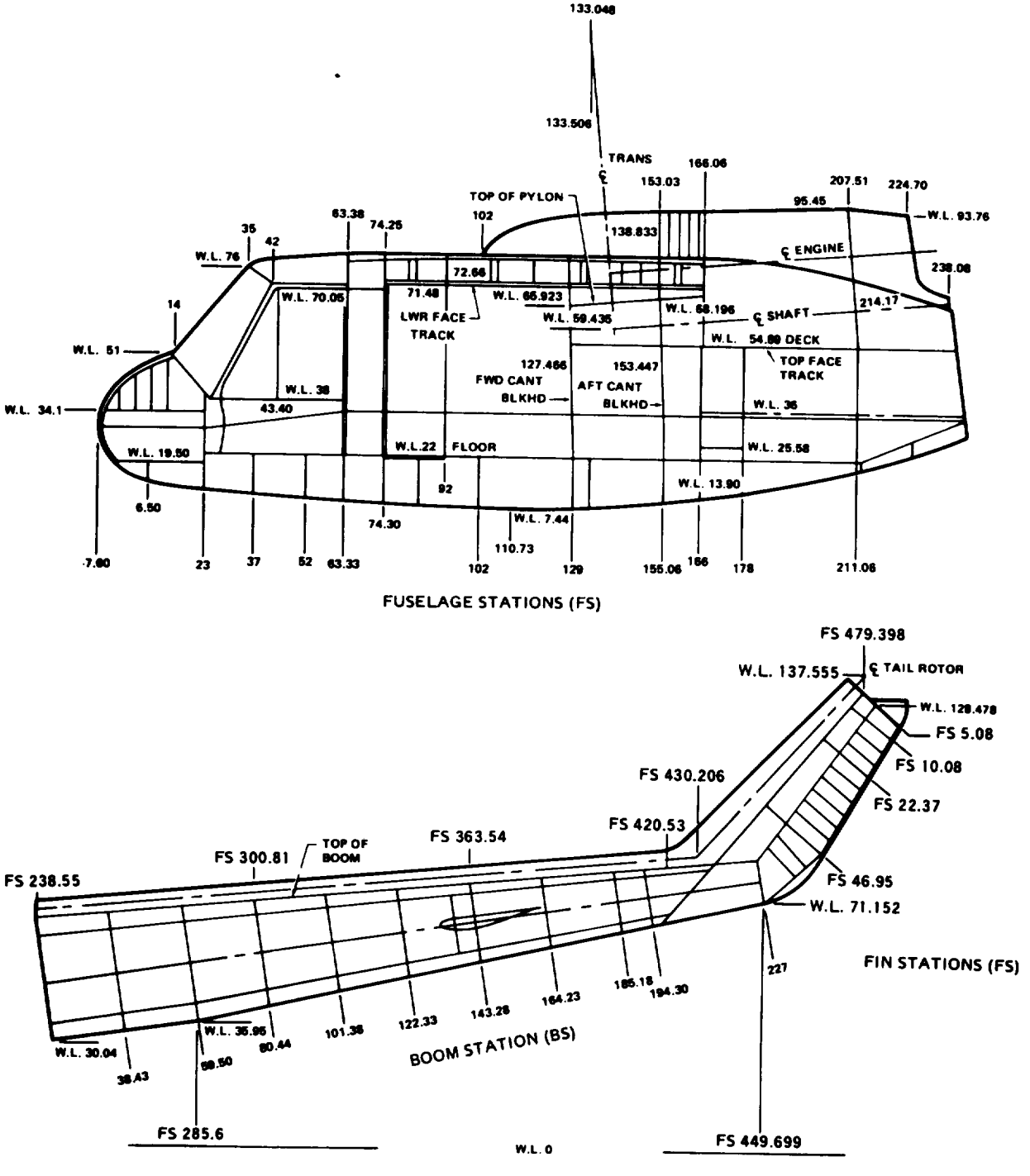


Figure 2-3. Station, Water and Butt Lines (Sheet 1 of 2)

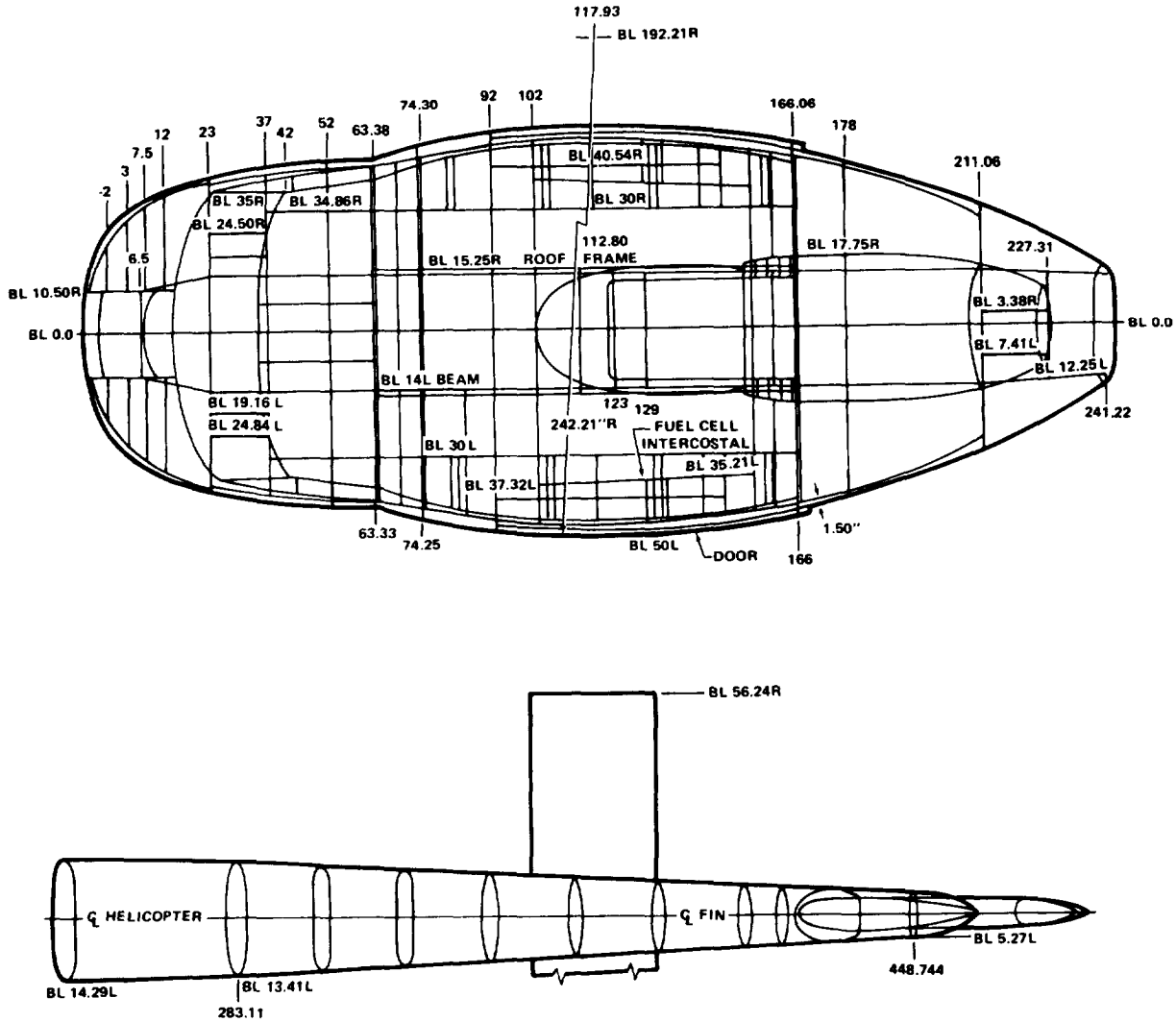


Figure 2-3. Station, Water and Butt Lines (Sheet 2 of 2)

2-13. Skin Identification. Refer to figures 2-4 and 2-5 for skin identification.

2-14. Corrosion Control. a. General: Corrosion is usually attributed to two factors: Location of operation and fabrication process of parts. Corrosion is caused by presence of salt in moist air, certain chemicals in water, elements in the metal, treatment of parts, and contact of dissimilar metals. Corrosion will not normally be as prevalent on painted, clad, or plated surfaces. Corrosion on painted parts is usually characterized by a scaly or blistered appearance, and sometimes by discoloration of paint. Corrosion on clad or plated parts is recognized by a dulling and pitting of the surface and is sometimes accompanied by a whitish or reddish powdery deposit. The extent and forms of corrosion may be determined by examination and visual inspection. A pointed instrument may be used to make the test. Care should be taken to avoid further damage. In some cases the area must be cleaned to remove scales and powdery deposits before examination can be made.

(1) Superficial Corrosion. This type is the least serious on alclad parts. After deposits are removed, an etching will be noticed which results in the clad surface having a series of hills and valleys. Provided the etching has not reached the core, the effect on the strength of the metal is negligible. Corrosion of this same type on non-clad alloy parts is serious.

(2) Electrolytic Corrosion. There are two major causes for this type corrosion: Contact between Dissimilar metals and condensation. When dissimila, metals come in contact with each other with moisture present, an electrical current flows between the metals producing chemical by-products that lissolves one of the metals. Corrosion caused by condensation is a result of exhaust gases, battery acid, etc., contacting the metal.

(3) Intergranular Corrosion. This form of corrosion is not easily detected. It is caused by imperfect heat treatment and occurs mostly in unclad structural aluminum alloy parts. It is the most dangerous form of corrosion for sheet stock because the strength of the metal can be lowered without visible structure indications.

(4) Stress Corrosion. This form occurs in a part along the line of grain flow, if the part has been stressed to high without proper heat treatment.

(5) Galvanic Corrosion. Galvanic corrosion occurs when dissimilar metals are in contact and an electrolyte is present at the joint between the metals. For example aluminum and magnesium skins riveted together form a galvanic couple if moisture and contaminations are present. When aluminum pieces are attached with steel bolts or screws, galvanic corrosion can occur between the aluminum and the steel. Metals grouped together as illustrated in the following table have no strong tendency to produce galvanic corrosion and are relatively safe to use in contact with each other. The coupling of metals from different groups and the distance from each other in the chart will usually result in galvanic or accelerated corrosion of the metal higher on the list. The farther apart the metals are in the table, the greater will be the galvanic tendency, as can be determined by measurement of the electrical potential difference between them.

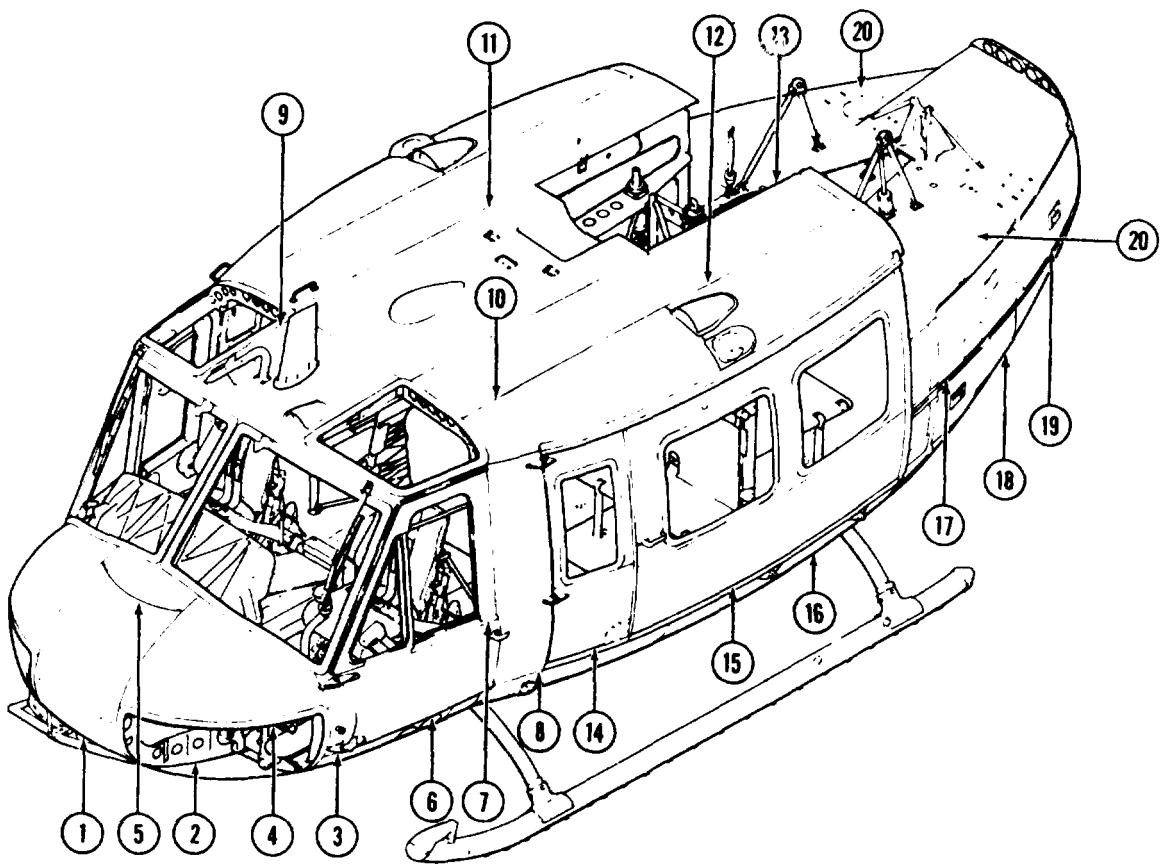


Figure 2-4. Forward Fuselage Skin (Sheet 1 of 5)

Item	Name	Material	Specification	Condition	Thickness
1	Nose door	Fiberglass	Type C	—	—
	Nose door	Al Honeycomb	MIL-C-7438	—	0.250
2	Nose, lwr fwd	Al Aly	QQ-A-250/5	T42	0.020
3	Side, fwd LH	Al Aly	QQ-A-250/5	T42	0.032
	Side, fwd RH	Al Aly	QQ-A-250/5	T42	0.032
4	Side, upper LH	Al Aly	QQ-A-250/5	T42	0.020
	Side, upper RH	Al Aly	QQ-Q-250/5	T42	0.020
5	Center, upper	Al Aly	QQ-A-250/5	T42	0.020
6	Door, lwr LH	Al Aly	QQ-A-250/5	T4	0.025
	Door, lwr RH	Al Aly	QQ-A-250/5	T4	0.025
7	Door, upper LH	Al Aly	QQ-A-250/5	T4	0.025
	Door, upper RH	Al Aly	QQ-A-250/5	T4	0.025
8	Post, LH	Al Aly	QQ-A-250/5	T3	0.020
	Post, outer RH	Al Aly	QQ-A-250/5	T4	0.012
	Post, center RH	Al Honeycomb	MIL-C-7438	—	0.250
	Post, inner RH	Al Aly	QQ-A-250/5	T3	0.008
	Post, outer LH	Al Aly	QQ-A-250/5	T3	0.020
	Post, cntr LH	Al Honeycomb	MIL-C-7438	—	0.375
	Post, inner LH	Fiberglass	Type "E"	—	—
	Post, pan LH	Al Aly	QQ-A-250/5	T4	0.025
	Post, outer RH	Al Aly	QQ-A-250/5	T3	0.020
	Post, cntr RH	Al Honeycomb	MIL-C-7438	—	0.375
	Post, inner RH	Fiberglass	Type "E"	—	—
	Post, pan RH	Al Aly	QQ-A-250/5	T4	0.025
9	Roof, center fwd	Al Aly	QQ-A-250/5	T42	0.020
10	Roof, side LH	Al Aly	QQ-A-250/5	T42	0.020
	Roof, side RH	Al Aly	QQ-A-250/5	T42	0.020
11	Roof, cntr outer	Al Aly	QQ-A-250/5	T3	0.012
	Roof, cntr cntr	Al Honeycomb	MIL-C-7438	—	0.750
	Roof, cntr inner	Al Aly	QQ-A-250/5	T3	0.008
12	Roof, side aft LH	Al Aly	QQ-A-250/5	T4	0.020
	Roof, side aft RH	Al Aly	QQ-A-250/5	T4	0.020
13	Roof, cntr outer LH	Al Aly	QQ-A-250/5	T3	0.012
	Roof, cntr cntr LH	Al Honeycomb	MIL-C-7438	—	0.500
	Roof, cntr inner LH	Al Aly	QQ-A-250/5	T3	0.008
	Roof, cntr outer RH	Al Aly	QQ-A-250/5	T3	0.012
	Roof, cntr cntr RH	Al Honeycomb	MIL-C-7438	—	0.500
	Roof, cntr inner RH	Al Aly	QQ-A-250/5	T3	0.012
14.	Hinged, panel Outer skin	Al Aly	QQ-A-250/5	T4	0.020
	Pan	Al Aly	QQ-A-250/5	T4	0.025
15	Door, outbd LH	Al Aly	QQ-A-250/5	T42	0.020
	Door, outbd RH	Al Aly	QQ-A-250/5	T42	0.020
	Door, outbd LH	Al Aly	QQ-A-250/5	T42	0.020
	Door, outbd RH	Al Aly	QQ-A-250/5	T42	0.020
	Door, inbd LH	Al Aly	QQ-A-250/5	T3	0.012
	Door, inbd RH	Al Aly	QQ-A-250/5	T3	0.012
	Door, inbd LH	Al Aly	QQ-A-250/5	T3	0.020
	Door, inbd RH	Al Aly	QQ-A-250/5	T3	0.020
	Door, inbd LH	Al Aly	QQ-A-250/5	T3	0.020
	Door, inbd RH	Al Aly	QQ-A-250/5	T3	0.020
	Door, inbd LH	Al Aly	QQ-A-250/5	T42	0.020
	Door, inbd RH	Al Aly	QQ-A-250/5	T42	0.020
	Door, inbd LH	Al Aly	QQ-A-250/5	T42	0.020
	Door, inbd RH	Al Aly	QQ-A-250/5	T42	0.020
16	Fuselage LH	Al Aly	QQ-A-250/5	T4	0.025
	Fuselage LH	Al Aly	QQ-A-250/5	T6	0.025
	Fuselage LH	Al Aly	QQ-A-250/5	T6	0.025
	Fuselage LH	Al Aly	QQ-A-250/5	T6	0.032

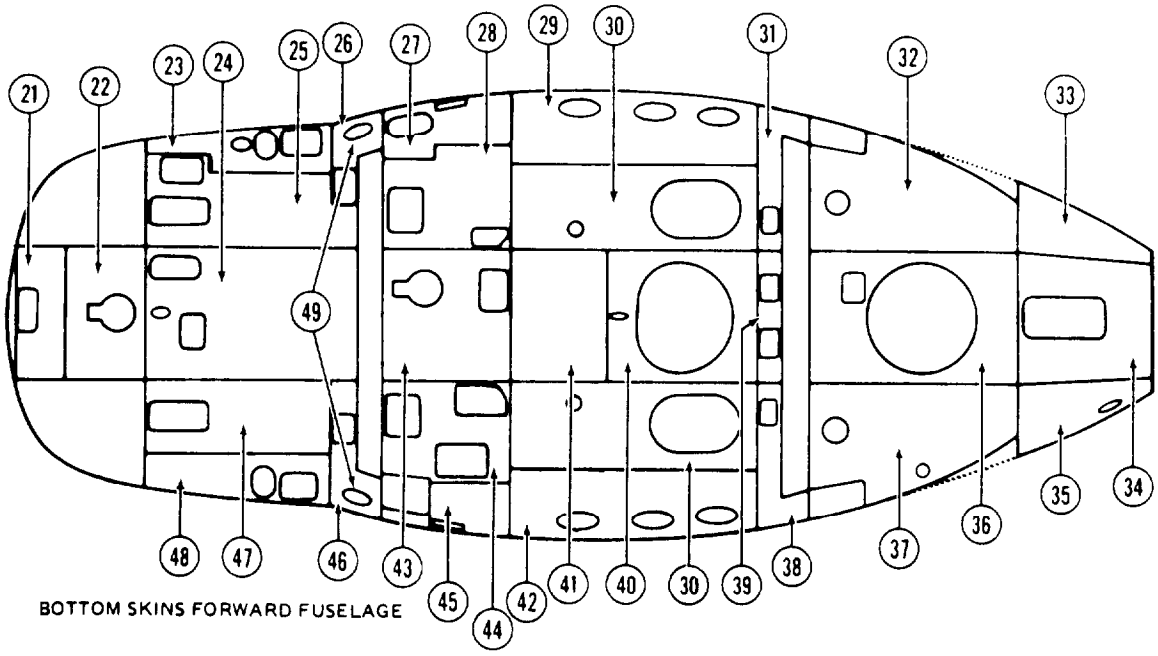
205030-1010-2B

Figure 2-4. Forward Fuselage Skin (Sheet 2 of 5)

Item	Name	Material	Specification	Condition	Thickness
	Fuselage LH	Al Aly	QQ-A-250/5	T6	0.032
	Fuselage LH	Al Aly	QQ-A-250/5	T6	0.032
	Fuselage LH	Al Aly	QQ-A-250/5	T4	0.025
	Fuselage LH	Al Aly	QQ-A-250/5	T6	0.025
	Fuselage RH	Al Aly	QQ-A-250/5	T4	0.025
	Fuselage RH	Al Aly	QQ-A-250/5	T6	0.025
	Fuselage RH	Al Aly	QQ-A-250/5	T6	0.025
	Fuselage RH	Al Aly	QQ-A-250/5	T6	0.032
	Fuselage RH	Al Aly	QQ-A-250/5	T6	0.032
	Fuselage RH	Al Aly	QQ-A-250/5	T6	0.032
	Fuselage RH	Al Aly	QQ-A-250/5	T6	0.032
	Fuselage RH	Al Aly	QQ-A-250/5	T4	0.025
	Fuselage RH	Al Aly	QQ-A-250/5	T6	0.025
	Fuselage RH	Al Aly	QQ-A-250/5	T6	0.032
	Fuselage RH	Al Aly	QQ-A-250/5	T6	0.032
	Fuselage cntr	Al Aly	QQ-A-250/5	T3	0.032
	Fuselage, cntr	Al Aly	QQ-A-250/5	T3	0.032
	Fuselage, cntr	Al Aly	QQ-A-250/5	T3	0.032
	Fuselage, cntr	Al Aly	QQ-A-250/5	T4	0.025
	Fuselage, cntr	Al Aly	QQ-A-250/5	T4	0.025
17	Door, outer LH	Fiberglass	Type "E"	—	—
	Door, cntr LH	Al Honeycomb	MIL-C-7438	—	0.500
	Door, cntr LH	Al Honeycomb	MIL-C-7438	—	0.250
	Door, inner LH	Fiberglass	Type "E"	—	—
	Door, outer RH	Fiberglass	Type "E"	—	—
	Door, cntr RH	Al Honeycomb	MIL-C-7438	—	0.500
	Door, cntr RH	Al Honeycomb	MIL-C-7438	—	0.250
	Door, inner RH	Fiberglass	Type "E"	—	—
18	Door, outer LH	Fiberglass	Type "E"	—	—
	Door, cntr LH	Al Honeycomb	MIL-C-7438	—	0.500
	Door, cntr LH	Al Honeycomb	MIL-C-7438	—	0.250
	Door, inner LH	Fiberglass	Type "E"	—	—
	Door, outer RH	Fiberglass	Type "E"	—	—
	Door, center RH	Al Honeycomb	MIL-C-7438	—	0.500
	Door, center RH	Al Honeycomb	MIL-C-7438	—	0.250
	Door, inner RH	Fiberglass	Type "E"	—	—
19	Door, outer LH	Fiberglass	Type "E"	—	—
	Door, center LH	Al Honeycomb	MIL-C-7438	—	0.500
	Door, inner LH	Fiberglass	Type "E"	—	—
	Door, outer RH	Fiberglass	Type "E"	—	—
	Door, center RH	Al Honeycomb	MIL-C-7438	—	0.500
	Door, inner RH	Fiberglass	Type "E"	—	—
20	Service deck outer skin	Titanium	MIL-T-9046	—	0.016
	Service deck core	Al Honeycomb	MIL-C-7438		
	Service deck inner skin	Fiberglass	BHT 299-947-059 Type II		

205030-101-3B

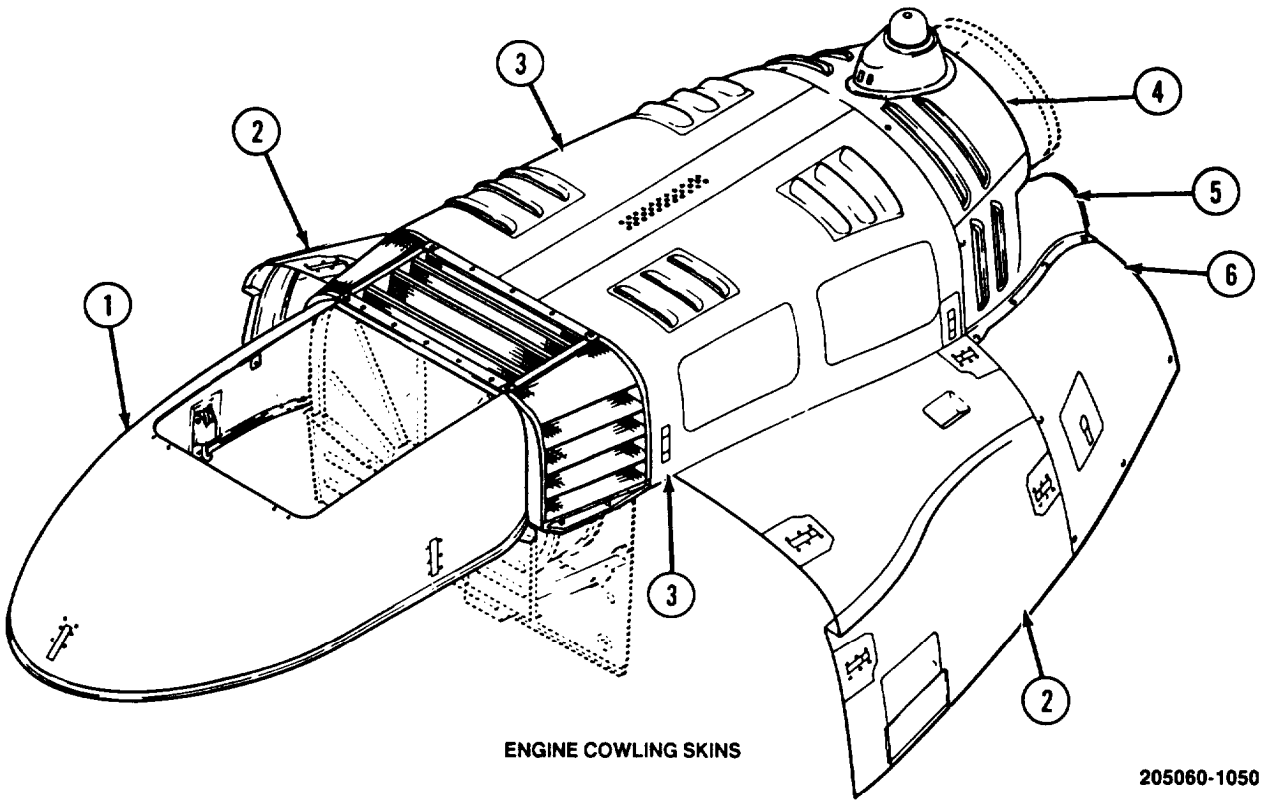
Figure 2-4. Forward Fuselage Skin (Sheet 3 of 5)



BOTTOM SKINS FORWARD FUSELAGE

Item	Name	Material	Specification	Condition	Thickness
21	Door	Al Aly Honeycomb	MIL-C-7438		
22	Skin	Al Aly	QQ-A-250/5	T6	0.020
23	Skin	Al Aly	QQ-A-250/13	T6	0.025
24	Skin	Al Aly	QQ-A-250/5	T3	0.032
25	Skin	Al Aly	QQ-A-250/13	T6	0.032
26	Skin	Al Aly	QQ-A-250/5	T42	0.025
27	Skin	Al Aly	QQ-A-250/5	T42	0.025
28	Skin	Al Aly	QQ-A-250/13	T6	0.032
29	Skin	Al Aly	QQ-A-250/13	—	0.032
30	Panel	Al Aly Honeycomb	MIL-C-7438		
		Outer Skin Al Aly	QQ-A-250/13	T6	0.012
		Inner Skin	BHT 299-947-057 Type C Glass Fabric		
31	Skin	Al Aly	QQ-A-250/13	T6	0.032
32	Skin	Al Aly	QQ-A-250/13	T6	0.025
33	Skin	Al Aly	QQ-A-250/13	T6	0.025
34	Skin	Al Aly	QQ-A-250/5	T42	0.025
35	Skin	Al Aly	QQ-A-250/13	T6	0.025
36	Skin	Al Aly	QQ-A-250/5	T42	0.025
37	Skin	Al Aly	QQ-A-250/13	T6	0.025
38	Skin	Al Aly	QQ-A-250/13	T6	0.032
39	Skin	Al Aly	QQ-A-250/5	T3	0.032
40	Panel	Al Aly Honeycomb	BHT 299-947-059 Type II		
		Inner Skin Al Aly	QQ-A-250/13	T6	—
		Outer Skin Al Aly	QQ-A-250/13	T6	—
41	Panel	Fiberglass/Honeycomb Core			
42	Skin	Al Aly	QQ-A-250/13	T6	0.032
43	Skin	Al Aly	QQ-A-250/5	T3	0.032
44	Skin	Al Aly	QQ-A-250/13	T6	0.032
45	Skin	Al Aly	QQ-A-250/5	T42	0.025
46	Skin	Al Aly	QQ-A-250/5	T42	0.025
47	Skin	Al Aly	QQ-A-250/13	T6	0.032
48	Skin	Al Aly	QQ-A-250/13	T6	0.025
49	Fairing	Al Aly		—	0.040

Figure 2-4. Forward Fuselage Skin (Sheet 4 of 5)



ENGINE COWLING SKINS

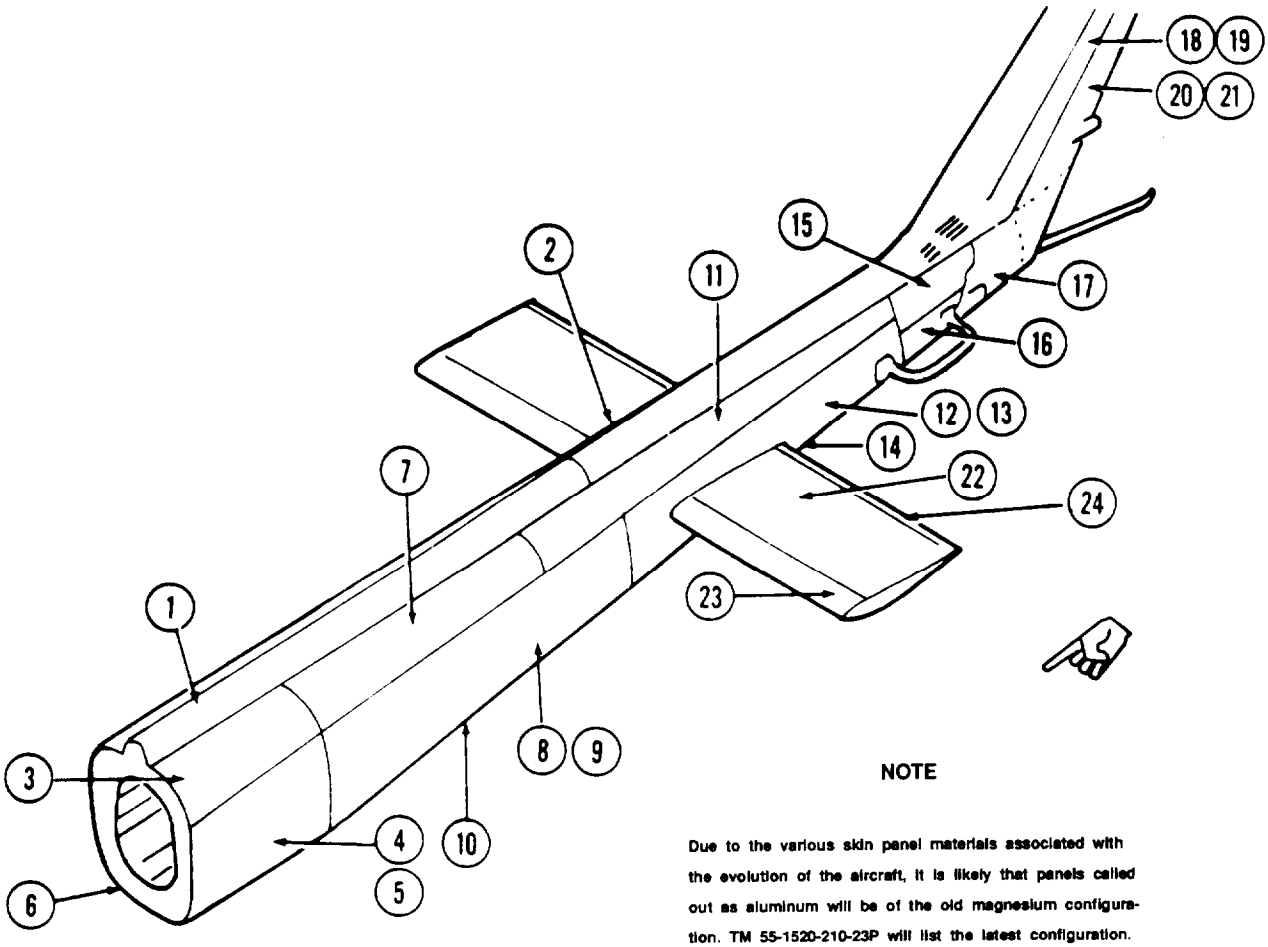
205060-1050

Item	Name	Material	Specification	Condition	Thickness
1	Fairing				
	Outer Skin	Glass Fabric	BHT299-947-037, Type E		
	Core	Al Aly Honeycomb			0.500
	Inner Skin	Al Aly	BHT299-947-037, Type E		
2	Lower Cowl				
	Inner Skin	Al Aly	QQ-A-362	T4	0.025
	Outer Skin	Al Aly	QQ-A-362	T4	0.020
3	Upper Cowl:				
	Louvers	Al Aly	BHT299-947-012, Type VIII		
	Bulkheads	Al Aly	QQ-A-250/5	T42	0.025
	Skins:				
	Upper Inner	Al Aly	QQ-A-250/5	T42	0.025
	Lower Inner	Al Aly	QQ-A-250/5	T42	0.025
	Outer	Al Aly	QQ-A-250/5	T42	0.020
	Perforated Inner	Al Aly	QQ-A-250/8	H34	0.032
	Tailpipe Fairing				
4	Upper Fairing	Al Aly	QQ-A-250/5	T42	0.025
5	Upper Fairing	Al Aly	QQ-A-250/8		0.025
6	Lower Fairing	Al Aly	QQ-A-250/5	T4	0.020

NOTE

Due to the various skin panel materials associated with the evolution of the aircraft, it is likely that panels call out as aluminum will be of the old magnesium configuration. TM 55-1520-210-23P will list the latest configuration.

Figure 2-4. Forward Fuselage Skin (Sheet 5 of 5)



NOTE

Due to the various skin panel materials associated with the evolution of the aircraft, it is likely that panels called out as aluminum will be of the old magnesium configuration. TM 55-1520-210-23P will list the latest configuration.

ITEM	DESCRIPTION	MATERIAL	COND	THICKNESS	PART NUMBER
1.	Cover, Dr Shaft Acc, Fwd	Al Aly	2024-T3	0.040	205-031-813-3
2.	Cover, Dr Shaft Acc, Center	Al Aly	2024-T3	0.040	205-031-813-5
3.	Extension, Top	Al Aly	2024-T3	0.025	205-031-801-47
4.	Extension, L/H	Al Aly	2024-T3	0.025	205-031-801-81
5.	Extension, R/H	Al Aly	2024-T3	0.040	205-031-801-82
6.	Extension, Bottom	Al Aly	2024-T3	0.032	205-031-801-61
7.	Top, Fwd, B.S. 59-101	Al Aly	2024-T3	0.025	205-032-800-23
8.	Side, Fwd, L/H B.S. 59-122	Al Aly	2024-T3	0.025	205-032-800-47
9.	Side, Fwd, R/H B.S. 59-143	Al Aly	2024-T3	0.040	205-032-800-48
10.	Bottom, Fwd, B.S. 59-143	Al Aly	2024-T3	0.025	205-032-800-49
11.	Top Center, B.S. 101-194	Al Aly	2024-T3	0.032	205-032-800-55
12.	Side Center, L/H B.S. 122-195	Al Aly	2024-T3	0.032	205-032-800-69
13.	Side Center, R/H B.S. 122-194	Al Aly	2024-T3	0.032	205-032-800-70
14.	Bottom Center, B.S. 122-194	Al Aly	2024-T3	0.032	205-032-800-53
15.	Skin, Fin Top, Aft, B.S. 194.3	Al Aly	2024-T3	0.050	205-032-800-37
16.	Skin, Fin, Bottom	Al Aly	2024-T3	0.032	205-031-800-35
17.	Skin, Fin, Bottom	Al Aly	2024-T3	0.040	205-030-899-95
18.	Skin, Fwd Fin, L/H	Al Aly	2024-T3	0.025	205-030-899-7
19.	Skin, Fwd Fin, R/H	Al Aly	2024-T3	0.025	205-030-899-9
20.	Skin, Aft Fin, L/H	Al Aly	2024-T3	0.032	205-030-899-3
21.	Skin, Aft Fin, R/H	Al Aly	2024-T3	0.032	205-030-899-5
22.	Skins, Top, Bottom, L/H & R/H	Al Aly	2024-T3	0.025	UH1-SC0031-1
23.	Leading Edge, L/H & R/H	Al Aly	2024-T3	0.032	UH1-SC0031
24.	Trailing Edge, L/H R/H	Al Aly	2024-T3	0.040	205-030-856-29

Figure 2-5. Tallboom Skins

Growing of Metals and Alloys

Group I. . . . . Magnesium and Its alloys, aluminum alloys 5052, 5056, 5356, 6061, and 6063

Group II . . . . . .Cadmium, zinc, and aluminum and their alloys (Including the aluminum alloys in Group 1).

Group III . . . . . Iron, lead, and tin and their alloys (except stainless steel)

Group IV. . . . . .Copper, chromium, nickel, silver, gold, platinum, titanium, cobalt, and rhodium and their alloys; stainless steel and graphite.

Metals classified in the same group are considered similar to each other,

Metals classified in different groups are considered dissimilar to each other

(6) Hydroscopic Material Corrosion. This form of corrosion IS caused by such materials as sponge rubber, felt, cork etc. absorbing water and holding it in contact with the part

b. Corrosion Forms and Causes. Refer to table 2-2.

c. Corrosion Damage Classification – General Requirements. Refer to table 2-3. The limits of table 2-3 do not apply when the limits conflict with other parts of this chapter.

d. Corrosion Damage Repair. Refer to table 2-4 for general instructions for cleaning and treating corroded parts. (TM 55-1 500-344-23)

e. Corrosion Prevention at Structural Metal Fastener Locations. Rivets, lock bolts, blind rivets, and threaded fasteners shall be assembled using wet, unthinned zinc chromate primer (TT-P-1757), item C 215, table 1-1. Fasteners, holes, and washers (if applicable) shall be coated with wet unthinned primer, If the fasteners are dissimilar to and can result in direct contact with magnesium, a washer of 5052 aluminum alloy with a minimum overlap of 1/8 inch shall be used in addition to TT-P-1757 primer,

Table 2-2. Forms and Causes of Corrosion

FORM	DESCRIPTION	CAUSE
Chafing	A rubbing action between two parts	Improper clearance between parts and Improper lubrication.
Brinelling	Raised areas Indicating separation of metal. Normally found on plated or finished parts and precedes flaking and peeling	Improper assembly or dis-assembly technique, such as using force to install a roller or ball bearing in the race; also caused by heat and wear.
Fretting Corrosion	Discoloration where surfaces are pressed or bolted together under pressure Color of residue on steel parts IS usually reddish brown while aluminum or magnesium parts are black	Incomplete adhesion of metal or excessive loads
Scuffing	Surface damage of pieces of a plated or finished surface	Rubbing off of fine particles of metal by slight movement
Galling	Transfer of metal from one surface to another	Rubbing off of particles of two surfaces under high pressure
Abrasion	Roughened area can vary from light to heavy moving surfaces	Presence of fine particles of foreign material between moving surfaces

Table 2-3. Corrosion Damage Classification – General

PART	NEGLIGIBLE	REPAIRABLE	REPLACE-ABLE
Skins Decks Roofs Cowlings Fairings	Less than 20% Material Thickness Across 25% of Cross Section after Elimination	Greater than 20% of Material Thickness but less than 50% of Cross Section and Clear of All Adjacent Structural Parts after Elimination	More than 50% of Cross Section Affected.
Webs	Less than 10% of Material Thickness Across 25% of Cross Section after Elimination	Greater than 10% of Material Thickness but less than 50% of Cross Section and Clear of All Adjacent Structural Parts after Elimination	More than 50% of Cross Section Affected.
Formed Parts Extrusions Tubes	Less than 10% of Material Thickness Across 25% of Cross Section after Elimination	Any Damage Meeting These Conditions: (1) Less than 50% of Part Affected. (2) Sufficient Good Area Remaining to Attach Repair (3) Economically Justified.	Any Damage Not Meeting Conditions Previously Stated.
Fittings Castings Forgings Clips Brackets Isolation Mounts	Reworked Area Must Not Exceed 25% of Cross Section and Must Affect Less than 10% of the thickness or 0.040 Inch Depth. It must Clear Fillets and Fastener Holes or Counterbores by 0.50 inch minimum	Damage Exceeding Negligible Requires Replacement	Same as Reparable.
Fasteners Root Ends Bearings Cables Turnbuckles Bushings	Corrosion Which Can be Removed or Allowed to Remain Without Affecting the Size or Function of the Part	Not Applicable	Any Damage Not Classed as Negligible.

Table 2-4. Cleaning and Treating Corroded Parts

METAL	CONDITION	CLEANING	TREATMENT
Aluminum Alclad Surfaces	Mild or heavy pitting staining and superficial etching	Apply cleaning compound, (C67), and rinse with water. Do not use abrasives.	Apply paint as required. On internal surfaces use epoxy primer (C110). Unfinished external surfaces should be finished with aluminum pigmented lacquer (C15).
	Mild surface pitting staining and superficial etching	Apply cleaning compound, (C67) and heavy duty brightener	Apply paint as required On internal surfaces use epoxy primer, (C110). Unfinished external surfaces should be finished with aluminum pigmented lacquer (C15).

Table 2-4. Cleaning and Treating Corroded Parts (Cont)

METAL	CONDITION	CLEANING	TREATMENT
	Heavy surface pitting	Hand rub with aluminum wool (C309) and kerosene (C143); apply cleaning compound (C67), and rinse with fresh water.	
Aluminum	Intergranular corrosion	Remove corroded area. Burnish part to remove sharp edges.	Treat with a five percent solution of potassium dichromate and allow to dry. Brush off excess crystals. Apply epoxy primer (C110).
Magnesium	Surface pitting, large nonremovable parts	Remove corrosion with a stiff bristle brush	Apply corrosion treatment, IAW TM 55-1500-344-23.
Steel	Lightly rusted parts. No pitting	Clean parts with cleaning compound, (C67), and rinse with fresh water. Use steel wool (C310) to remove compound, if necessary.	Apply primer, (C312) on previously cadmium plated parts.
	Badly rusted	Not applicable	Replace parts.

Table 2-4.1 Inspection Limits for Control Rode, Tube Assemblies and Connecting Link

INSPECT FOR	LIMITS	REPAIR/REPLACE
1. Nicks and scratches on rods.	10 percent of wall thickness.	Repair
2. Nicks, and scratches on end fittings.	10 percent of material thickness or .040 inches, whichever is less.	Repair
3. Dents. Divide connecting link tube into three equal sections. Check tube for dents in middle third.	One dent not exceeding 0.010 inch deep and free from any abrasions is permissible in this area.	
Check tube for dents in other two thirds.	A maximum total of two dents, each not exceeding 0.015 inch in depth and free from any abrasions is permissible in these areas.	

Table 2-4.1 Inspection Limits for Control Rods, Tube Assemblies and Connecting Links (Cont)

INSPECT FOR	LIMITS	REPAIR/REPLACE
4. Visually check for out-of-roundness.	If an out-of-round condition is found, determine the extent of this condition. Use calipers at out-of-round location to measure diameter. Move calipers 90° around link and repeat measurement. On tubes less than 2 inches in diameter, an out-of-round condition of 0.010 inch is permissible in middle one-third of tube. On tubes greater than 2 inches in diameter, an out-of-round condition of 0.015 inch is permissible. On any diameter tube an out-of-round condition of 0.015 inch is permissible in each of end one-third portions of tube.	
5. Corrosion.	5 percent of wall thickness after removal of 10 percent of thickness of rod ends or fittings or 0.040 inch, whichever is less.	
6. Rod ends for looseness in rod.	No looseness allowed.	
7. Checknuts on the adjustable end of the connecting link for looseness.	If the checknut on the adjustable end of the connecting link is loose, install an internal star washer under the checknut as follows: a. For checknut AN316-6R, use washer MS35333-42. b. For checknut AN316-7R, use washer MS35333-43. c. For checknut AN316-8R, use washer MS35333-44.	
8. Bearings for looseness.	Dry type bearings. a. 0.007 inch radial play max. b. 0.010 inch axial play max. Anti friction bearings. 0.004 inch radial play max. Axial play on antifriction bearings can vary. It is not a satisfactory criterion for checking serviceability of anti friction bearings.	

Table 2-4.1 Inspection Limits for Control Rods, Tube Assemblies and Connecting Links (Cont)

INSPECT FOR	LIMITS	REPAIR/REPLACE
9. Bolts and bushings used at moving connections.	Max wear. Bolt shank minimum diameter is no less than 0.001 inch below minimum production diameter. Max wear. Bushing hole maximum diameter is no more than 0.001 inch above maximum production diameter.	

2-15. HONEYCOMB PANELS.

2-16. Description — Honeycomb Panels. Structural panels consisting of aluminum alloy core with metal facings and/or glass cloth facings are used in forward fuselage structure (figure 2-4).

2-17. Classification Inspection of Damage-Honeycomb Panels. Refer to table 2-5 for classification of damage.

Table 2-6. Classification of Damage. — Honeycomb Panels

DEFECT	NEGLIGIBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
a. Dents.	a. Dents Smooth contoured dents up to **5%** of panel thickness *provided:* 1. Total damage does not exceed **5%** *of panel area.* 2. No voids under dent. 3. Maximum diameter *does not exceed* **4.0** inches for a single dent. 4. Edge of dent is **1.0** inch minimum from supporting structure or beveled edge of panel. b. Smooth contoured dents up to **10%** of panel thickness provided: 1. No voids under dent. 2. Maximum diameter does not exceed **0.75** inch for a single dent. 3. No more than three dents can be encompassed by a **4.0** inch diameter circle. NOTE: Dents closer than **1.0** inch are classed as one dent. 4. Edge of dent is *minimum* **1.0** *inch* from supporting structure or beveled edge. 5. Total Damage does not exceed **2%** of panel area.	a. Damage exceeds negligible damage Limits. No cracks. holes, or voids *(figure* 2.6). Dent has sharp nicks, hole or crack. Damage penetrates only one surface and does not exceed **0.5** inch after cleanup. Refer to paragraph 2-18 step b., and figure 2-7. If cleanup exceeds **0.5** inch, refer to paragraph 2-18, step c. and figure 2-8.	a. Damage exceeds repairable limits. Corrosion in honeycomb core.

Table 2-5. Classification of Damage – Honeycomb Panels (Cont)

DEFECT	NEGLIGIBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
b. Voids.	b. Voids up to 0.25 inch square (1/2 x 1/2 provided. 1 No more than two such areas can be encompassed by a 4.0 inch circle 2. The edge of any void is a minimum of 3.0 inches from supporting structure, panel edge bevel or insert or fitting, NOTE: Voids closer than 1.0 inch are classed as one void. Edge separation IS never classed as negligible damage.	b. Damage exceeds negligible limits (figure 2-10).	b. Damaged exceeds repairable limits,
c. Nicks and scratches (metal facing)	c. Nicks and scratches not exceeding 10 percent of metal facing thickness and 4.0 inches square after cleanup, Damage 1.0 inch minimum from supporting structure after cleanup.	c. Damage exceeds negligible limits, See Figures 2-7 and 2-8 for aluminum faced panel and see Figure 2-11 for titanium faced panels, (Excluding center service deck.)	c. Damage exceeds repairable limits. Replace any panel having evidence of water or corrosion in the core.
d. Corrosion	d. Corrosion not to exceed 10 percent of metal facing thickness and 4.0 square inches after cleanup Damage minimum 1.0 inch from supporting structure.	d. Damage not to exceed 2 percent of panel area. Maximum diameter of any area after cleanup is 1.0 inch. One repair per bay allowed, Minimum distance between repairs IS 3.0 inches, No repair within 1.0 inch of supporting structure, inserts, beveled edge.	d. Same as preceding step c.

Table 2-5. Classification of Damage — Honeycomb Panels (Cont)

DEFECT	NEGLIGIBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
e. Cracks, holes, punctures.	e. None.	e. Cracks, holes or punctures. 1. Damages affect only one skin and core (figure 2-7). (a) Damage limited to two holes within a 4.0 inch dia. circle. (b) Holes separated by 1.0 inch of undamaged material. NOTE: Holes closer than 1.0 inch are classed as one hole. (c) Hole diameter is 0.5 inch or less after cleanup. (d) Edge of cleanup is minimum 3.0 inches from supporting structure beveled edge, or mounting surface. 2. Damage exceeds 0.5 inch dia. after cleanup (figure 2-8). (a) Damage limited to 12.0 square inches when only one skin and core are affected, or 10.0 inches when both skins and core are affected. (b) Maximum two repairs per panel with 5.0 inches of undamaged material between repairs. (c) Edge of cleanup minimum 3.0 inches from panel edge, cutout or supporting structure.	e. Same as preceding step c.
f. Loose or damaged inserts.	f. None.	f. Replace as required (figure 2-9).	

Table 2-5. Classification of Damage – Honeycomb Panels (Cont)

DEFECT	NEGLIGIBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
NOTE For repairable damage limits and damage requiring replacement of the left and right upper aft cabin walls, refer to defect g.			
g. Bond separation	g. None	g. Bond separation up to 100%. may be repaired on left, right and center roof walkways if panel is still sound and will perform its primary function, i.e., to support the weight equivalent of two men.	g. If bond separation is present and any of the following conditions are present, i.e., the honeycomb is crushed or mushy, or if the panel becomes water, fuel or oil soaked or corrosion exists, then the panels will be replaced during the next scheduled inspection that panels are available.

2-18. Repair or Replacement — Honeycomb Panels (AVIM).

a. Repair nonpenetrating damage to external honeycomb panels (excluding titanium faced panels).

(1) Smooth contoured dents on surface may be filled and faired providing damage does not exceed limits of figure 2-6.

(2) Apply paint and primer to match surrounding area.

b. Repair of holes, sharp dents, and dents exceeding 10 percent of honeycomb panel thickness (excluding titanium faced panels).

(1) Damage not to exceed:

(a) 0.50 inch diameter after cleanup. (Does not include undercut.)

(b) No more than two damages encompassed by a 4.0 inch diameter circle and damage comes no closer than 1.0 inch to a similar damage or repair. Damage closer than 1.0 inch is classed as a single damage.

(c) Penetration affects only one surface

(d) Damage after cleanup, comes no closer than 3.0 inches to panel edge or cutout, insert or attachment point for structural members.

(e) Replace panel if corrosion or water is found in core.

(2) Repair damage in accordance with figure 2-7 and the instructions following:

(a) Protect opening to prevent entry of cleaning materials,

(b) Remove paint and primer from surface extending 3.0 inches from edge of damage.

CAUTION

All corrosion and damage must be removed. Do not cut into inner skin of panel. No corrosion or water allowed in core.

(c) Cut away skin and core to remove all damage (figure 2-7).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(d) Flush cavity with MEK (C177). Dry immediately with clean compressed air.

(e) Fill cavity with adhesive (C29).

(f) Sand (C233) adhesive to contour (after curing) and refinish area to match surrounding finish.

c. Repair of honeycomb panels requiring a cleanup hole in excess of 0.50 inch diameter. (Excluding titanium faced panels (figure 2-8).

NOTE

Repairs to honeycomb panels must be applied subject to component limitations, and must not be accomplished if weight and balance, structural integrity, interchangeability or operational characteristics will be adversely affected.

(1) Protect the opening to prevent entry of cleaning agents and solvents.

(2) Remove paint and primer from an area extending 3.0 inches beyond the edge of damage.

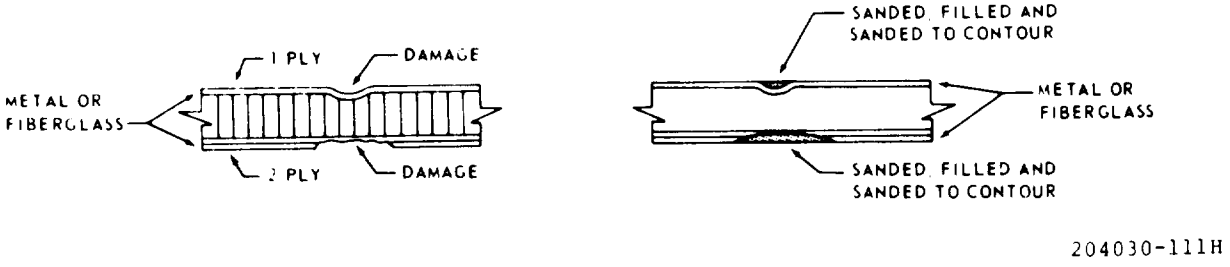
CAUTION

Any core or skin contaminated by fuel, oil, water, corrosion or debris must be cut out. Replace panel if water or corrosion is found in panel.

NOTE

Where damage is limited to one skin, the opposite skin may be left intact provided cleanup operation does not cut into the skin.

(3) Cut away skins and core to remove all damaged and contaminated material. Undercut core approximately 0.10 inch from edge of cleanup. Use a minimum of 0.500 inch radius at corners. Do not exceed cleanup limits of table 2-5.



FIBERGLASS AND METAL FACED HONEYCOMB PANELS – STRUCTURAL

DESCRIPTION OF DAMAGE

FIBERGLASS FACED PANELS

Dents. scratches, scars, or erosion in facings with no holes, cracks, or voids.

METAL FACED PANELS

Smooth dents or depressions in the skins with no holes, or cracks or voids.

LIMITS -- REPAIRABLE DAMAGE

1 Maximum depth: 25 percent of panel thickness.

2 Minimum distance from an edge bevel: 0.500 inch.

1. Maximum diameter of damage: 1.00 inch.
2. Maximum depth: 20 percent of panel thickness
3. Maximum area of all dents combined in any one bay: 3 percent of area of bay.
4. Maximum of two 1.00 inch diameter dents in a 3 square inch area.
5. No voids may exist under damage.
6 Minimum of 1.0 inch from panel beveled edge.

REPAIR PROCEDURES

FIBERGLASS AND METAL FACED

1 Remove paint and or primer from damaged area.

2. Smooth out damaged area by lightly sanding with abrasive pad (C11), or No. 400 grit sandpaper (C233).

3. Clean sanded area with methyl-ethyl-ketone (C177) end wipe dry.

4. Apply adhesive (C29) with suitable tool. Level to panel contour and allow to cure.

5. Sand smooth with abrasive pad (C11) or No. 400 grit sandpaper (C233).

6. Apply two coats of lacquer of color to match original finish.

Figure 2-6. Honeycomb Panels - Repair of Dents, Scars, and Scratches

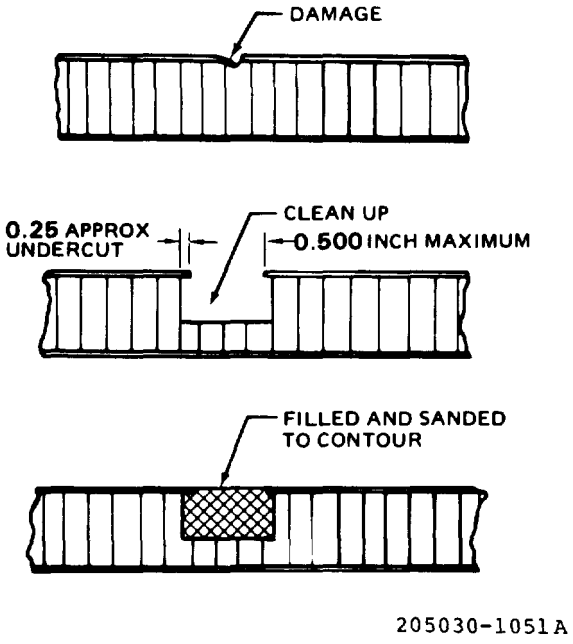


Figure 2-7. Honeycomb Panels — Minor Damage Repairs

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(4) Flush the cavity with MEK (C177). Dry promptly with clean dry compressed air.

(6) Fill the cavity as follows:

(a) Damage of 1.0 inch or less in diameter may be filled with adhesive (C29) and smoothed to contour of skins (figure 2-8, detail C).

(b) Damage exceeding 1.0 inch in diameter must be filled with a core plug of like honeycomb material. Refer to following steps 1 through 5 (Detail D).

1. Cut a core plug (use only clean material of the same type as original) to fit the damaged area allowing approximately 0.10 inch gap for adhesive at the edges.

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

2. Flush the plug with MEK (C177) and dry immediately with dry filtered air.

3. Apply a 0.020 TO 0.030 inch film of adhesive to a piece of P.V.F. Tedlar (C56) (area to be equal to surface area of plug).

4. Place the core plug on the adhesive, apply firm—contact to five PSI pressure and allow adhesive to cure.

NOTE

This will seal the core cells and provide a better bonding surface. If both panel skins are affected, both sides of plug should be sealed.

5. Protect the core plug from contamination until ready for use.

(6) Patching metal faced panels.

(a) Cut a skin patch (of composite bond material) (prebend), sufficiently large to provide a 1.5 inch overlap outside of the damaged skin trim, remove the peel ply protecting the adhesive and apply adhesive (C29) evenly to the patch 0.020 TO 0.030 inch thick. Minimum patch thickness to be that of existing skin (figure 2-8, detail E).

NOTE

Where the panel is curved, the skin patch must be shaped to match.

(b) Install skin patch over the repair area.

(c) Add rivets around patch in the overlap area. Rivets are to be installed within the pot life of the adhesive (figure 2-8).

(d) Apply pressure to the patch in the cavity area to ensure a good bond.

(7) Patching fiberglass faced panels.

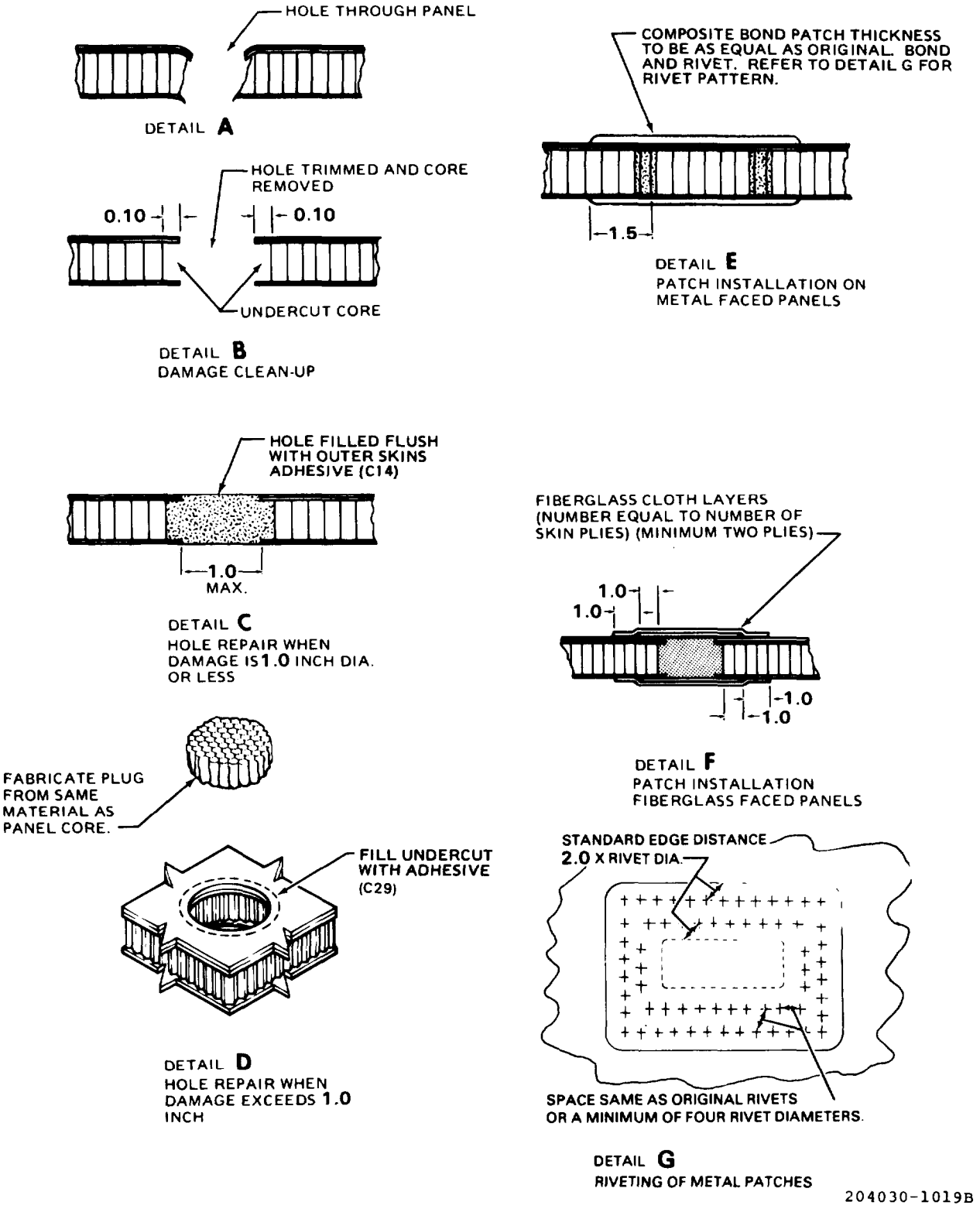


Figure 2-8. Honeycomb Panels

NOTE

Fiberglass repairs should be accomplished after core plug has cured.

(a) Prepare a patch of fabric layers (equal to number of plies lost) or a minimum of two plies to provide a minimum of **1.0** inch minimum overlap outside the damaged skin trim and to provide a minimum of **1.0** minimum overlap, over each preceding layer (figure 2-8, detail F).

(b) Saturate the first patch with adhesive (C27). Apply resin to the exposed filler and to the exposed clean area of the panel around the damage.

(c) Fit the impregnated patch into place. Smooth out air pockets and wrinkles.

NOTE

Ensure that adequate resin is forced through the patch ply in the core area.

(d) Saturate each succeeding ply with adhesive and brush coat the entire repair area with resin and apply the patch. Work each ply to remove the wrinkles and entrapped air prior to application of the next ply. Minimum number of plies to be the same as existing skin.

(e) Cover repair with cellophane and apply firm contact pressure to the patch with shot bags, clamps, vacuum bag or other suitable means.

d. Repair bonded panel inserts. See figure 2-9 for repair limitations and instructions.

e. Certain honeycomb panels may be replaced at AVIM provided adequate precautions are taken to prevent airframe misalignment during the removal and installation operations. These precautions include but are not limited to:

(1) Defueling aircraft.

(2) Removing engine.

(3) Removing transmission.

(4) Removing tailboom.

(5) Supporting airframe in a level restrained position.

(6) Removing and replacing one panel at a time.

NOTE

Provisions of paragraph 2-18e do not apply where specific instructions for replacing honeycomb panels are provided.

2-19. Repair - Honeycomb Panel Service Decks (AVIM). Repair engine service decks as follows:

a. Center service deck repair.

NOTE

Any bonding separation in excess of that defined in the following steps ((1) or (2)) or if core is damaged, or if damage penetrates honeycomb facing, replace center service deck. If a void is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 Helicopter Series.

(1) Bonding separation around the edges of large hole in canted portion of service deck or at center fuel cell access door, repair in accordance with figure 2-12.

(2) Bonding separation in area of the aft engine mount fittings at station 200, repair as outlined in figure 2-12.

b. Center Service Deck Replacement (P/N 205-031-197) (AVIM).

CAUTION

Replacement of center service deck is restricted to AVIM nondivisional level of maintenance.

NOTE

If crack in the center service deck panel, center service deck, hanger bearing brace assembly, or main beam caps is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 Helicopter Series.

(1) Defuel helicopter and remove the following components:

(a) Main Rotor

(b) Transmission and Mast Assembly

(c) Engine

(d) Tailboom

(e) Center Fuel Cell

(2) Clean surfaces of special alignment tool P/N 205-200-005-1 AAT-D1, which interface with the aircraft fuselage and the No. 1 hanger bearing support (6, Figure 2-8.1).

(3) Clean surfaces of fuselage which interface with alignment tool and the hanger bearing support.

(4) Remove No. 1 hanger bearing assembly from No. 1 hanger bearing support.

(5) Using two (2) each 0.375 inch diameter and 0.500 inch diameter close tolerance bolts, attach the alignment tool to the aft fuselage bulkhead (18) at the tailboom attachment points with the arm of the tool extending forward and above the engine deck.

(6) After alignment tool installation, selectively loosen each of the four attachment bolts one at a time to

determine if the bulkhead is in the correct plane, i.e., the wear pads are of the correct thickness. If there is a discrepancy in the wear pad thickness the tool will spring out as one bolt is loosened.

(7) If a discrepancy exists, shim the tool as required at the location(s) where the tool does not seat properly so as to provide proper tool placement against the fuselage bulkhead.

(8) Using the sliding adjustment on the alignment tool, align the bolt holes in the top of the hanger bearing support to the sliding adjustment in the tool. Using two (2) 0.250 inch diameter close tolerance bolts, check the hole alignment between the hanger bearing support and the alignment tool. The attaching bolts should slide freely through the tool into the support. When this is accomplished, tighten the sliding adjustment on the tool.

(9) Insert the 0.062 inch thick shim provided with the tool between the hanger bearing support and the alignment tool. Using the two (2) 0.250 inch diameter close tolerance bolts, attach the hanger bearing support to the alignment tool. Remove the four (4) bolts attaching the hanger support to the engine deck. Remove the brace assembly (12) attached to the hanger bearing support. Inspect brace assembly (12) visually for cracks and dents. No cracks are allowed. Any dents large enough to cause driveshaft misalignment are cause for rejection.

(10) Remove the alignment tool from the aft fuselage bulkhead with the hanger support attached. Inspect brace assembly (12) visually for cracks and dents. No cracks are allowed. Any dents large enough to cause driveshaft misalignment are cause for rejection.

(11) Place jacks under jack points and raise fuselage sufficiently to remove weight from landing gear and level helicopter. Position signs near helicopter to prevent personnel other than those involved with service deck replacement from climbing on helicopter.

(12) Remove engine mounts and all associated hardware. Remove fuel, oil, bleed air lines and fittings from center service deck. Cap or plug open lines and fittings from center service deck to prevent entry of foreign matter. Remove tail rotor drive shaft heat shield and engine fire walls See Figure 2-8.1.

(13) Remove screws on lower side of service deck below aft engine mounts to free deck from supports (four screws at each side). Remove rivets which secure service deck to main beams and lateral bulkheads. Use caution when removing rivets to prevent damage to fuselage. Remove tension strap at Station 166.00 (45). Remove service deck.

NOTE

Clean and inspect main beam caps for cracks at engine mount locations.

If crack is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 Helicopter Series.

(14) If a new service deck in not to be installed immediately, install special tool P/N 71SAVAE-D-0009 at FS 200 to prevent possible shifting between L/H and R/F main beams.

(15) If a new deck is to be installed immediately lay the new service deck in place but do not attempt to drill any fastener holes at this time.

(16) Reinstall the special alignment tool with the hanger support still attached and with any shim determined in paragraph (7) above installed. Leaving the sliding adjustment on the alignment tool fixed, shift the new service deck such that the four inserted holes for the hanger bearing support in the new service deck align with the four holes in the hanger bearing support. The attaching bolts should slide freely through the support base into the holes in the engine deck.

NOTE

Weight may be placed on the top of the service deck to aid in positioning deck prior to clamping in place.

(17) Temporarily clamp the new service deck in place. Locate a series of perimeter holes by back drilling through the main beam cap angles. Locate only enough holes to hold the new engine deck in place. Install cleco fasteners in newly drilled holes.

(18) At FS 200 locate the attaching holes for the engine mount fittings (2 holes each on L/H and R/H BL 14) by backdrilling existing holes through main beam car angle.

(19) Install special tool P/N 71SAVAE-D-0009 a FS 200 using the four holes located in Step (18) above. Using the drill bushing pattern at center of the tool, drill four (4) .250 inch diameter holes through the engine deck.

(20) With special tool P/N 71SAVAE-D-0009 in place locate the remaining perimeter holes in the new service deck by back drilling through the main beam car angles.

(21) Remove new service deck and clean and deburr holes. Touch up as required with zinc chromate primer (C312) on both the replacement panel and the helicopter fuselage.

(22) After the zink chromate primer is thoroughly dry, clean the mating surfaces of the center service deck and fuselage (including the vertical flanges of the main beam cap angles forward of FS 166) with naptha (C178). Apply Pro-seal 890 class A-2 (C244) to the mating surfaces of the new deck and fuselage; be sure to thoroughly cover the vertical flange, rivets, and dome nuts forward of FS 166. Pro-seal 890 comes as a properly proportioned two part kit and does not require weighing or measuring. Mix the accelerator thoroughly in its container before mixing with the base material. The base material does not require premixing. Mix the accelerator and base material in a nonabsorbent container for approximately five minutes or

until streaks are blended; use an air motor and paddle if available. Pot life of mixed sealant is approximately two hours. Apply sealant to both mating surfaces with a stiff bristle brush (a suitable brush can be made by cutting about one inch of the bristles off an ordinary paint brush). If the sealant is too stiff, thin slightly with methlyethylketone (C177).

(23) Position service deck on fuselage and cleco in place. Position tension strap at FS 166.00. Install rivets as illustrated on Fig 2-8.1 with the following qualification: Hilok bolts, P/N HL2066W65, may be used in place of Hi-shear rivets at FS 211.06 on both LUH and RPH sides.

(24) Seal edges of service deck with same sealant used on mating surfaces. If there was not adequate squeeze out to form a fillet add a small amount of sealant. Smooth the exterior fillets with a tongue depressor soaked in methylethylketone. (C177)

(25) Using feeler gauges, determine the required shim thickness for shims to be inserted between the base of the hanger bearing support and the engine deck. When determining final shim thickness account for thickness of dissimilar metal tape between the shim and the hanger support.

NOTE

The hanger bearing support is to be shimmed to a position 0.003 inch of and square within 1/4 degree of the driveshaft centerline.

(26) Insert the required shim thickness under the hanger support (21 under UH fwd leg and 22 under R/H and UH aft and RIH fwd legs) as determined in Step 27.

(27) Insert the four (4) hanger support attaching bolts through the hanger bearing support into the engine deck. Do not force the bolts through the installation. If force is required to install the bolts, realign the support .

(28) Remove the 1/4 inch diameter close tolerance bolts securing the hanger bearing support to the alignment tool. Remove the .062 inch thick shim from the hanger bearing support.

(29) Torque the 1/4 inch diameter close tolerance bolts securing the hanger bearing support to the engine deck. After torquing the support attaching bolts, the 1/4 inch diameter close tolerance bolts in the arm of the alignment tool must be in line with the holes in the top of the hanger bearing support. i.e., the bolts must pass through the alignment tool into the support without binding.

(30) Using feeler gauges, check the gap between the alignment tool and the hanger bearing support. The gap measured must not exceed 0.062 inch +.015. However, the gap measured forward to aft must not taper more than 0.004 inch.

(31) If during Steps 5, 6 and 7 a need for shimming one or more of the four attachment points was required to achieve proper tool positioning determine if the wear pad thickness at each tailboom attachment point is correct according to Figure 2-8.2.

(32) If the thickness of any wear pad is not correct, install new wear pad(s) at location(s) determined in Steps 6 and 7 such that the alignment tool will be positioned flat against the fuselage bulkhead.

(33) Reinstall brace assembly (12) to hanger bearing support and center service deck as shown in Figure 2-8.1 with the appropriate shim and washer arrangement as shown.

(34) Remove jacks and reinstall the following components:

(a) Center fuel cell
(b) Transmission and mast assembly
(c) Tailboom

(35) Install engine, fire walls, and tail rotor driveshaft fire shield. Install tail rotor driveshaft. Install fuel, oil and air lines and fittings removed in Step 12.

(36) Install engine mounts and engine. Align engine to transmission. Refer to Main Driveshaft Alignment. Conduct a tail rotor driveshaft alignment check. This alignment check will assure correct alignment between the No. 1 hanger bearing on the fuselage and the hanger bearings of the tailboom.

(37) Install main rotors. Refuel helicopter, check calibration fuel calibration system and check fuel leaks. Perform functional checks of engine and rotor system.

c. Installation of No. 1 Hanger Bearing Support Assembly (P/N 205030236) (AVIM).

NOTE

Inspect No. 1 hanger bearing support assembly for damage and corrosion in accordance with figure 2-8.3 prior to installation on engine deck assembly.

(1) Clean surfaces of alignment tool P/N 2052000051AAT1 which interface with the aircraft fuselage and the No. 1 hanger bearing support (6).

(2) Clean surfaces of fuselage which interface with alignment tool and the hanger bearing support.

(3) Using two (2) each 0. inch diameter and 0.50 inch diameter close tolerance bolts, attach the alignment tool to the aft fuselage bulkhead (18) at the tailboom attachment points with the arm of the tool extending forward and above the engine deck.

(4) After alignment tool installation, selectively loosen each of the four attachment bolts one at a time to determine if the bulkhead is in the correct plane, i.e., the wear pads are of the correct thickness. If there is a discrepancy in the wear pad thickness the tool will spring out as one bolt is loosened.

(5) If a discrepancy exists, shim the tool as required at the location(s) where the tool does not seat properly so as to provide proper tool placement against the fuselage bulkhead.

(6) Attach the No. 1 hanger bearing support to the alignment tool using two (2) .250 inch diameter close tolerance bolts. Insert the 0.062 inch thick shim provided with the tool between the hanger bearing support and the alignment tool. The base of the support should be down and parallel to the engine deck.

(7) Using the sliding adjustment on the alignment tool, align the bolt holes in the base of the hanger bearing support with the corresponding holes in the engine deck until the attaching bolts for the hanger bearing support slide freely through the support base into the holes in the engine deck.

CAUTION

Do not use force on the alignment tool while aligning the holes in the hanger bearing support and the engine deck. Excessive forcing will result in possible misalignment or damage to tool.

(8) Using feeler gauges, determine the required shim thickness for shim (21 and 22) to be inserted between the base of the hanger bearing support and the engine deck. When determining final shim thickness account for thickness of dissimilar metal tape between the shim and the hanger support.

NOTE

The hanger bearing support is to be shimmed to position ±.003 inch of and square within 114 degree of the driveshaft centerline.

(9) Insert the required thickness under the hanger support (21 under UH aft leg and 22 under R/H and L/UH and R/H fwd legs) as determined in Step 8.

(10) Insert the four (4) hanger support attaching bolts through the hanger bearing support into the engine deck. Do not force the bolts through the installation. If force is required to install the bolts, realign the support as described in Steps 7 and 8.

(11) Remove the 1/4 inch diameter close tolerance bolts securing the hanger bearing support to the alignment tool. Remove the 0.062 inch thick shim from the hanger bearing support.

(12) Torque the 1/4 inch diameter close tolerance bolts securing the hanger bearing support to the engine deck. After torquing the support attaching bolts, the 114 inch diameter close tolerance bolts in the arm of the alignment tool must be in line with the holes in the top of the hanger bearing support, i.e., the bolts must pass through the alignment tool into the support without binding.

(13) Using a feeler gauge, check the gap between the alignment tool and the hanger bearing support. The gap measured must not exceed 0.062 inch +0.015. The gap measured forward to aft must not taper more than 0.004 inch.

(14) If the gap does not meet the requirements as stipulated in Step 13 above or the bolts will not pass through the support as per Step 12, repeat Steps 7 through 13 and either add or subtract from and/or taper the shims between the engine deck and the hanger bearing support as required to meet the tolerances stipulated.

(15) Remove alignment tool from the fuselage bulkhead and store in a cool, dry place free from possible accidental bumping and damage.

(16) If during Step 4 a need for shimming one or more of the four attachment points was required to achieve proper tool positioning, determine if the wear pad thickness at each tailboom attachment point is correct as shown in Figure 2-8.2.

(17) If the thickness of any wear pad is not correct, install new wear pad(s) at location(s) determined in Step 4 such that the alignment tool will be positioned flat against the fuselage bulkhead.

(18) Attach upper end of brace (12, figure 2-8.1) with bolt (8), washers (10 and 9), and nut (11). Measure gap at lower end of brace assembly and fill gap with shims (15), one washer (17), and shims (16) as required. Install bolt (13), washer (14), and nut (24).

d. Left and right side service deck repair.

(1) Dents in top skin constitute negligible damage and need not be repaired provided the top skin is not pierced and the fiberglass facing on the underside is not cracked.

(2) Bonding separation around edges of large hole in right side service deck repair in accordance with figure 2-12 by injecting adhesive (C29) and sealing edges.

(3) Repair acceptable voids in accordance with figure 2-10 observing the restrictions on sheets 1 and 2 of figure 2-10.

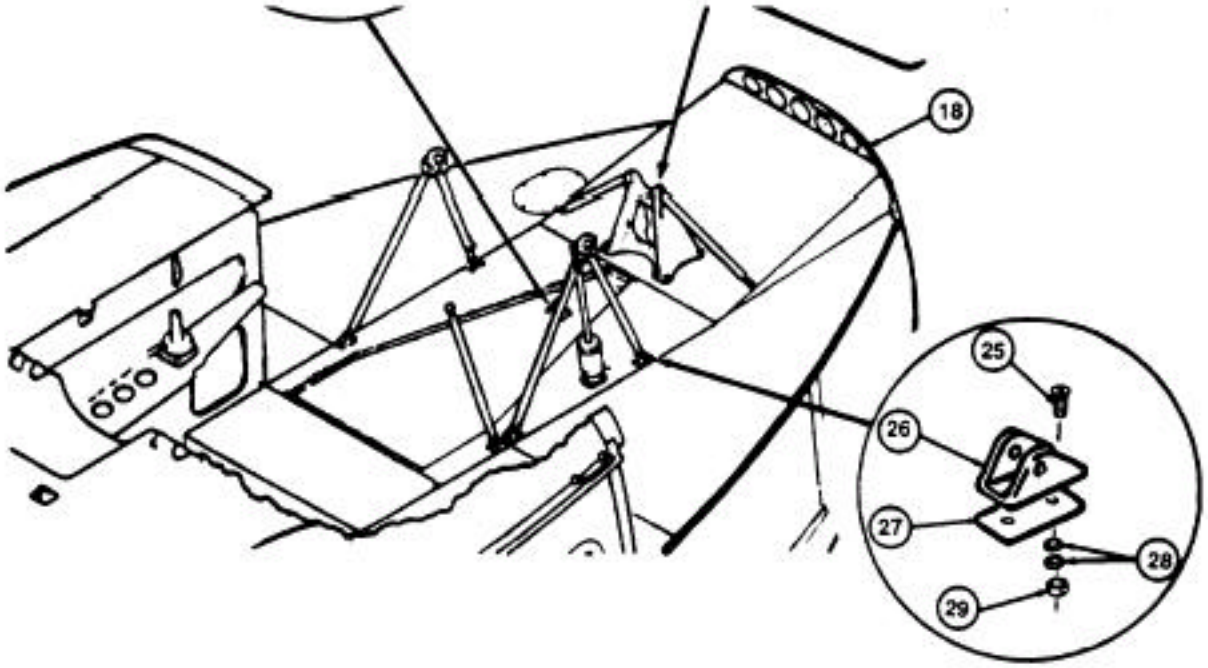
(4) Repair penetrating damage in accordance with figure 2-11, observing the damage limits noted on sheet 1 and 2 of figure 2-11.

e. Replace left side or right service dock if repairable limits are exceeded.

NOTE

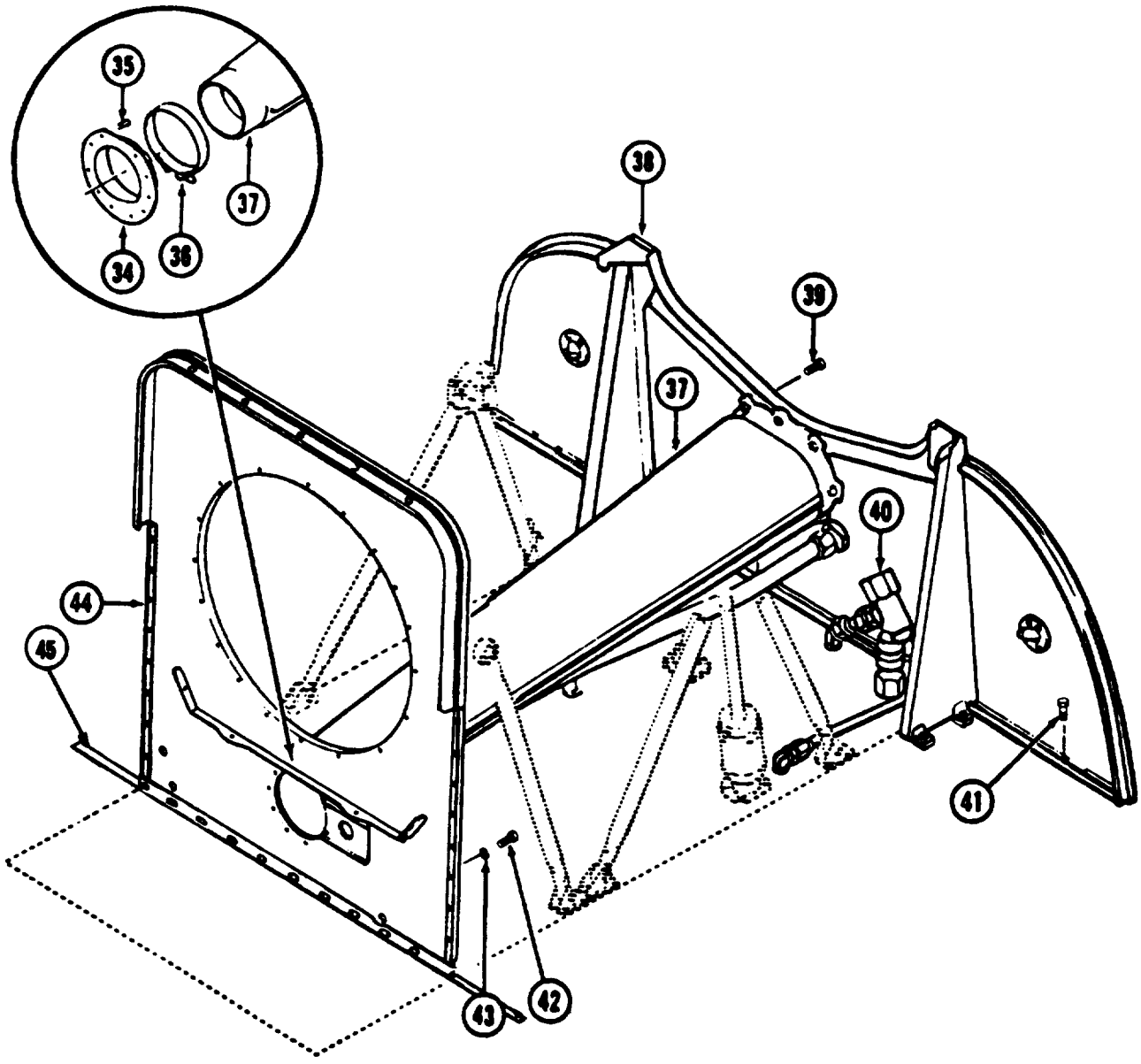
Instructions al re for either left or right side service decks.

(1) Support tailboom with sling or stand.



1. Bolt, Machine
2. Fitting
3. Shim
4. Washer, Steel
5. Nut
6. Support, Tail Rotor Drive Shaft
7. Hanger Assembly
8. Bolt, Machine
9. Washer, Steel
10. Washer, Aluminum
11. Nut
12. Brace Assembly
13. Bolt, Machine
14. Washer, Aluminum
15. Shim P/N 35Z3-32-9-125
16. Shim P/N 32Z3-32-9-62
17. Washer, Aluminum
18. Bulkhead
19. Screw, Machine
20. Washer, Aluminum
21. Shim, P/N 120-038-28-8 Three Required Under Forward Left-Hand Leg
22. Shim, P/N 205-030-424-1 Six Required
23. Washer, Aluminum
24. Nut
25. Screw, Machine
26. Bracket, Five Required
27. Shim P/N 205-060-137-3
28. Washer, Steel
29. Nut
30. Power Plant Controls (ref only)
31. Tripod Assembly (ref only)
32. Bipod Assembly (ref only)
33. Connecting Link (ref only)

Figure 2-8.1. Center service deck hardware (Sheet 1 of 6)



34. Gasket
35. Screw
36. Clamp
37. Tail Rotor Drive Shaft Heat Shield
38. Aft Firewall
39. Screw
40. Engine Bleed Air System Fittings
41. Screw
42. Screw
43. Washer
44. Forward Firewall
45. Tension Tie Strap 205-030-499

Figure 2-8-1. Center service deck hardware (Sheet 2 of 6)

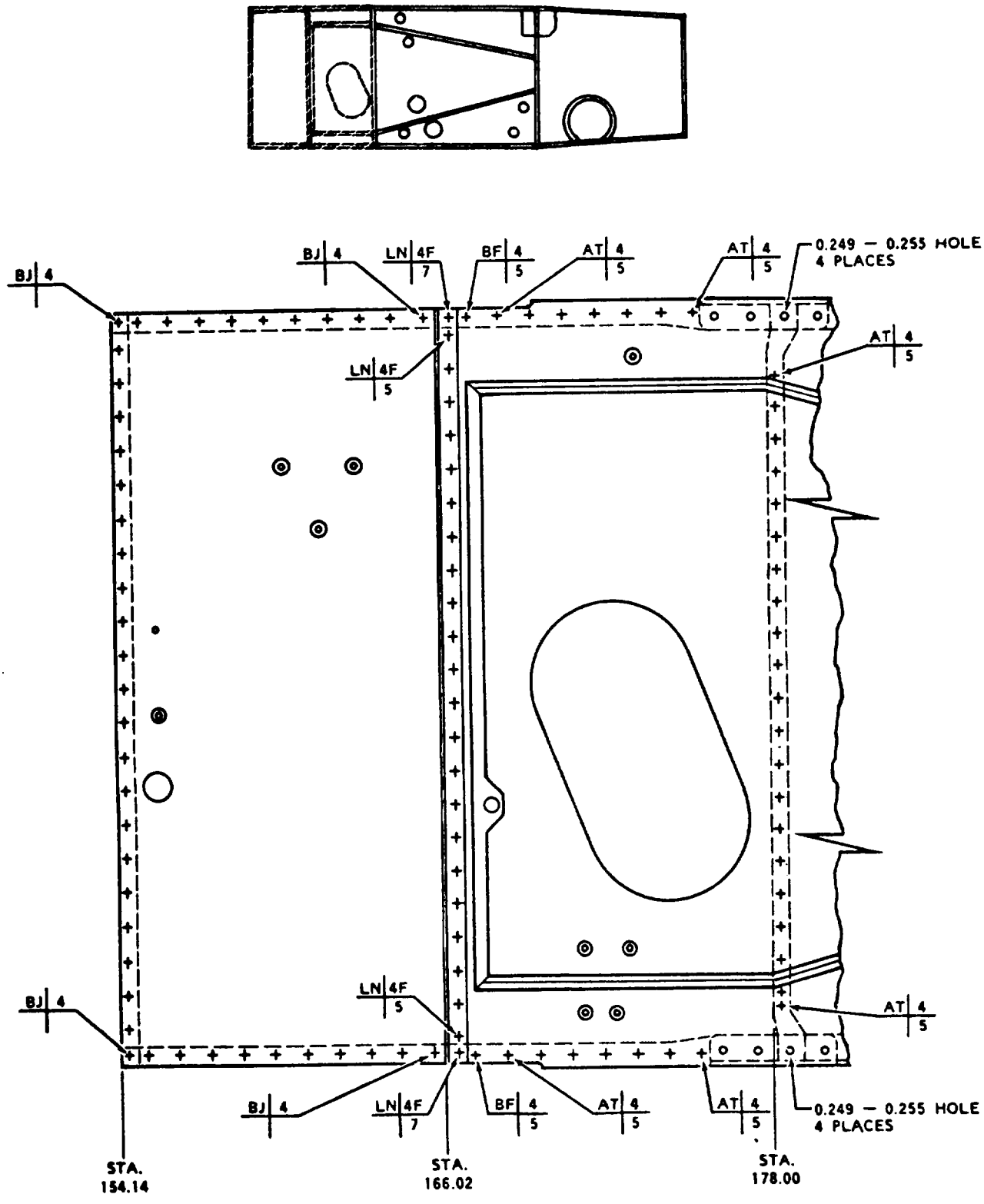


Figure 2-8.1. Center service deck hardware (Sheet 3 of 6)

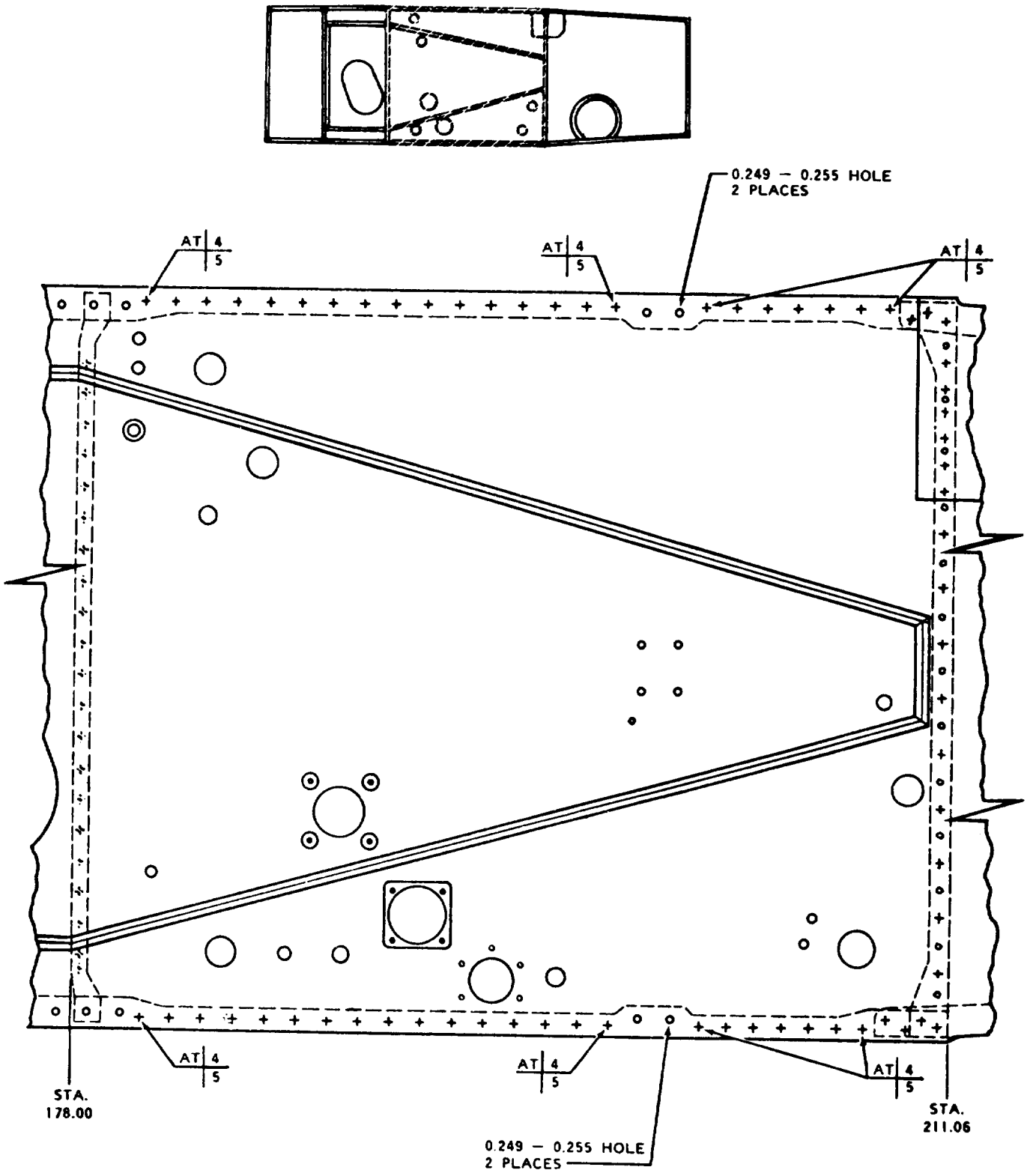


Figure 2-8.1. Center service deck hardware (Sheet 4 of 6)

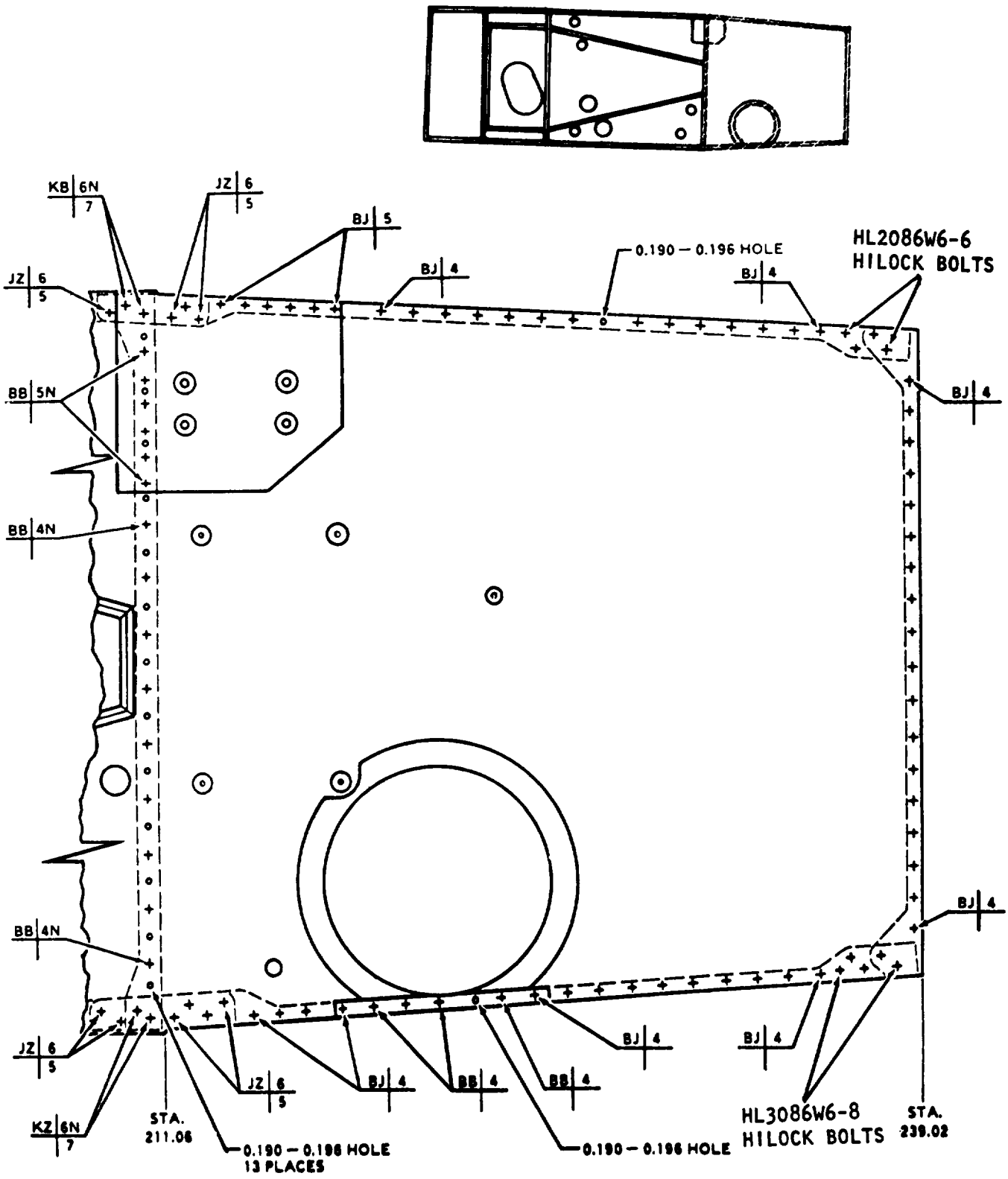


Figure 2-8.1. Center service deck hardware (Sheet 5 of 6)

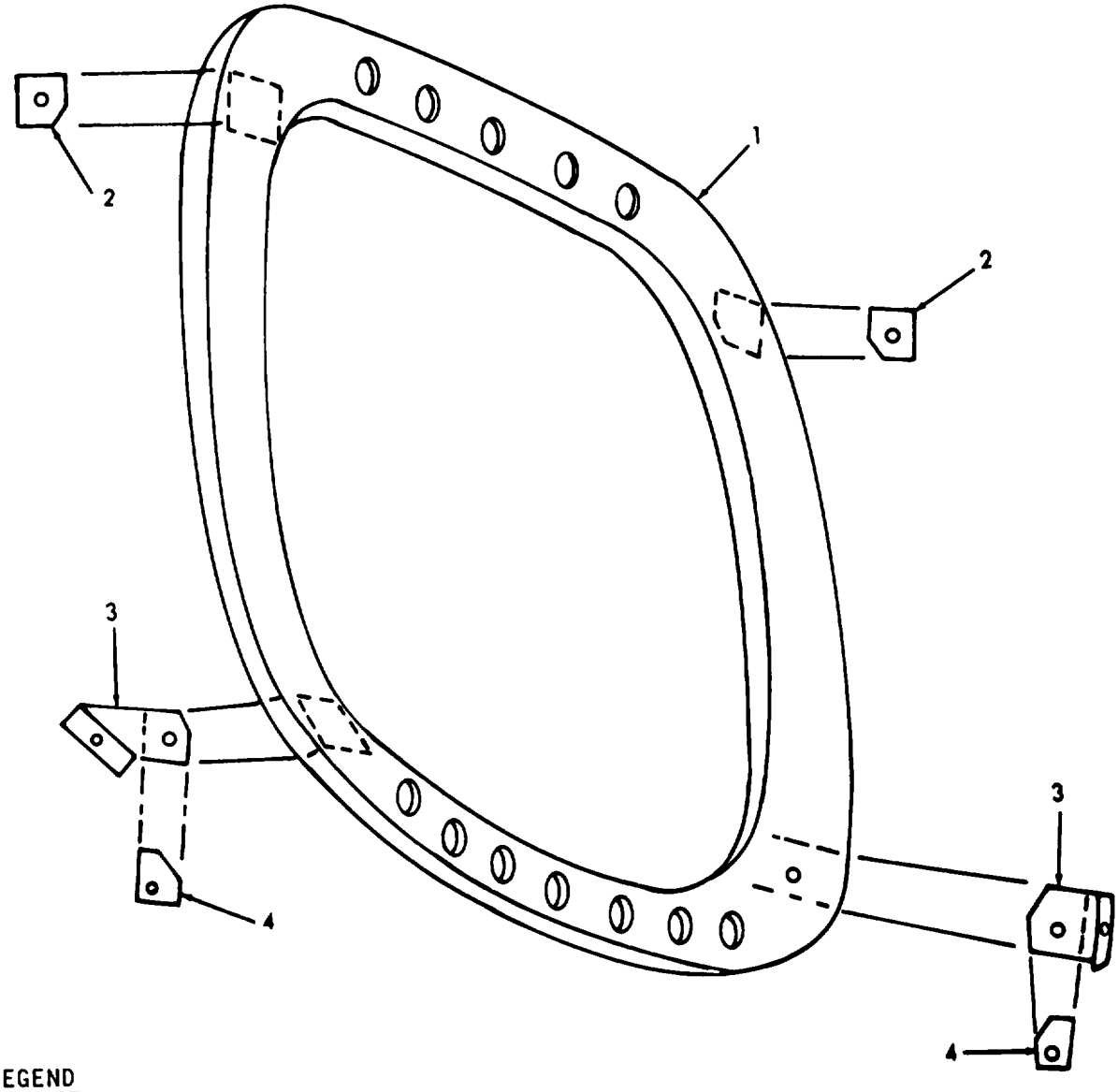
FASTENER CODE DATA

EXAMPLE	DESCRIPTION
LN 4F 5	Basic Code | Dash No. for Dig. N - Mfg. Head Near Side F - Mfg. Head Far Side | Dash No. For Length

BASIC CODE	BASIC PART NUMBER	NOMENCLATURE
BJ	MS20470AD	Rivet
LN	MS20615M	Rivet
BF	MS20427M	Rivet
AT	MS20435M or MS20615M	Rivet
KB	NAS1055 or NAS525	Rivet
BB	MS20426AD	Rivet
JZ	NAS1054 or NAS529	Hi-Shear Rivet
KZ	MS20604B	Blind Rivet
	HL3086-6-8	Bolt
	HL20PB86-6-6	Bolt
	HL20PB86-6-5	Bolt

NOTE Alternate fasteners for station 211.06 are specified In the text.

Figure 2-8.1. Center service deck hardware (Sheet 6 of 6)



LEGEND

1. AFT FUSELAGE BULKHEAD P/N 205-030-713
2. UPPER WEAR PADS
3. LOWER DOUBLERS P/N 205-030-253-27 L/H,-29 R/H
4. LOWER WEAR PADS
5. UPPER ATTACHMENT ANGLE, P/N 205-030-712-23
6. R/H ATTACHMENT ANGLE, P/N 205-030-712-29
7. L/H ATTACHMENT ANGLE, P/N 205-030-712-33

THICKNESS OF UPPER AND LOWER WEAR PADS

	TOP		BOTTOM	
	L/H	R/H	L/H	R/H
A. With Lower Doublers Installed	.080	.080	.050	.050
b. Without Lower Doublers Installed	.032	.032	.032	.032

Figure 2-8.2. Aft fuselage bulkhead arrangement (Sheet 1 of 2)

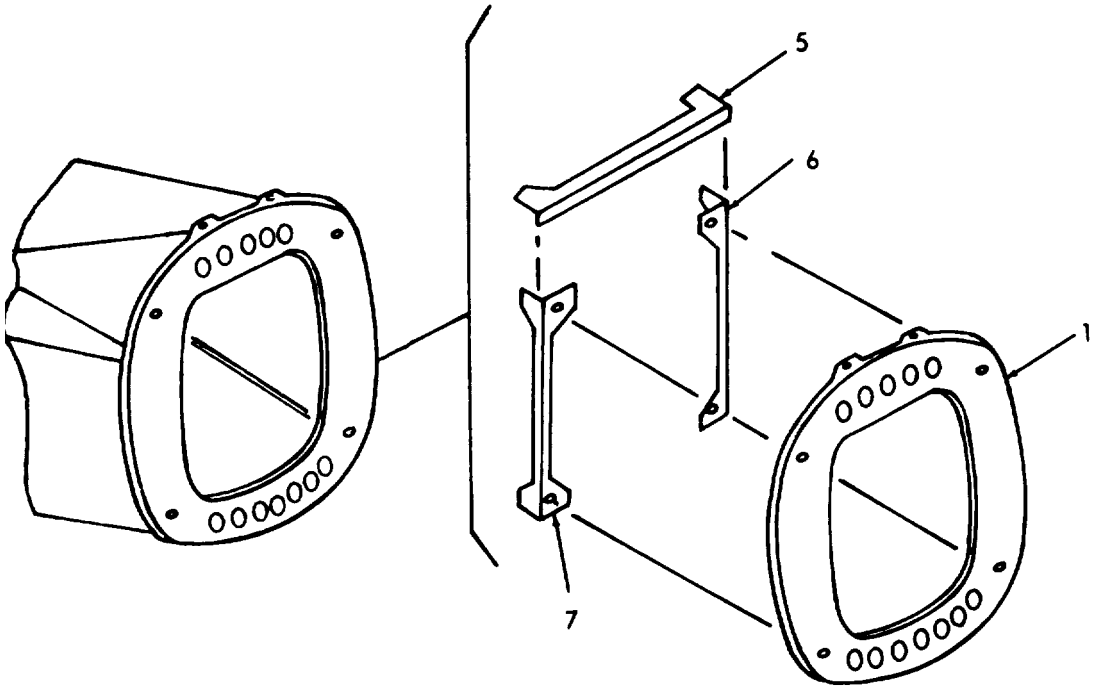
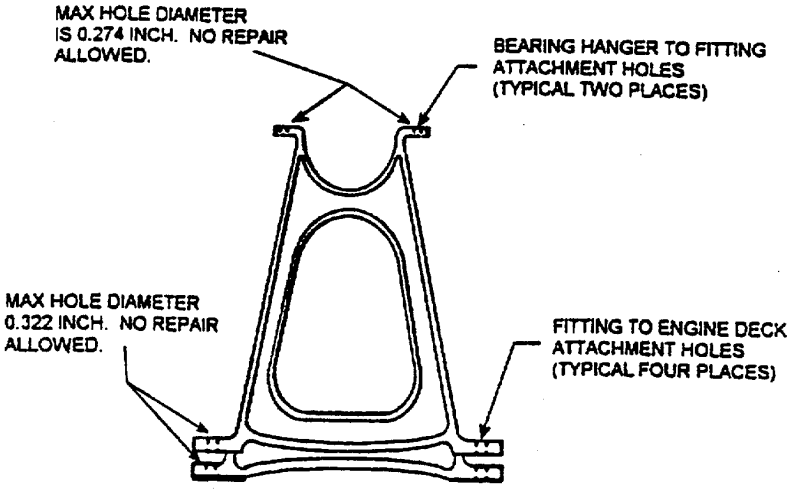


Figure 2-8.2. Aft fuselage bulkhead arrangement (Sheet 2 of 2)



205-030-236 FITTING

DEFECT	NEGLIGIBLE DAMAGE	REPAIRABLE DAMAGE	DAMAGE REQUIRING REPLACEMENT
1. Corrosion		Light surface corrosion may be repaired per note 1 below.	Pitting exceeding 0.020 inch in depth on 25 percent of surface area.
2. Mechanical Damage.		For bolt holes: Mechanical damage within one diameter not exceeding 0.010 inch in depth by ¼ inch in length may be repaired or note 2 below.	Scores, dents or scratches in the web or angle areas, exceeding 0.040 inch in depth by 1 inch in length.
3. Wear or Hole Elongation in Hanger to Fitting Attachment Holes.	Maximum diameter of 0.274 inch for one or both holes.	None.	Either hole diameter exceeds 0.274 inches.
4. Wear or Hole Elongation in Fitting to Engine Deck Attachment Holes.	Maximum diameter of 0.322 inch for one or both holes.	None.	Either hole diameter exceeds 0.322 inches.

NOTES:

1. Corrosion repair — Polish out all corrosion pits to twice the depth of the pits with 400-500 grit abrasive cloth or fine India stone. Clean and treat all corrosion areas.

2. Mechanical repair — Polish out damage using 180 grit or finer sandpaper. Repair is not to exceed depth of damage. Blend to contour of surrounding area.

Figure 2-8.3. Bearing Hanger Support Fitting Damage Limits

(2) Open engine and transmission cowl. Remove engine cowl, tailpipe fairing and lower left or right fairings. Remove compartment doors below engine deck level, left or right side.

(3) Remove V-and clamp and tailpipe.

(4) Remove screws securing tail rotor driveshaft fire shield to lower aft firewall. Loose clamp securing driveshaft boot. Remove clamp retaining tail rotor driveshaft to coupling on forward driveshaft support.

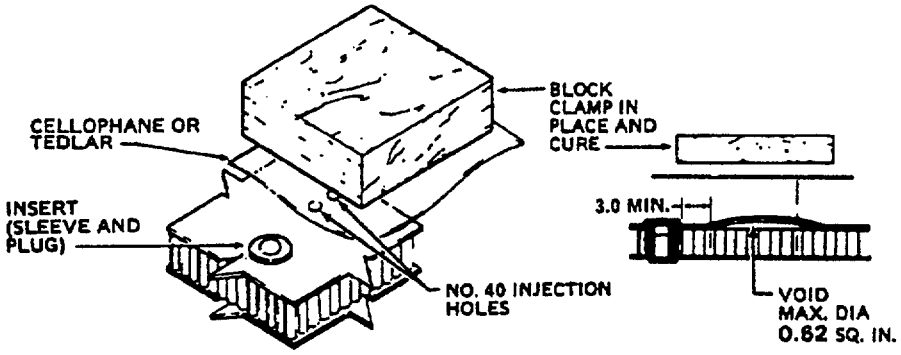
(5) Remove screws or fastener securing upper aft firewall to lower aft firewall.

(6) Remove screws attaching lower aft firewall to service deck. Remove screws from forward and aft brace legs of firewall. Retain any shims under legs for reuse.

(7) Upper aft firewall can be removed to allow movement of lower aft firewall.

(8) Drill out rivets and remove the turn lock receptacle bracket or angle from edge of the service deck.

(9) Remove three bolts, dowel, or shear pin, and bracket from aft outboard comer of service deck and forward fuselage aft bulkhead.



INSERTS OF BONDED PANELS

APPLICATION A:

Void existing in area of metal insert bonded in honeycomb panel.

RESTRICTIONS A:

1. Void area not to exceed 0.62 inch square.
2. Insert not to be damaged.
3. Edge of void 3.0 inch minimum from insert.

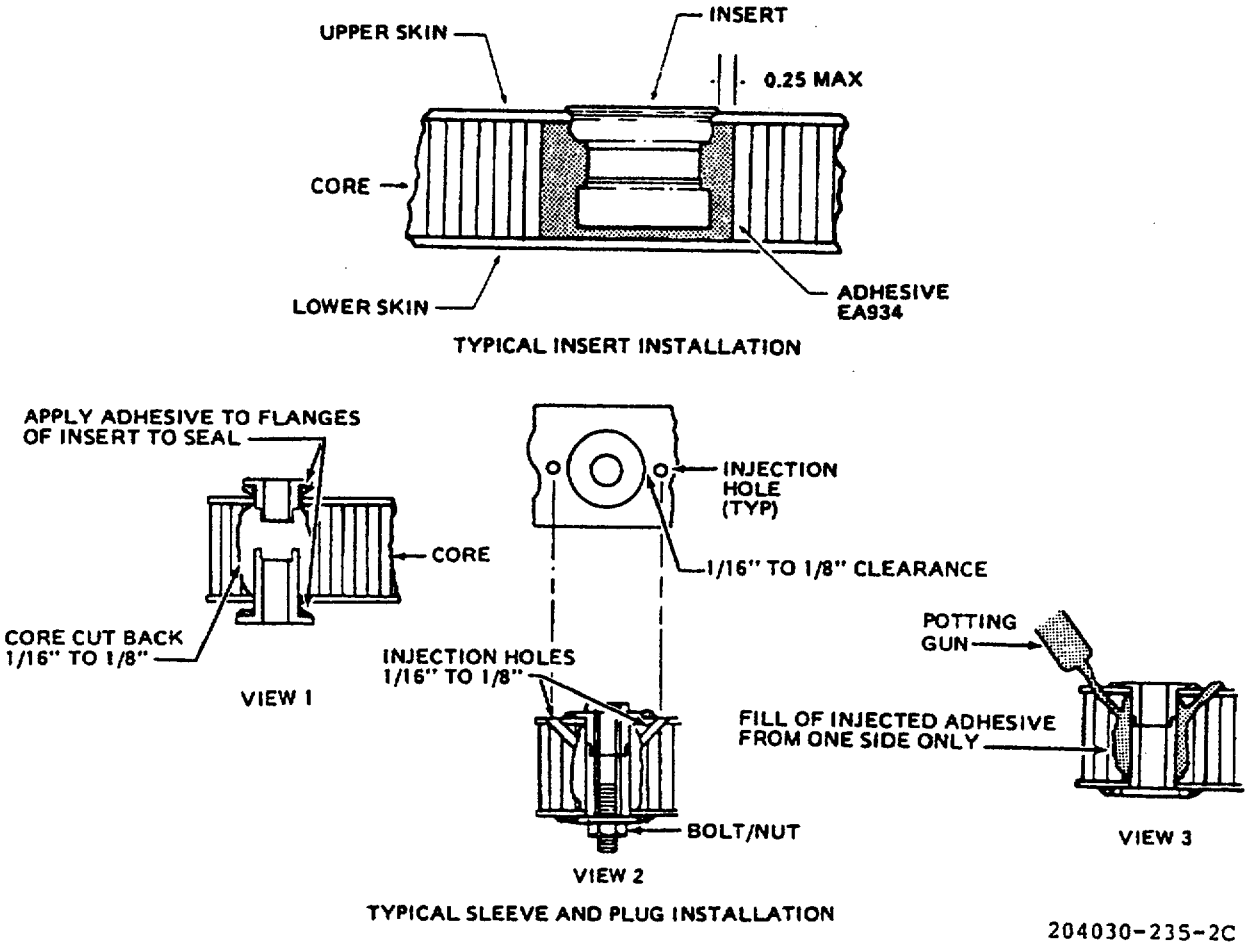
REQUIRED A:

Adhesive (C27)

PROCEDURE A:

1. Drill No. 40 hole at each end of void.
2. Inject adhesive (C27) into one hole until it flows out opposite hole.
3. Clamp flat and cure.
4. If void enlarges or still exists after full cure, submit for re-evaluation.
5. Refinish as required per engineering if void is eliminated.

Figure 2-9. Inserts of Bonded Panels (Sheet 1 of 2)



INSERTS OF BONDED PANELS

APPLICATION B:

Damaged or improperly installed potted insert that can be removed by counter boring without enlarging the blueprint size hole in the panel surfaces.

RESTRICTIONS B:

1. Immediate adjacent surface area is not to be damaged.

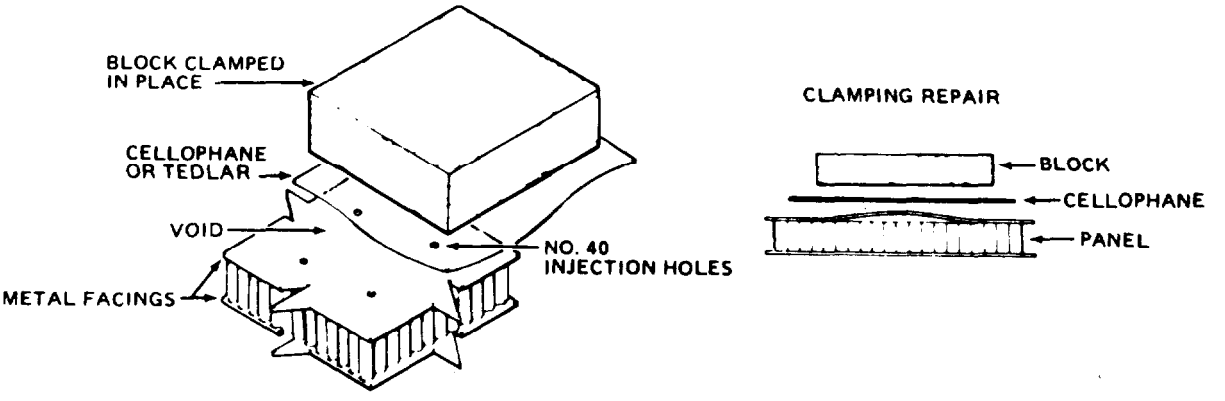
REQUIRED B:

1. Adhesive (C27).
2. Insert.

PROCEDURE B:

1. Counter bore to depth required to removed discrepant insert without enlarging existing holes through outer skins.
2. Install insert with adhesive and fair.
3. Refinish as required.

Figure 2-9. Inserts of Bonded Panels (Sheet 2 of 2)



REPAIR OF VOIDS IN METAL SURFACED BONDED PANELS

APPLICATION A

DAMAGE DESCRIPTION A:

Adhesion voids between metal skin and core less than 1.5 square inches.

RESTRICTIONS A:

1. Total area voids shall not exceed approximately 10 percent of total panel area.
2. A minimum of one inch between voids is allowable in a 6 inch circle, the center of which will be located in the center of one such void.
3. Voids shall not come within 3.0 inches of an insert or 1.0 inch of adjacent structure.
4. If the total voided area on a side of a panel (including large voids previously repaired) is less than ten percent (10%) of the total surface area of the panel on that side, the repair may be considered permanent and no extra inspections are required.
5. If the total voided area in a side of a panel (including voids previously repaired by either the bolt-type process and/or the process in steps (3) through (6) exceeds 10%, any repair is considered temporary, and must be inspected at each Phase inspection for evidence of further debonding, deterioration, core corrosion, or damage to other adjacent structure.
6. When the total voided and/or repaired area exceeds 25% of the total area of the panel, the panel will be repaired again (to preserve the panel) and scheduled for replacement at the next Phase inspection, major repair or modification, or overhaul, whichever comes first, following receipt of the replacement panel by the maintenance organization authorized to replace it.

REQUIRED A:

1. Adhesive (C27).
2. Cellophane (C56).
3. Sandpaper (C233).

PROCEDURE A:

1. Drill No. 40 holes around edge of damage a minimum of 1.0 inch span. Use as many holes as required to ensure complete filling of cavity.
2. Inject adhesive (C27) with hypodermic syringe until forced out opposite hole.
3. Cover repair with cellophane (C561) and level out by clamping with blocks. Allow to cure.
4. Clean up and smooth with 400 grit sandpaper (C233). Refinish as required.
5. Deleted.

Figure 2-10. Repair of Voids in Metal Surfaced Bonded Panels (Sheet 1 of 2)

REPAIR OF VOIDS IN METAL SURFACED BONDED PANELS

APPLICATION B

DAMAGE DESCRIPTION B

Edge voids or delamination.

RESTRICTIONS B

1. Voids shall not extend into attachment holes.
2. Void must be less than four inches in length.
3. No more than three voids per panel.
4. Minimum distance between two distinct voids to be 1.0 inch.
5. If void spreads or is not eliminated at injection and/or curing description of panel damage is to be submitted to engineering for evaluation.

REQUIRED B

1. Adhesive (C27).
2. Sealant (C244), Type I, class B-2.

PROCEDURE B

1. Inject void with adhesive (C27).
2. Sealant (C244) may be used for edge sealer.
3. Cover repair with cellophane (C56) or tedlar (C66) end level out by clamping. Cure under pressure.
4. Clean up and smooth with 400 grit sandpaper (C233).

Figure 2-10. Repair of Voids in Metal Surfaced Bonded Panels (Sheet 2 of 2)

(10) Remove electrical harness, clamps and clips from service deck.

(11) Remove rivets securing deck to main beams and lateral bulkheads. Use caution when removing rivets to prevent damage to fuselage or elongation of rivet holes. Remove service deck.

NOTE

Firewall is loosened to permit access to rivets and to allow removal of deck. Slide firewall fore and aft or lift as necessary.

(12) If a new service deck is not to be installed immediately, fabricate a holding fixture or strap, to be installed in place of service deck as follows:

(a) Fabricate a strap of aluminum alloy approximately 1/8 inch thick, length sufficient to pick up rivet holes on outboard and inboard sides at approximately station 190.00 and wide enough to pick up two fasteners at each end.

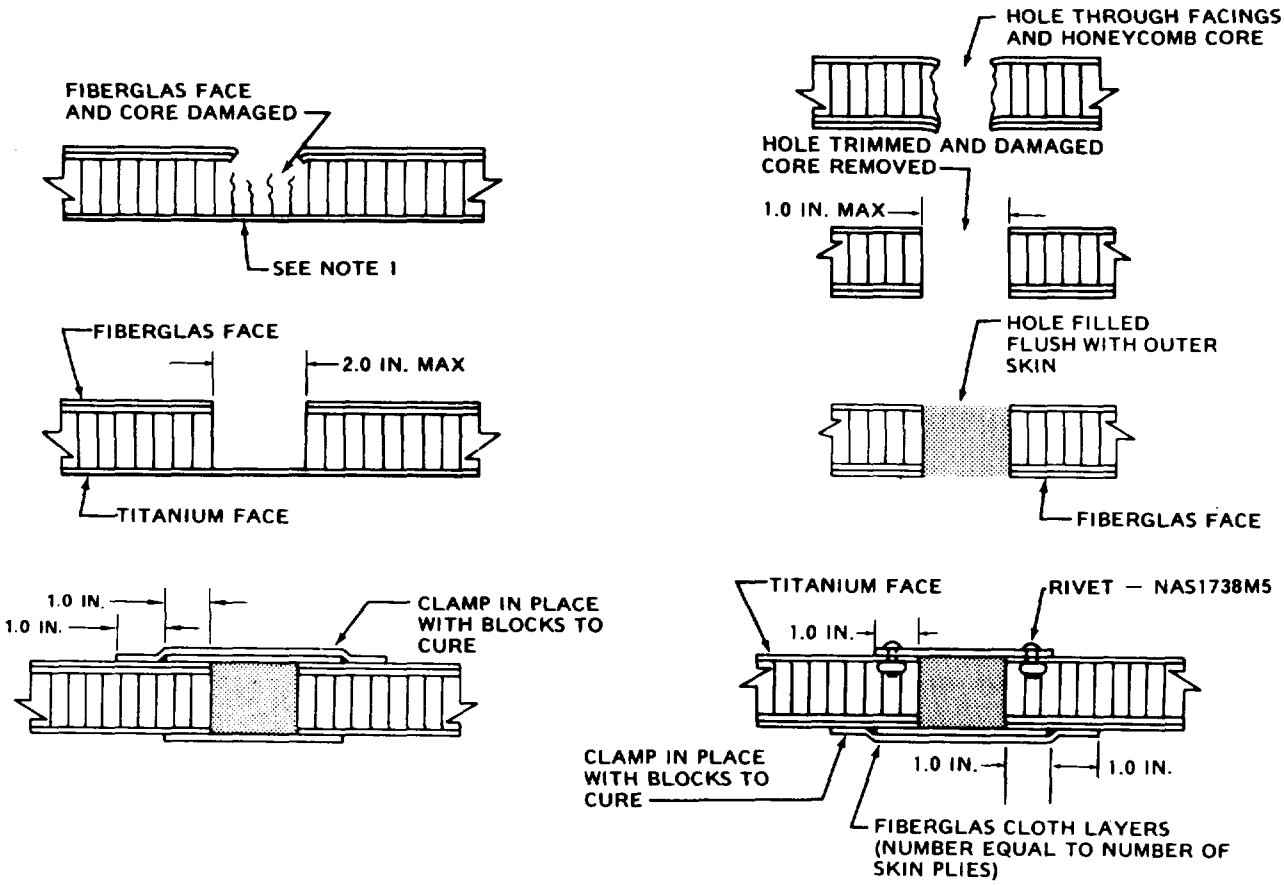
(b) Install fixture or strap on helicopter by back-drilling holes in ends of straps through existing rivet holes and using 1/8 steel screws and nuts to secure.

(c) Holding fixture should remain installed until new service deck is ready for installation. Place sign in area to prevent personnel from climbing on fuselage at location of repair.

(13) Position service deck on main beams and lateral bulkheads. Hold or clamp tightly in place and back-drill existing rivet holes, fastening deck with cleco fasteners or equivalent, as drill progresses.

(14) Check all screw and bolt holes for alignment. Install service deck using rivets as indicated in Figure 2-13. Omit rivets on edge of deck where turnlock receptacle is located.

(15) Position aft firewall on service deck and install previously removed shims under the forward and aft brace legs.



NOTE 1

If the titanium face has been damaged, the damage after clean-up shall not exceed the limits of repairable damage for titanium facing. Repair in accordance with titanium face repair procedures.

NOTE 2

If water or corrosion is found in the honeycomb, the entire panel must be replaced.

FIBERGLASS AND METAL FACED HONEYCOMB PANELS-STRUCTURAL

DESCRIPTION OF DAMAGE

FIBERGLASS FACE	TITANIUM FACE
Damage penetrating one or both facings and extending into core. The following limits apply only to fiberglass facings and core damage associated with it.	Damage penetrating titanium facing greater than 0.50 inch diameter, and damage extending completely or partially through panel.

Figure 2-11. Honeycomb Panel — Repair of Damage Penetrating Titanium and Fiberglass Facings and Core (Sheet 1 of 2)

LIMITS – REPAIRABLE DAMAGE

FIBERGLASS FACE

1. Maximum damaged area after cleanup: Total of 3.0 square inches. Applies whether a single area of combination of separate areas.
2. Maximum length of damage: 2.0 inches in any direction.
3. Maximum diameter of cleanup hole 2,0 inches.
4. Minimum distance of completed repair from an edge bevel: 1.0 inches.
5. Minimum distance between adjacent repairs 2.0 inches (distance measured from edge of patch). Maximum of one repair per bay. Minimum distance from edge patch, fitting, insert, hard point, or control mounting surface is 2.0 inches.

TITANIUM FACE

1. Maximum diameter of any hole after cleanup is 1.0 inch.
2. Only one 1.0 inch hole is permitted per bay, except in critical edge areas,
3. Minimum distance from existing repair is 2.0 inches.
4. Minimum distance from an edge bevel is 1.0 inch.
5. Minimum distance between adjacent repairs 3.0 inches (distance measurad from edge of patch). Minimum distance between edge of patch, fitting, hard point, or insert is 3.0 inches.

REPAIR PROCEDURES

WARNING

Cleaning materials are flammable and toxic. Avoid akin contact and breathing of solvent vapors.

FIBERGLASS FACE

1. Clean up damage with counterbore or hole cutter. If damage is limited to one side of panel, counterbore only deep enough for proper cleanup.
2. Pack hole with adhesive (C29). Allow to cure and lightly sand with abrasive peals (C11), or No. 400 grit abrasiva paper (C233), to smooth surface. Clean with Methyl-Ethyl-Ketone (C177) and wipe dry.
3. Cut fiberglass plies from 181 weave. specification MIL-C-9084. as necessary to equal the number plies in the area being repaired. Each ply shall be of sufficient size to overlap the ply being covered by 1.0 inch in all directions. Saturate all plies with adhesive (C26).
4. While still wet, position fiberglass plies over repair area, as shown above.
5. Cover repair area with cellophane (C56), or P.V.F. Tedlar No. 40S (C56). Press down to smooth and allow to cure.
6. Remove cellophane or Tedlar after curing and sand lightly, if necessary, with abrasive pad (C11) or No. 400 grit paper (C233).
7. Apply two coats of paint of color to match original finish.

TITANIUM FACE

1. Clean up damage with counterbore or hole cutter. If damage is limited to one side of panel, counterbore only deep enough for proper cleanup.
2. Pack hole with adhesive (C29). Allow to curs and lightly sand with abrasive pad (Cl 1), or No. 400 grit abrasive paper (C233) to smooth surface. Clean with Methyl-Ethyl-Ketone (C177) and wipe dry.
3. Cut patch from stainless steel or titanium sheet.
4. Bevel the edges of patch.
5. Clean all surfaces with Methyl-Ethyl-Ketone. (C177).
6. Lay out rivet pattern (space rivets to a minimum of 40 or equivalent spacing of adjacent edge attachments) and position patch in place and drill. Deburr all holes.
7. Apply adhesive (C29) to patch and position patch in place and rivet patch to panel at predrilled location using NAS1738M5 rivets.
8. Apply two coats of paint of color to match original finish.

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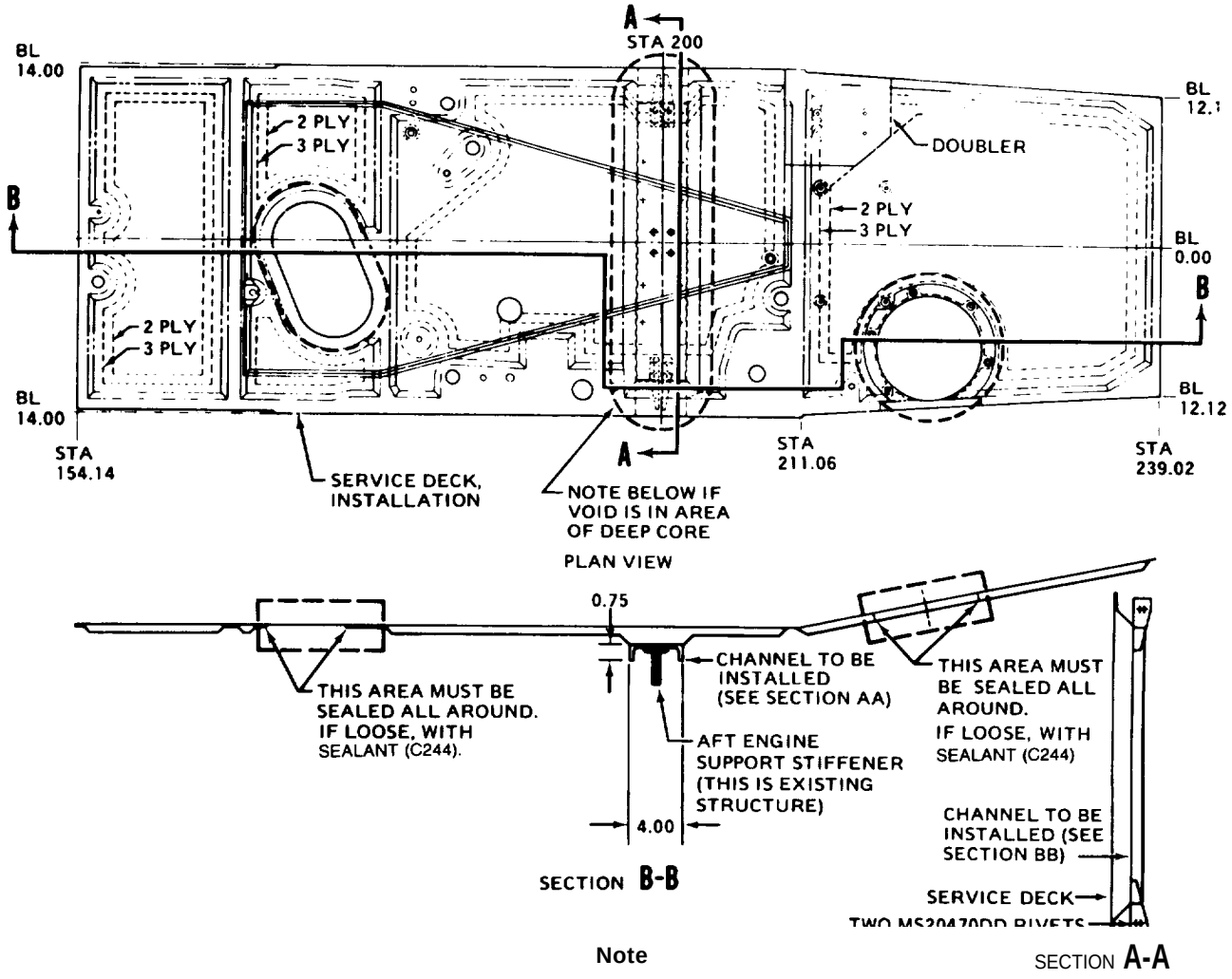
Figure 2-11. Honeycomb Panel — Repair of Damage Penetrating Titanium and Fiberglass Facings and Core (Sheet 2 of 2)



Note

1. The area around the hole in the canted deck and the area around the fuel cell access panel must be sealed all around. If voids are present, seal with (C244). See Section B-B and Plan view.
2. If bonding separation occurs in the area of the engine mount fittings at Station 200, repair as follows:
   a. Fabricate a channel for installation between service deck and aft engine support stiffeners. Make the channel from aluminum alloy sheet 0.025 inch thick, 2024-T3 Alclad, QQ-A-250/5. Make the channel web 4 inches wide with 0.75 flanges on 0.12 inch bend radius as shown in side view. Make channel approximately 25 inches in length to extend from the lower beveled edge on one side of the service deck to the same location on the opposite side as illustrated in Section A-A.
   b. Remove aft engine support stiffeners. There are four stiffeners located under the aft engine mount fittings. There are two screws and two rivets holding each stiffener.
   c. Drill holes in channel to match holes for aft engine support stiffeners (four holes at each end). Drill holes at approximate center of channel to prevent interference with existing holes or nutplates at this location. Deburr holes and apply two coats of unreduced zinc chromate primer (C312).
   d. Position channel next to service deck with flanges down as illustrated in Section B-B, Install four aft engine support stiffeners with two screws for each stiffener. Install two rivets at end of each support stiffener (see Section A-A).

205031-1002B

Figure 2-12. Center Service Deck Panel Repair

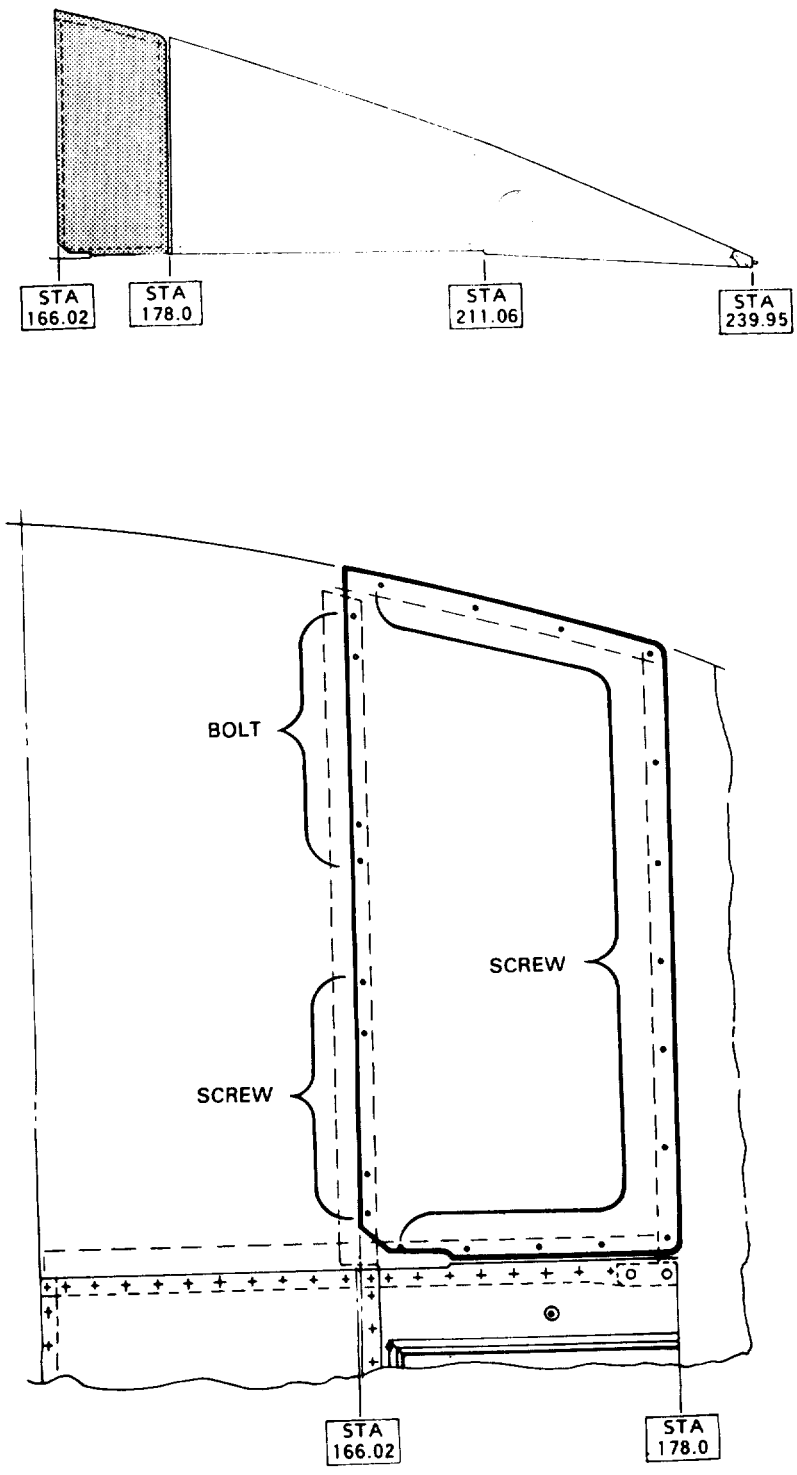


Figure 2-13. Right and Left Service Deck (Sheet 1 of 3)

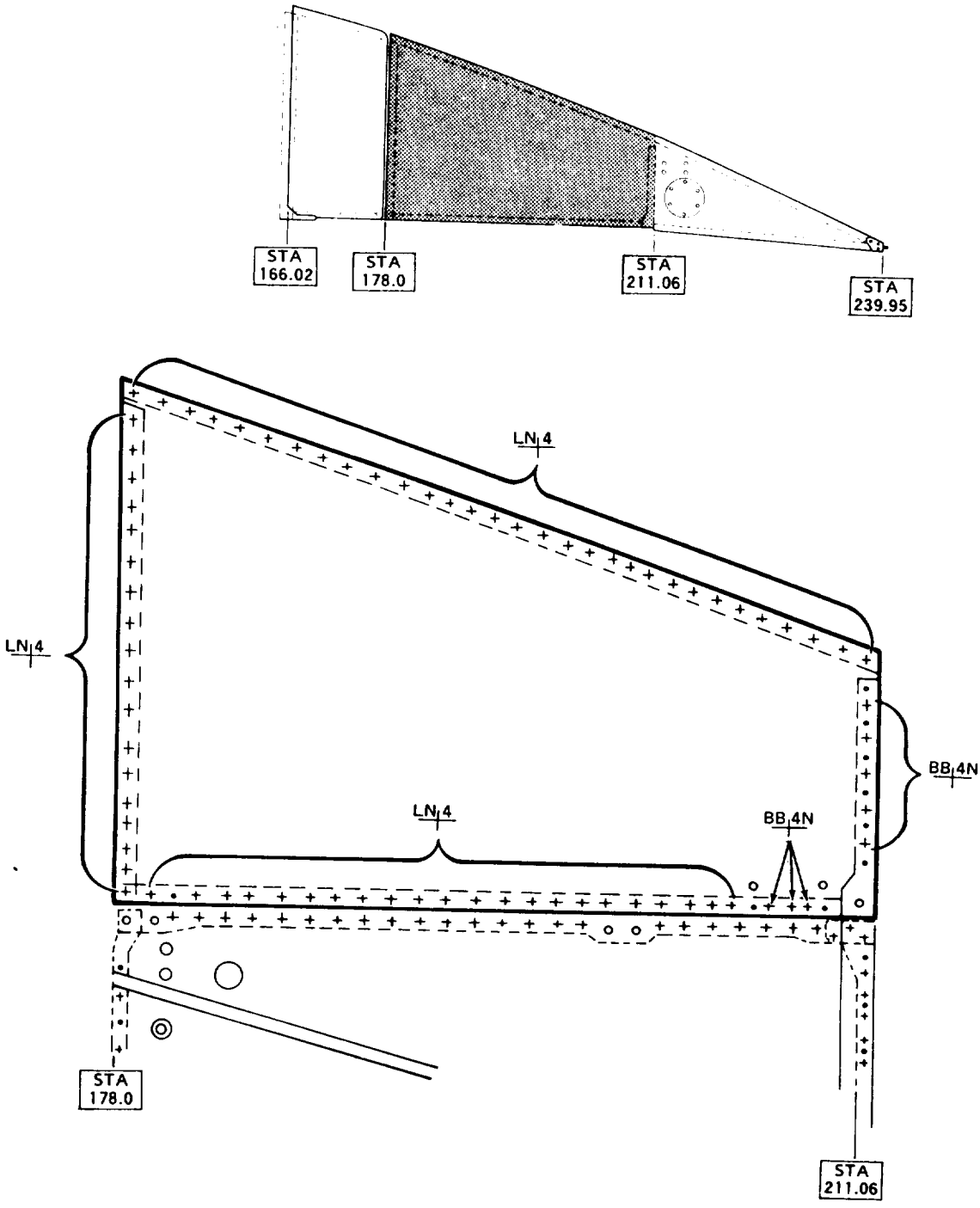


Figure 2-13. Right and Left Service Deck (Sheet 2 of 3)

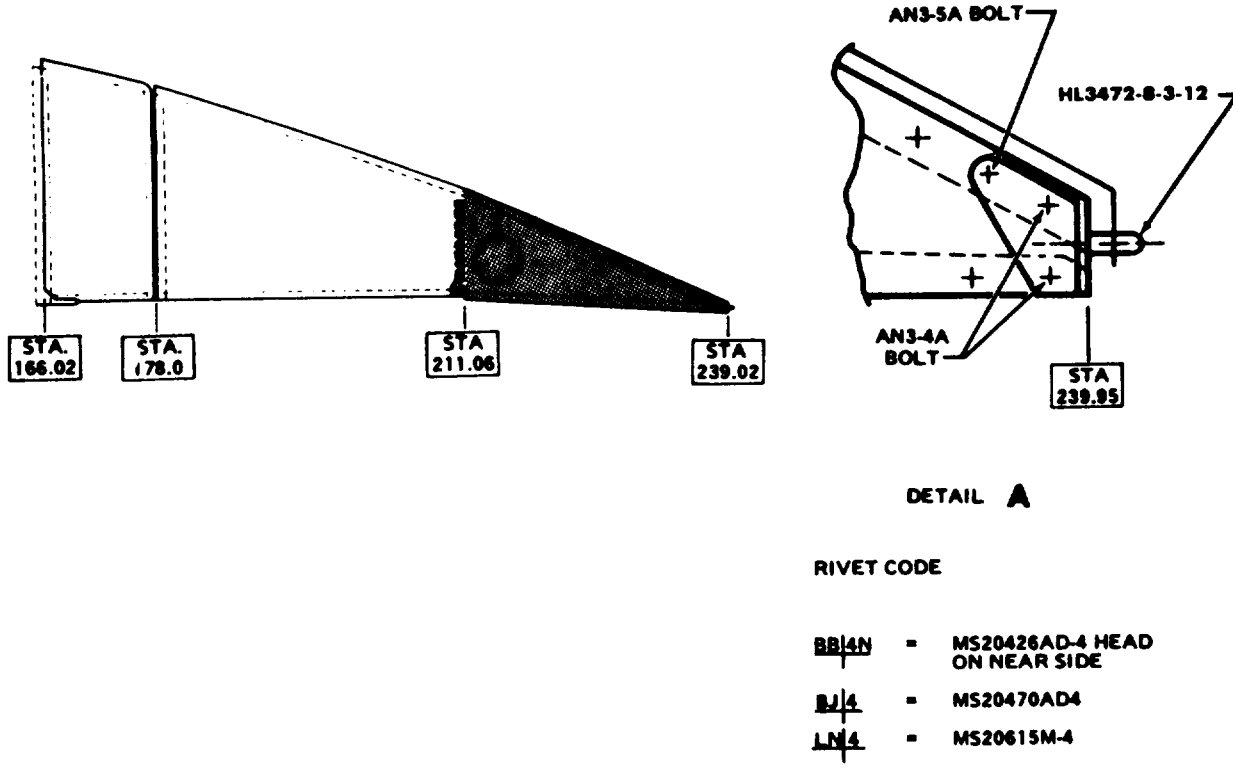
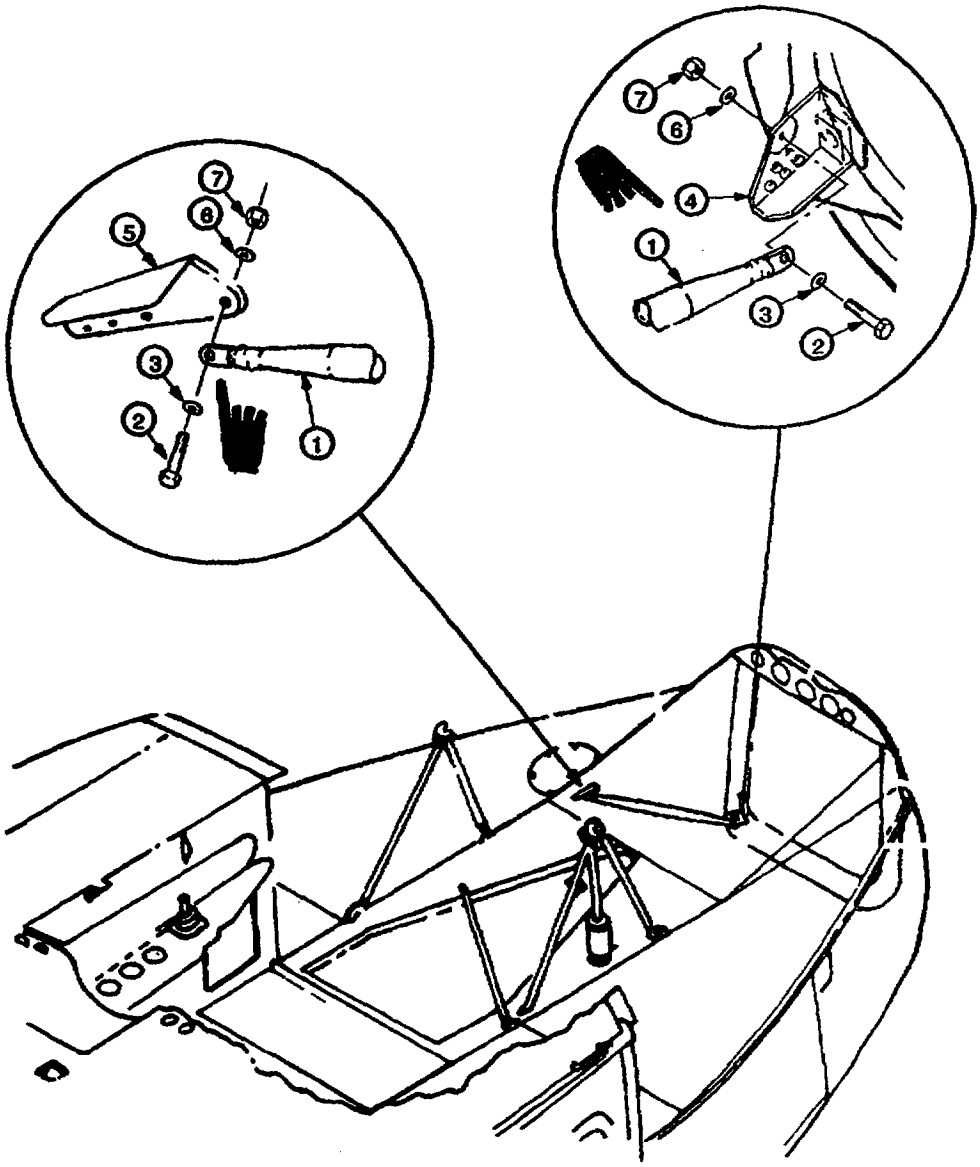


Figure 2-13. Right and Left Service Deck (Sheet 3 of 3)



NOTE: STRUCTURAL TUBE MUST BE INSTALLED IN AIRCRAFT BEFORE JACKING. TOWING, HOISTING, GROUND RUN OR FLIGHT.

1. TUBE
2. BOLT
3. WASHER
4. FITTING
5. FITTING
6. WASHER
7. NUT

Figure 2-13.1. Aft Fuselage Structural Tube

(16) Install screws through firewall lower flange and through fore and aft legs. Install all screws prior to tightening.

(17) Install bracket with dowel σ shear pin and three bolts at the aft outboard corner of the service deck and the forward fuselage aft bulkhead. Install two bolts from inside track, heads down (figure 2-13, Detail A, Sheet 3).

(18) Install turnlock receptacle bracket or angle (lower cowl) on edge of service deck using MS20470AD4 or NAS1738B-4 rivets.

(19) Secure upper aft firewall to lower aft firewall.

(20) Secure tail rotor driveshaft clamp retaining coupling to forward driveshaft. Install screws securing tail rotor driveshaft fireshield to lower aft firewall. Tighten clamp securing driveshaft boot.

(21) Install electrical harness, clips and clamp to service deck.

(22) Install tail pipe and V-band clamp.

(23) Install tail pipe fairing, engine cowl, lower left or right fairings. Install compartment doors below engine deck level, left or right side.

(24) Close cowl and remove tailboom support.

f. Replace fuel cell cover as follows:

(1) Remove screws and bolts retaining fuel cell cover to airframe.

(2) Separate fuel cell cover from sealant around edges of cover. Remove cover.

(3) Apply coat of sealant (41) to edges of fuel cell cover and fuel opening on aircraft. Position cover on airframe and install with previously removed screws and bolts.

2-19.1. AFT FUSEL AGE STRUCTURAL TUBE.

2-19.2. Removal - Aft Fuselage Structural Tube.

a. Gain access to structural tube (1, figure 2-13.1) through oil cooler/aft battery compartment door.

b. Remove nut (7), washer (6), bolt (2), and washer (3) from each end of the tube (1), slide-tube ends off of fittings (4 and 5) and remove tube.

2-19.3. Inspection - Aft Fuselage Structural Tube.

a. Inspect tube (1) for dents, cracks, bends, corrosion, nicks, and scratches (table 2-4.1). If crack in aft fuselage structural tube is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 Helicopter Series.

b. Inspect end fittings (4 and 5) for loose rivets and elongated holes.

NOTE

If elongation is greater than 0.030 inch, drill out to next larger size. Maximum permissible bolt size will not exceed 0.375 inch diameter.

2-19.4. Replacement - Aft Fuselage Structural Tube.

a. Replace tube (1) if it is bent or cracked.

b. Replace tube (1) if dents, nicks, scratches, or corrosion exceed the limits of table 2-4.

2-19.5. Installation - Aft Fuselage Structural Tube.

a. Insert tube (1) through access hole and slide tube ends on fittings (4 and 5).

b. Align holes, and install bolt (2), washer (3), washer (6), and nut (7) through each end of tube (1). Torque nuts (7).

2-20. SHEETMETAL SKINS.

2-21. Description – Sheetmetal Skins. The external skins of the forward and aft sections consist of formed aluminum alloy or magnesium skins and aluminum alloy faced honeycomb panels (figures 2-4 and 2-5).

2-22. Classification of Damage – Sheetmetal Skins. Refer to table 2-5 for honeycomb panels, table 2-6 for forward fuselage skins and table 2-7 for tail boom skins.

NOTE

Repair at (AVUM) Aviation Unit Maintenance is limited to minor repair of sheetmetal cracks, scratches, corrosion, loose or missing hardware. If any extensive damage occurs or major repair is required, then these repairs shall be accomplished by (AVIM) Intermediate Level of Maintenance. If major damage occurs requiring jigs and fixtures to repair, then these repairs shell be accomplished by depot level maintenance.

2-23. Repair – Sheetmetal Skins (AVIM) Repair acceptable damage to external skins as follows:

a. Polish out acceptable nicks, scratches, and corrosion classified as negligible in table 2-6. Treat corroded areas in accordance with paragraph 2-14 and table 2-4. Refinish area to match surrounding finish.

b. Repair mechanical and corrosion damage that is within repairable limits. See figures 2-14 through 2-17 for typical repair illustrations. Provide dissimilar metal protection in all areas as required.

c. Refer to TM 55-1500-204-25/1 for additional standard repairs and fastener replacement.

d. Refinish repaired areas and replace any decals or stencils removed in accordance with TM 55-1500-345-23.

TABLE 2-6A

Honeycomb Panels Requiring Jigs or Fixtures or Application of Special Precautions to Maintain Dimensions During Removal'installation

Procedures

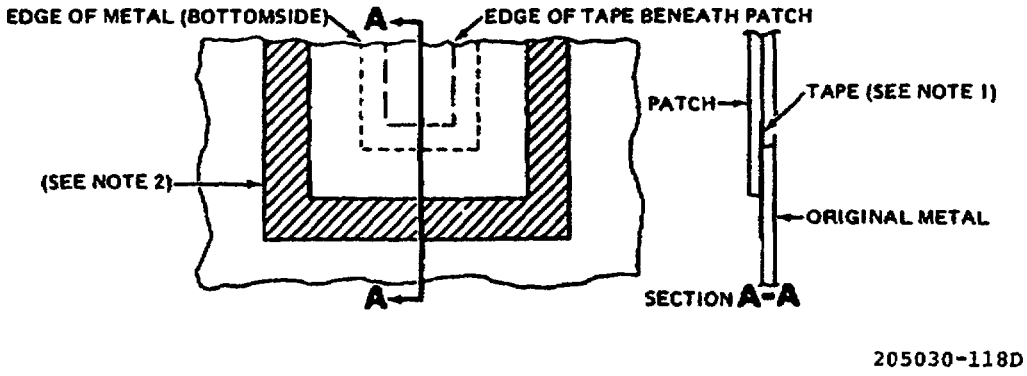
For Depot Repair Only	
Panels Requiring Jig	
P/N 205-030-008-3AFF-1-1D For Replacement	
Part Number	**Nomenclature**
205-030-169-243	R H Main Beam
205-030-169-387	L H Main Beam
20503020031	Bulkhead, F S 155
205-030-403-27	Bulkhead, F S 173
205-330407-285	R H Bulkhead, F S 166
205-030-407-286	L H Bulkhead F S 166
For Depot Repair Only	
Panels Requiring Special Precautions	
Part Number	**Nomenclature**
205-030-209-19	L H Outboard Lower Fuel Cell Panel
205-030-209-30	R H Outboard Lower Fuel Cell Panel
205.030-228-45	R H Lower Fuel Cell BL 14
205-030-228115	R H Lower Fuel Cell BL 14
205-030-229-53	L H Lower Fuel Cell BL 14
205-030229-139	L H Lower FueI Cell BL 14
205-030-407-27	L H Upper Bulkhead, FS 166
205-030-407-301	L H Upper Bulkhead, FS 166
205-030-407-329	R H Upper Bulkhead FS 166
205-031-179-1	L H Lower Fuel Cell Bulkhead Aft
205031-179-51	L H Lower Fuel Cell Bulkhead Aft
205-031-179-2	R H Lower Fuel Cell Bulkhead Aft
205-031-17952	R H Lower Fuel Cell Bulkhead Aft
205-031-197-53	Center Service Deck
205-031-197-139	Center Service Deck

Table 2-6. Classification of Damage — Sheetmetal Skins Forward Fuselage

DEFECT	NEGLIGIBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
Damaged, loose, missing, sheared, or improperly installed fasteners.		Replace as required.	
a. Dents	a. Smooth contoured dents, free of cracks or gouges. Depth and diameter not to exceed: Depth — Diameter **1/64 in.** — **1.0 in.** **3/64 in.** — **2.0 in.** **1/64 in.** — **3.0 in.** Nicks and scratches in a dent not to exceed **10** percent. of material thickness after polishing. Dents shall come no closer than **1.0** inch to internal structure and have a minimum of **3.0** inches of undamaged material between dents. NOTE: Dents closer than **1.0** inch are classed as one dent.	a. Damage exceeds negligible limits but does not exceed **25** percent of total area for a single skin panel (including prior repairs), Damage is **6.0** inches minimum from a similar repair and comes no closer than **2.0** inches to supporting structure.	a. Damage exceeds repairable limits between any two bulkheads. Damage and subsequent repair interferes with supporting structure.
b. Corrosion	b. Not to exceed **10** percent of material thickness and less than **4.0** square inches after cleanup. Damage **1.0** inch minimum from internal structure.	b. Damage exceeds negligible limits Cleanup shall not exceed **5** percent of skin panel area and come no closer than **2.0** inch to supporting structure.	b. Damage exceeds repairable damage limits.

Table 2-6. Classification of Damage — Sheetmetal Skins Forward Fuselage (Cont)

DEFECT	NEGLIGIBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
c. Holes, cracks or tears.	c. None.	c. Cracks or tears no longer than 25 Percent of shortest skin dimension, Holes 3.0 inch max. dia. Cleanup no closer than 2.0 inch to supporting structure and affect no more than 5 percent of skin area.	c. Damage exceeds repairable limits.
d. Nicks and scratches.	d. No deeper than 10 Percent of material thickness and less than 4.0 square inches after cleanup.	d. Same as preceding step c.	d. Damage exceeds repairable limits.
e. Trapped or stretched skin,	e. Inward or out. ward bulges located in a sectional area, that can be corrected by removing attach- ing hardware, allow- ing skin to shift. Mismatch of rivet holes shall not exceed that which can be cleaned up by drill- ing and installing one size larger rivet and maintain proper rivet edge distance. However, if condition does not disappear after unloading panel, area is stretched or oil canned and must be replaced or repaired. Oil canning or stretched condition can be determined by pressing in on a sectional area and that section remains depressed and a bulge appears in that section or adjacent structure.	e. Creased dents not Classified as oil can or stretched skin, not exceeding **25%** of a sectional area and no closer than **1.0** inch to a supporting structure. oil can condition, free of sharp dents or creases and not extending over or into supporting strcture may be repaired by inserting a backup stiffener over the damaged area.	e. Stretched skin, oil cans, or creased dents that cannot be repaired by un- loading, insertion repair or back Up stiffeners.



NOTE

1. **Apply tape (C281) between dissimilar metal joints to extend at least 1/4 inch past metal joint.**

2. **In moisture traps:**
   a. **The tape shall extend sufficiently past the joints to prevent bridging by water.**
   b. **Drain holes shall be provided wherever necessary subject to approval.**

Figure 2-14. Dissimilar Metal Corrosion Protection

2-24. ACCESS COVERS AND DOORS.

2-25. Description - Access Covers and Doors. Removable access covers and doors are provided for inspection, replacement of parts, servicing and adjustment of parts. Screws are used to secure removable panels in stressed areas. Panels in stressed areas are identified in figure 2-18, sheet 3, with an asterisk and shall be installed prior to towing, jacking or flight.

NOTE

All fasteners shall be installed in stressed area panel before moving aircraft. Nonstructural panels may have every third fastener removed.

2-26. Inspection - Access Covers and Doors. Inspect access doors and covers as follows:

a. Smooth contoured dents, free from cracks and do not affect function of part are acceptable.

b. Missing or damaged fasteners.

c. Cracks or tears no longer than **25** percent of shortest cover dimension are repairable. If crack in access cover or door is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

d. Corrosion damage not exceeding **10** percent of material thickness and less than **4.0** square inches after cleanup is acceptable.

2-27. Repair or Replacement - Access Covers and Doors. Repair access covers and doors as follows:

a. Replace damaged, loose, or missing fasteners in accordance with TM 1-1500-204-23 series.

b. Repair cracks, holes, tears in accordance with TM 1-1500-204-23 series.

c. Remove and treat corrosion in accordance with table 2-4.

d. Replace any cover or door if damage is extensive or repair will affect function of door or cover.

e. Paint repaired areas and replace any decals or stencils in accordance with TM 55-1500-345-23.

2-27.1. E REINFORCED FLOOR MOUNTING PLATES AND BASE ASSEMBLY.

2-27.2. Deleted.

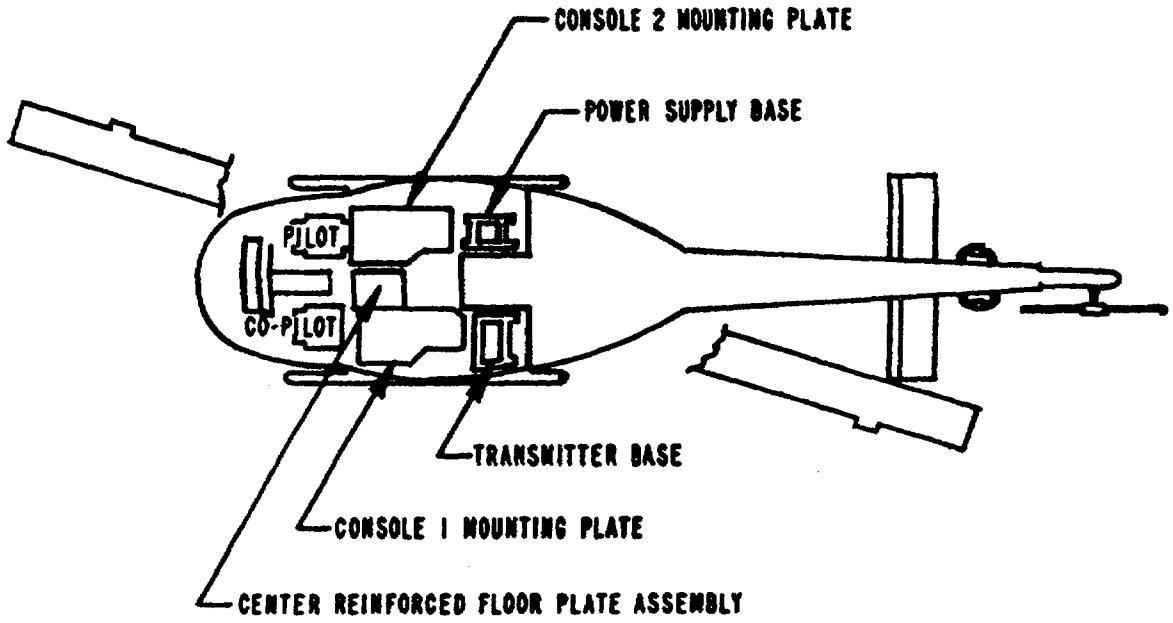


Figure 2-14.2. EB *Reinforced Mounting Plates and Base Assembly Location Diagram*

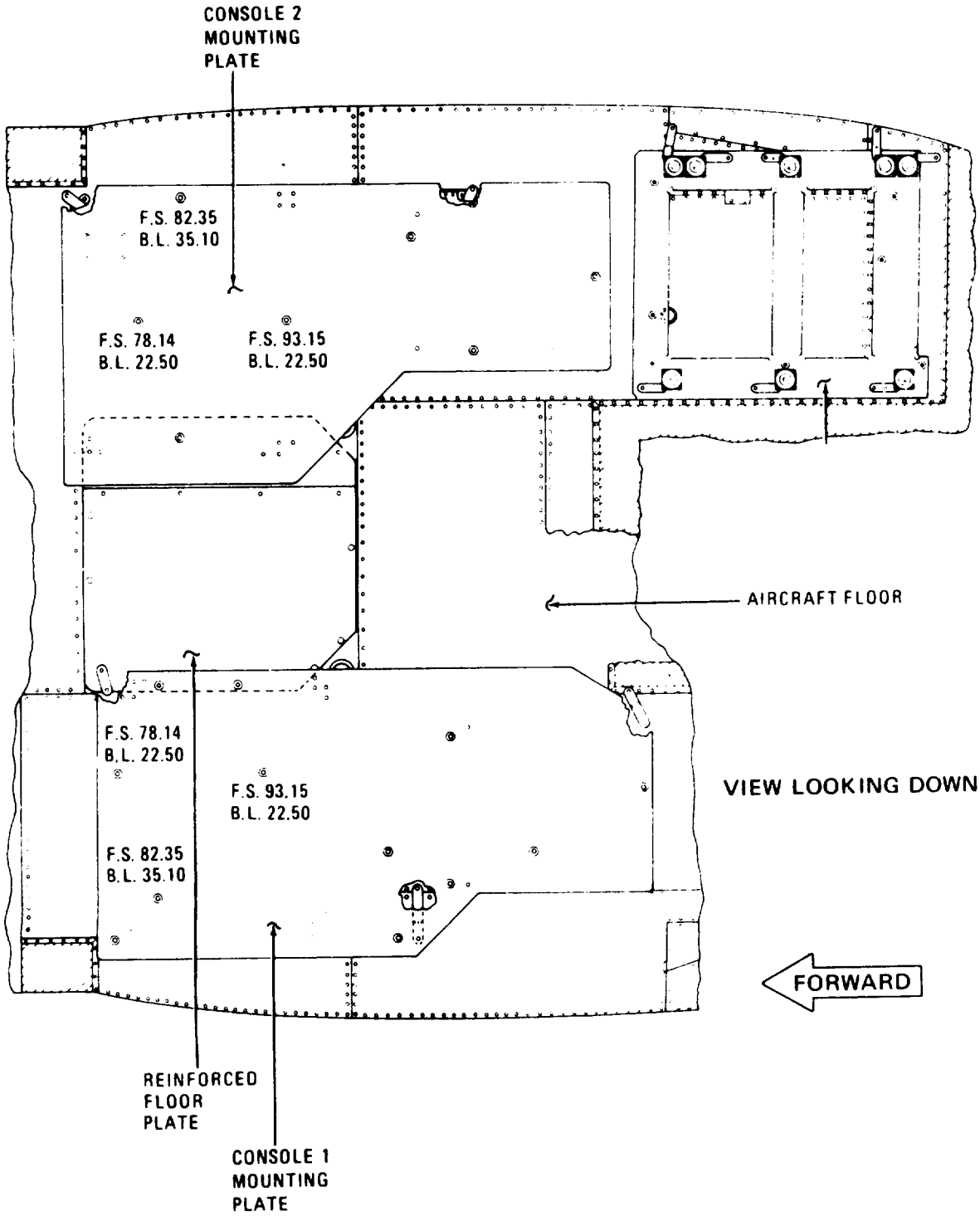


Figure 2-14.3. E Reinforced Mounting Plates and BaseAssembly

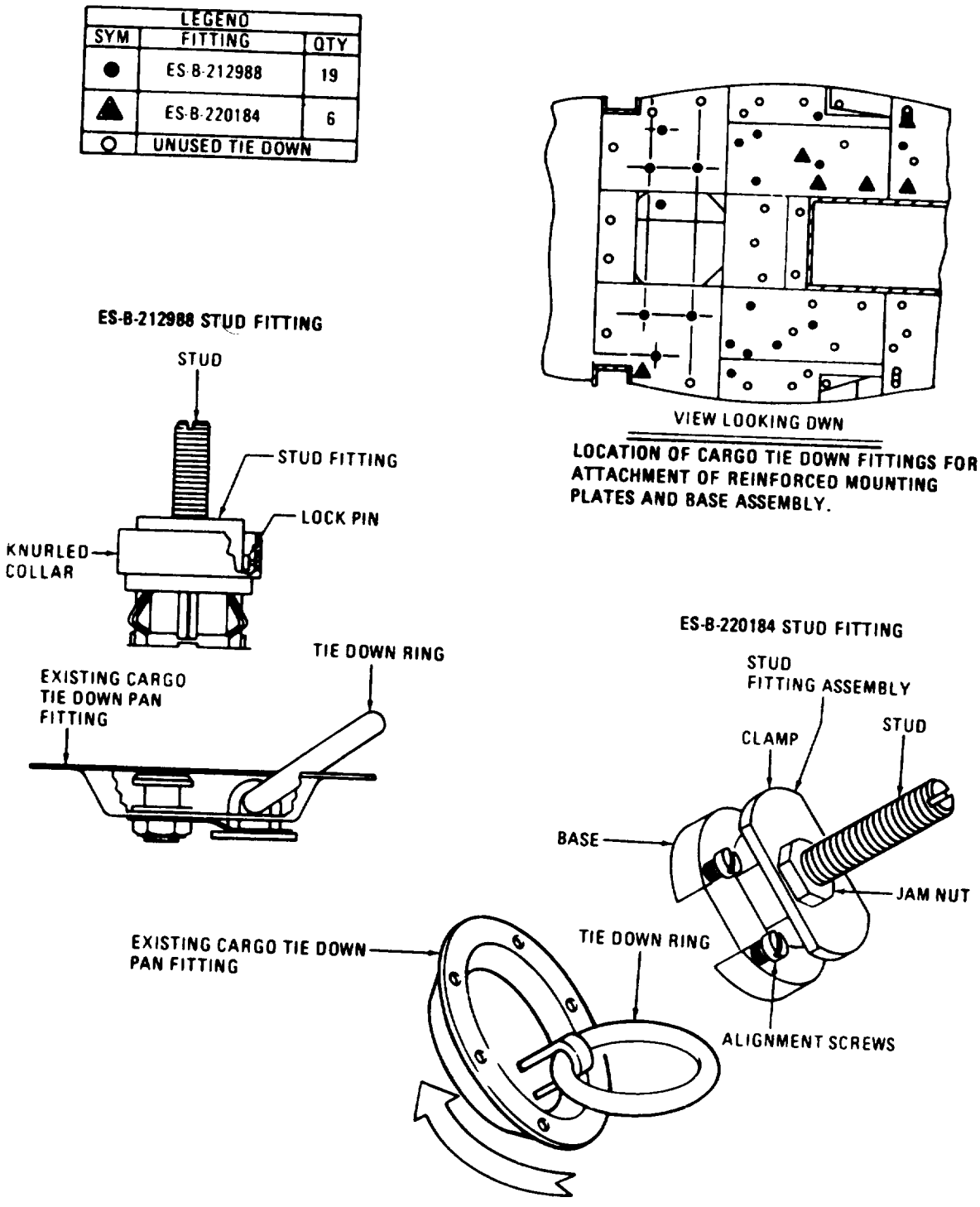


Figure 2-14.4. E Stud Fitting Type and Location Diagram

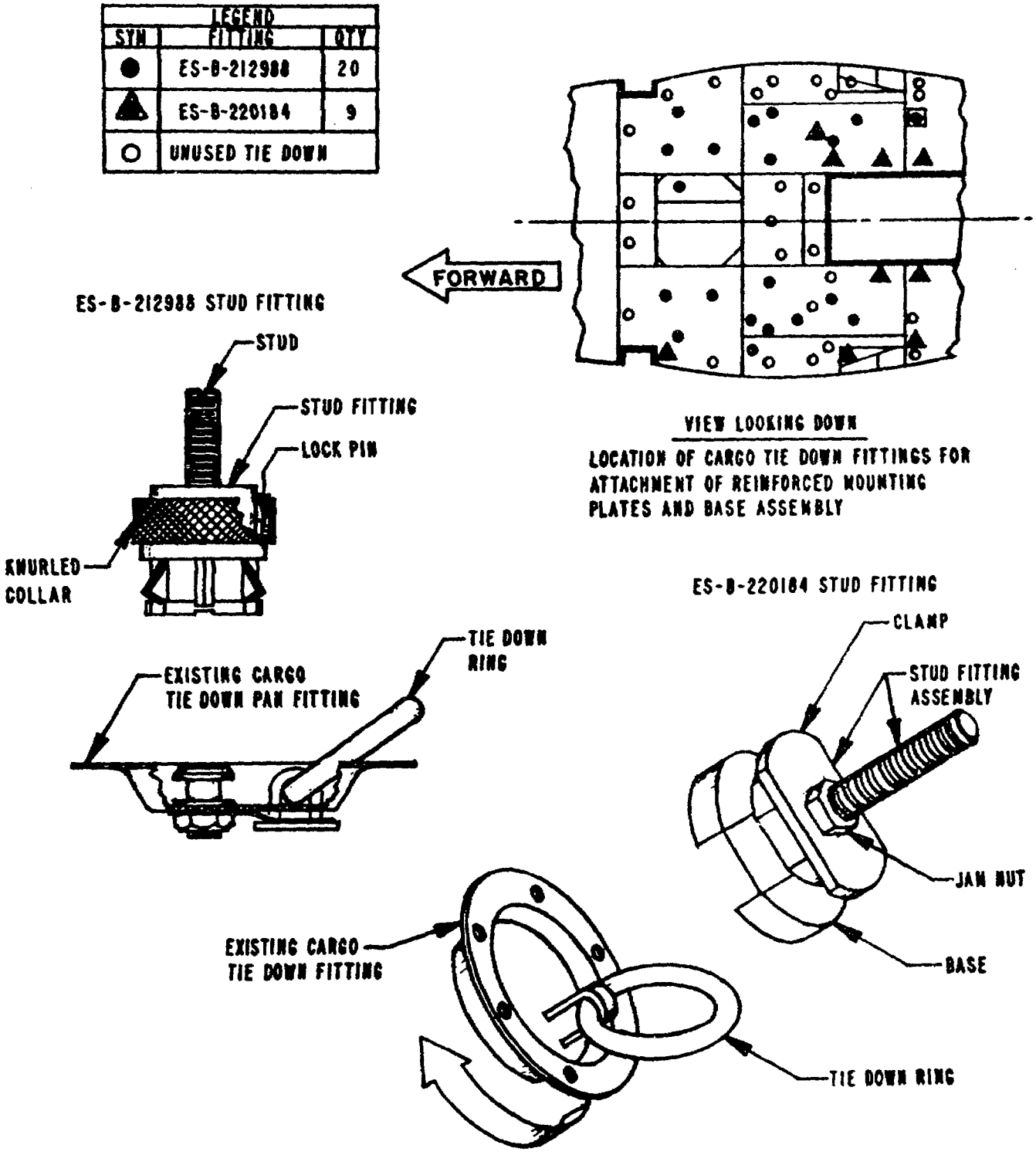


Figure 2-14.5. **EB** *Stud Fitting Type and Location Diagram*

2-27.2.1. EB Description - Reinforced Floor Mounting Plates and Bases Assemblies (figure 2-14.2). The reinforced floor mounting plates are used to support the mission equipment and operators seats for position 1 and 2 for the AN/ARQ-33A EB Radio Countermeasures System. A two piece reinforced floor plate to replace door assembly (P/N 205-031-324-5) is installed in the EH-1 H. These reinforced floor plates may be removed with the left and right floor mounting plates installed for maintenance below the floor. The mounting base assemblies are located in the rear cargo area alcoves and are used to support the AN/TLQ-17A power supply and transmitter.

2-27.3. Removal - Reinforced Mounting Plates and Base Assembly. a. Remove mission operator seat assemblies (paragraph 2-252.3).

b. Deleted.

c. Remove position 1 and 2 console and base assemblies.

d. Remove nuts and washers which secure the mounting plates and base to the helicopter floor.

e. Lift the mounting plates and base off the studs and remove from the helicopter.

NOTE

Use care in removing mounting plates and base so as not to damage threads or disturb alignment of stud fittings.

2-27.4. Inspection - Reinforced Mounting Plates and Base Assembly. a. Inspect for dents or cracks on upper and lower surface. If crack is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

b. Inspect support assemblies, tubes and gussets for loose rivets.

c. Inspect entire assembly for corrosion.

2-27.5. Repair or Replacement - Reinforced Mounting Plates and Base Assembly. Repair plates, base and support assemblies in accordance with TM 55-1500-204-25/1.

2-27.6. Painting - Reinforced Mounting Plates and Base Assembly. Refer to TM 55-1500-345-23 for painting instructions.

2-27.7. Installation - Reinforced Mounting Plates and Base Assembly. a. Position mounting plate/base assembly directly over studs and carefully lower it so all studs protrude through their holes.

b. Install nuts and washers on studs and tighten nuts.

c. Deleted.

d. Install position 1 and 2 console and base assemblies.

e. Install mission operator seat assemblies (paragraph 2-252.8).

2-27.8. MOUNTING PLATE AND BASE STUD ASSEMBLIES. E EB

2-27.9. Description - Mounting Plate and Base Stud Assemblies. Two types of stud fittings are used to secure the reinforced mounting plates and console base assembly to the helicopter cabin floor. Stud fitting (P/N ES-B-212988) is used where cargo tie down pan fittings include the locking stud as well as the tie down ring. Stud fitting assembly (P/N ES-B-220184) is used at tie down pan fittings which have no locking stud.

2-27.10. Removal - Mounting Plate and Base Stud Assemblies. a. Stud fitting (P/N ES-B-212988) is removed by pressing the lock pin and raising the knurled collar, then lift off the stud fitting.

b. Stud fitting assembly (P/N ES-B-220184) is removed by the following steps.

(1) Loosen jam nut and remove stud from the base of the assembly.

(2) Remove clamp.

(3) Raise tie down ring and remove base.

2-27.11. Inspection - Mounting Plate and Base Plate Assemblies. a. Inspect both type stud fittings for cracks, corrosion, burred or stripped threads. If crack is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

b. Inspect stud fitting (P/N ES-B-212988) for proper operation of locking mechanism.

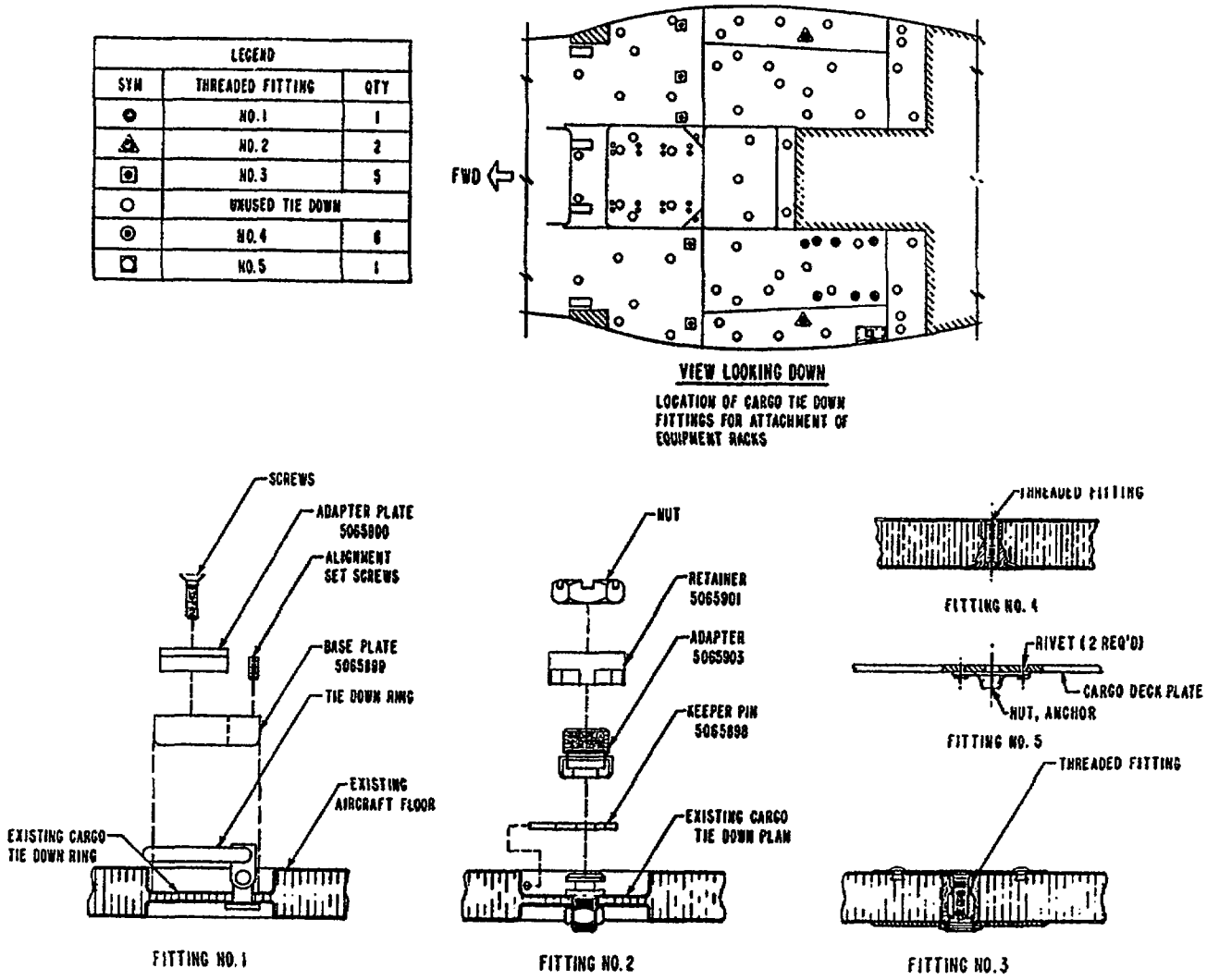


Figure 2-14.6. X FITTING TYPE AND LOCATION DIAGRAM

2-27.12. Repair and Replacement - Mounting Plate and Base Plate Assemblies. Stud fittings found defective will be replaced.

2-27.13. Installation - Mounting Plate and Base Plate Assemblies. a. See figure E 2-14.4 and EB 2-14.5 for proper location and stud fittings (P/N ES-B-212988 and P/N ES-B-220184).

b. Stud fittings (P/N ES-B-212988) are installed as follows:

(1) Press lock pin and raise knurled collar.

(2) Position stud fitting over locking stud in the tie down pan assembly and push knurled collar down to lock the stud fitting in place.

c. Stud fitting assemblies (P/N ES-B-220184) are installed as follows:

(1) Assemble the stud fitting over the tie down ring by inclosing ring with base and clamp.

(2) Tighten jam nut.

NOTE

Ensure that stud remains perpendicular to floor.

2-28. CABIN FLOOR PANELS.

2-29. Description - Cabin Floor Panels. The cabin floor (figure 2-19) consists of removable and fixed honeycomb panels. Fittings installed in the floor panels incorporate studs or tie-down rings or a combination of both. The tie-down fittings provide a means of securing cargo. The studs provide a mounting point for troop seats or litters. The EH-1 H is equipped with additional reinforced floor mounting plates which are bolted to the helicopter floor with stud fittings.

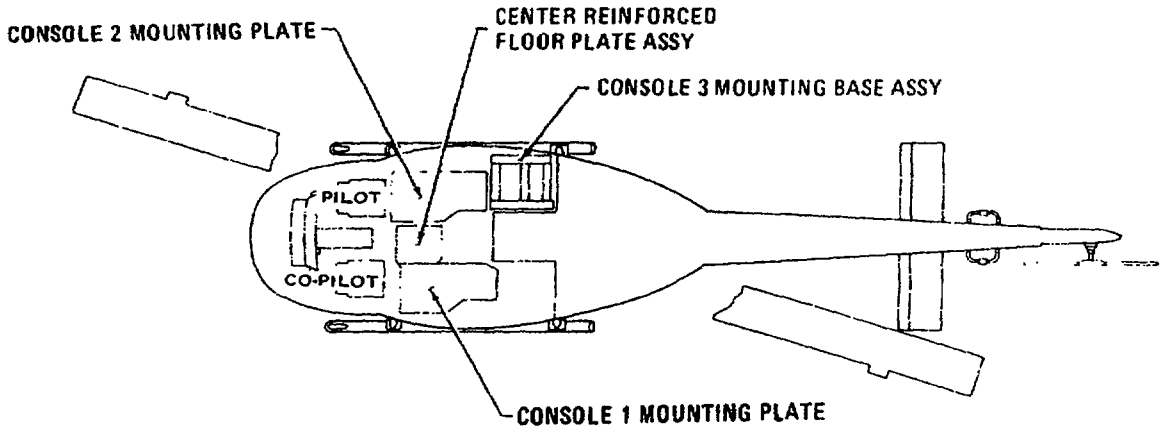


Figure 2-14.1. E Reinforced Mounting Plates and Base Assembly Location Diagram

2-30. Removal - Cabin Floor Panels.

a. Remove seats or other equipment, as necessary, to gain access to floor panel being removed.

b. Remove stud fittings and reinforce floor mounting plates.

WARNING

When removing panels (8 or 16, figure 2-19) with fuel in the aft tanks, the possibility of damaging the fuel cells under the aft portions of the floor exists due to swelling or bulging of the cells. Partially defuel if necessary to relieve pressure on forward fuel cells.

NOTE

The fixed cargo floor is considered part of the load distribution system of the UH-1 airframe. In general, jigging is not required. However, only one fixed panel at a time can be removed and replaced. The outboard floor panels between FS101 to 166 should not be removed unless the hardpoints at FS129 and 155 are unloaded. This requires removal of all externalstores and supporting structures. If replacement dictates removal of a multitude of fixed panels, remove and replace one at a time. All floor panels attached by screws maybe removed and replaced without special precautions. When entire cargo floor is removed, care must be exercised to avoid any action which would cause a shifting of the base airframe. All static load must be removed from airframe. This static load includes rotor, transmission, engine, and tailboom. When a floor panel is removed aircraft should rest on skids to minimize the floors torsional loading.

c. Remove panel attaching hardware and remove floor panel.

d. Remove aged sealant from mating surfaces of floor panel and cabin floor structure.

2-31. Inspection - Cabin Floor panels.

a. Inspect cabin floor honeycomb panels for damage (Table 2-5). If damage to the cabin floor panels is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

b. Inspect tie-down rings or studs for damage.

2-32. Repair - Cabin Floor Panels.

a. Repair cabin floor honeycomb panels (Paragraph 2-18).

b. Replace tie-down ring (28, figure 2-19) as follows:

(1) Remove cotter pin and remove pin (27) and ring (28).

(2) Remove pin (31) and washer (30).

(3) Place washer (30) on pin (31) and insert pin through floor panel.

(4) Attach ring (28) with pin (27). Secure with cotter pin (29).

(5) Apply sealant (C237) around head of pin (31).

c. Replace stud (34) as follows:

(1) Remove nut (32) and washer (33). Remove stud (34).

(2) Place stud (24) through floor panel and install washer (33) and nut (32).

(3) Apply sealant (C237) around nut (32).

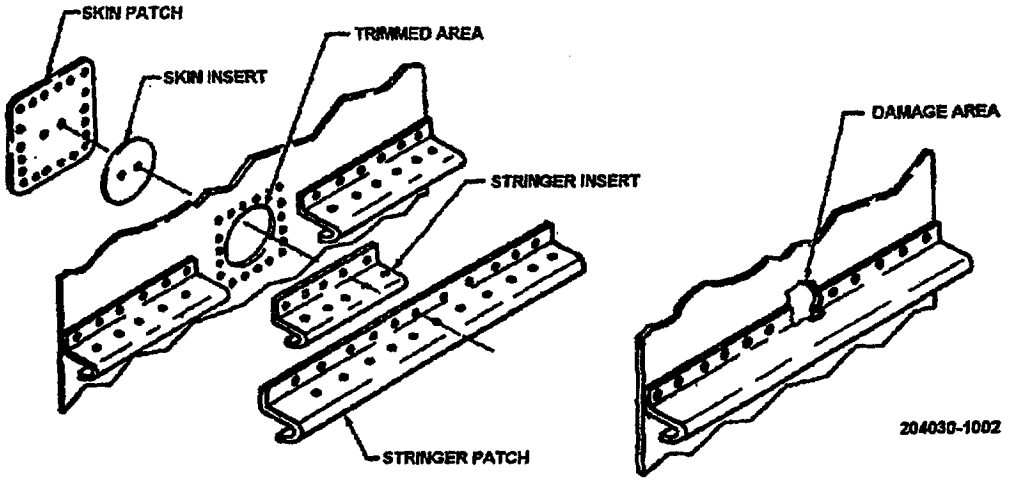
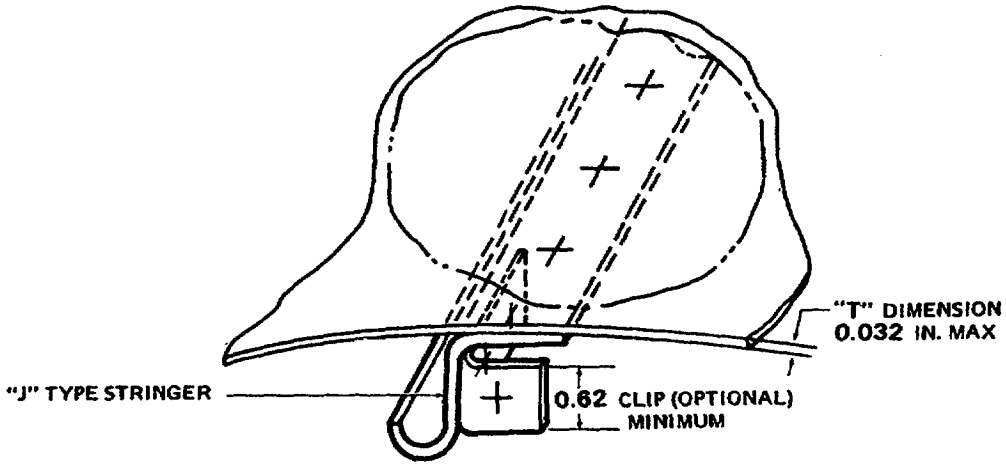


Figure 2-15. Combined Skin and Stringer Repair



OIL CAN REPAIR

APPLICATION A:

For components where excess metal exists between structure creating false contour or "Oil Can."

RESTRICTIONS A:

(1) Nonapplicable to skins that exceed 0.032 inch thick.
(2) Damage can not extend into stiffeners or other supporting structure.

REQUIRED A:

(1) "J" type stringer (Bell STD No. 120-021-32) or angle of like material grouping.
(2) Clip (optional) of like material grouping.
(3) Rivets compatible with material grouping and dissimilar metals. See procedure A (1) for diameter, spacing and edge distance.

PROCEDURE A:

(1) Attach "J" stringer or angle, using rivets same size and pitch as surrounding area. Rivet edge distance equal to two times the diameter of the rivet. Locate "J" stringer or angle through center of "Oil Can" area.
(2) Gauge of clips must be the same gauge as the "J" stringer or angle. Use of clips is restricted to application where adjacent structure permits use, and where clips are needed to secure added members, otherwise not necessary.
(3) Attach clips with three rivets as shown. Rivet size and spacing same as used to attach the "J" stringer.

Figure 2-16. Oil Can Repair in Skin

2-33. Installation - Cabin Floor Panels.

NOTE

An excess application of adhesive (C237) during installation will result in difficulty during removal of the floor panels.

a. Apply a small bead of sealant (C237) on the outermost edge of the floor panel lip immediately prior to installation.

NOTE

Some floor panels may not have mounting holes predrilled. The holes shall be drilled during installation.

b. Carefully lay floor panel in place and align holes in panel with holes in aircraft structure.

c. EH-1, install reinforced floor mounting plates using stud fittings.

d. Install attaching hardware.

e. Install equipment removed to gain access to panel.

2-34. Painting - Cabin Floor Panels. Refer to TM 551500-34523 for painting instructions.

2-35. COWLING AND FAIRINGS.

2-36. Description - Cowling and Fairings. Cowling and fairings are used to protect and provide easy maintenance access to engine compartment, intake and exhaust tailpipe areas, and top of main transmission.

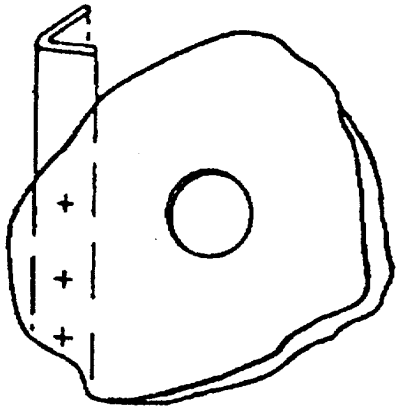
2-37. TRANSMISSION COWLING.

2-38. Description - Transmission Cowling. A one piece cowling (1, figure 2-20) over front and sides of transmission upper area, is secured by three latches and a hinge assembly. For access, the unlatched fairing can be swung forward to rest on cabin roof.

2-39. Removal -Transmission Cowling.

a. Disengage three latches and swing cowling to open position.

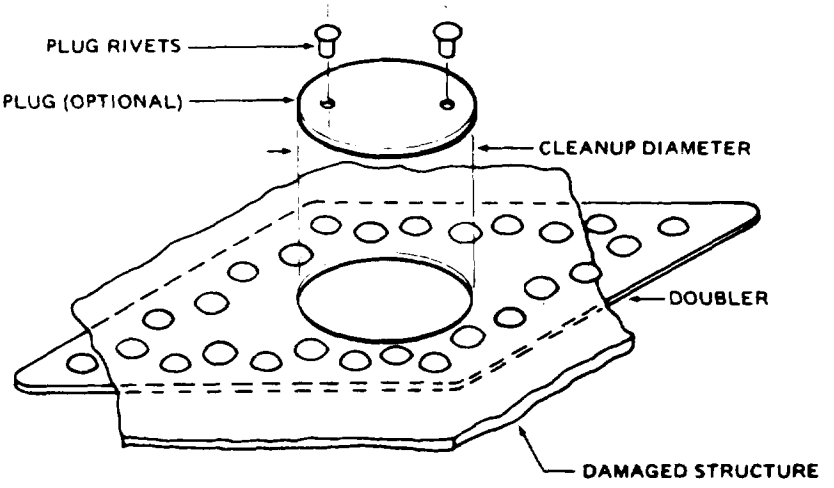
b. Detach hinge (17, detail A, figure 2-20) from fittings on cabin roof by removing cotter pin, nut (30), washer (29)and bolt (28). Remove cowling.



APPLICATION A
REPAIR BY REMOVING DAMAGED AREA

APPLICATION A:
For damaged internal aluminum webs and similar sheet structure.
RESTRICTIONS A:
(1) Nonapplicable in areas susceptible to toxic or flammable fumes.
(2) Maximum cleanup to be 0.50 inch diameter.
(3) Location limited to one cleanup diameter from nearest adjacent structure.
(4) Nonapplicable to exterior skins and the tail boom assembly.
PROCEDURE A:
(1) Stop drill with a No. 40 drill or rout out to minimum diameter (0.50 inch maximum and deburr.
(2) Touch up raw edges6

Figure 2-17. Sheet Meter Patch (Sheet 1 of 6)



APPLICATION B

SHEET METAL INSERTION REPAIR

APPLICATION B:

For damaged aluminum webs and skins.

RESTRICTIONS B:

(1) Location limited to a minimum distance of 1-1/2 inches from edge of cleanup to nearest adjacent structure.
(2) Maximum cleanup area to be 2.0 inches in diameter.
(3) Two repairs to a skin bay section. Damage areas to be no closer than 4.0 inches span after cleanup. A skin bay section is defined as that area of skin framed on four sides by supporting structure.

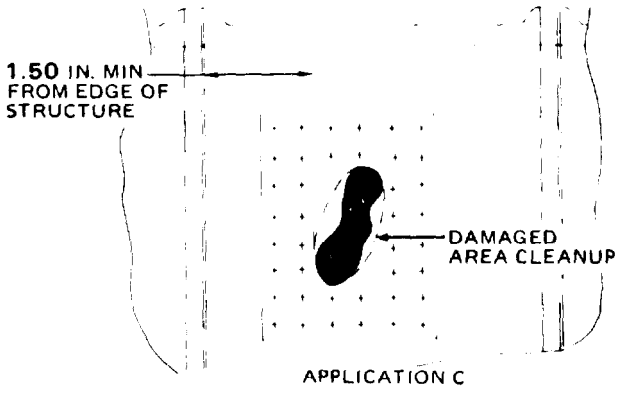
REQUIRED B:

(1) One doubler of the same gauge material as damaged material. Size to be sufficient to allow standard edge distance around edges for double row of rivets or a minimum of 2.00-inch overlap on each edge.
(2) One plug same material and thickness as damaged material and same size as cleanout. (Optional)
(3) Sealing compound (C244).
(4) Same type rivets installed in immediate area (1/8 inch minimum repair rivet diameter),

PROCEDURE B:

(1) Rout damaged area to minimum diameter.
(2) Touch up all raw edges.
(3) Center doubler over (or under) cleanup. Install two rows of rivets matching pattern and same type attaching damaged member to aircraft structure (minimal size repair rivets 1/8-inch diameter),
(4) If flush surface or appearance is required, install plug with 1/8-inch rivets to ensure conformance to contour.

Figure 2-17. Sheet Metal Patch (Sheet 2 of 6)



SHEET METAL PATCH 209030-159-3C

APPLICATION C:

For damaged aluminum webs and skins exceeding limits of application B.

RESTRICTIONS C:

(1) Damaged area is limited to a minimum distance of 1.50 inches from edge of cleanup to nearest adjacent structure.
(2) Damaged area is limited to a maximum of 20 percent of the skin area after cleanup.
(3) Overlapping repair doublers is not permitted.
(4) Minimum distance between repair cleanup is 4.0 inches.

REQUIRED C:

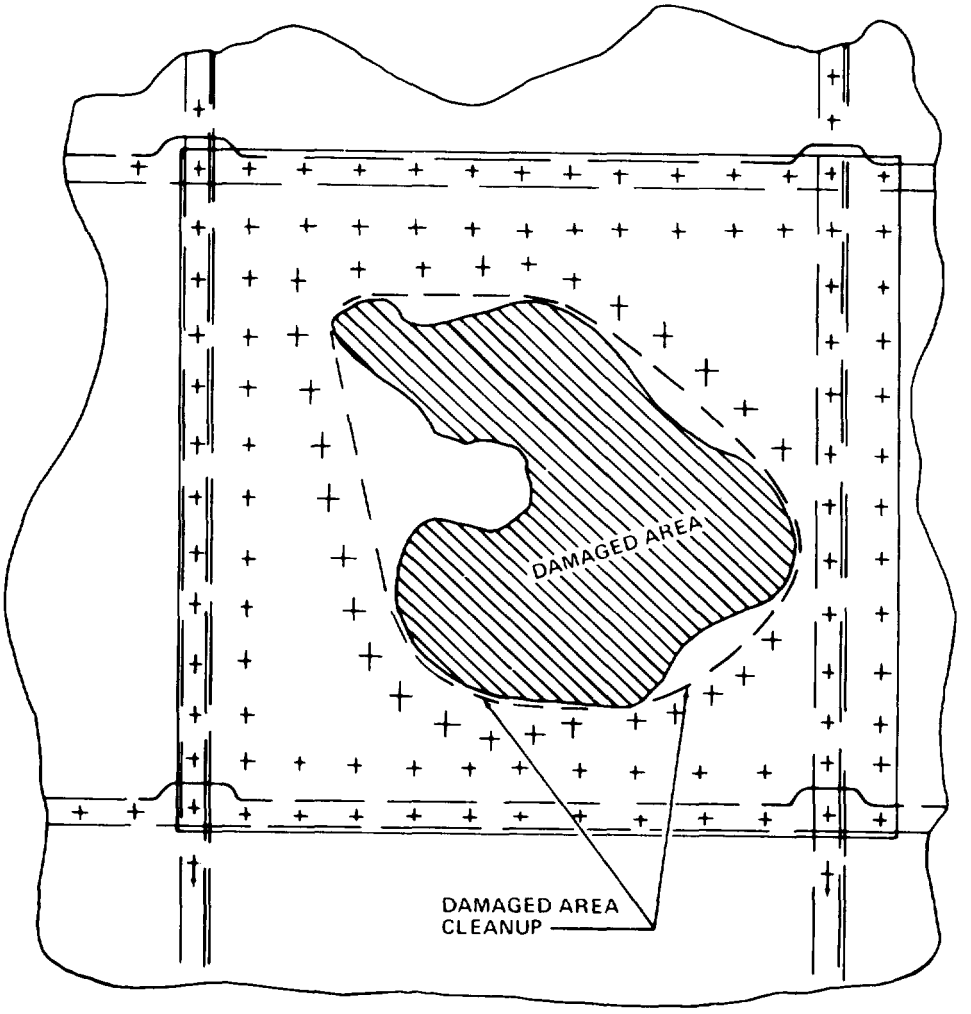
(1) One doubler of the same gauge and material as damaged material. Size to be sufficient to allow standard edge distance around edges for double row of rivets or a minimum of 2.0 inches overlap each edge.
(2) Sealing compound (C244).
(3) Same type rivets installed in immediate area (1/8-inch minimum repair rivet diameter).

PROCEDURE C

(1) Rout out damaged area to remove minimum material and to provide a smooth oval or circular cleanup area in accordance with good sheet metal practices. Minimum cleanup corner radius is 0,5 inch.

(2) Deburr and refinish damaged area.
(3) Center doubler over cleanup area. Install two rows of rivets around outer parameter of repair doubler. Using same type rivets and matching rivet pattern as rivets in the immediate area. (1/8 inch minimum diameter rivet for repair)
(4) If repair is made on external surface, add bead of sealing compound (C244) to all external edges.
NOTE: As a minimum, use two rivets to attach plugs up to one inch in diameter: three rivets for greater than one inch but less than 1.5 inches in diameter; and four rivets for plugs 1.5 inches to 2.0 inches in diameter.
(5) If repair is made on external surface, add bead of sealing compound (C244) to all external edges.
NOTE: Doubler is to be installed on external surfaces if plug is omitted on external skins.

Figure **2-17. Sheet Metal Patch (Sheet 3 of 6)**



APPLICATION D

APPLICATION D:

For damaged aluminum webs and skins in area of bulkheads and stiffeners.

RESTRICTIONS D:

(1) Damaged area is limited to a maximum of 20 percent of the skin panel (between any two bulkheads) after cleanup.
(2) Overlapping repair doublers is not permitted.
(3) No additional skin repair doublers are permitted in the same bay section with this repair.
(4) When 50 percent of the skin is removed for cleanup in bay section, the repair doubler is to pickup the supporting structure rivet pattern on all four sides of the bay section. Install double row of rivets around the outer perimeter of the repair doubler and where possible install one row of rivets around perimeter of the damaged skin area. Maximum one repair between any two bulkheads,

Figure 2-17. Sheet Metal Patch (Sheet 4 of 6)

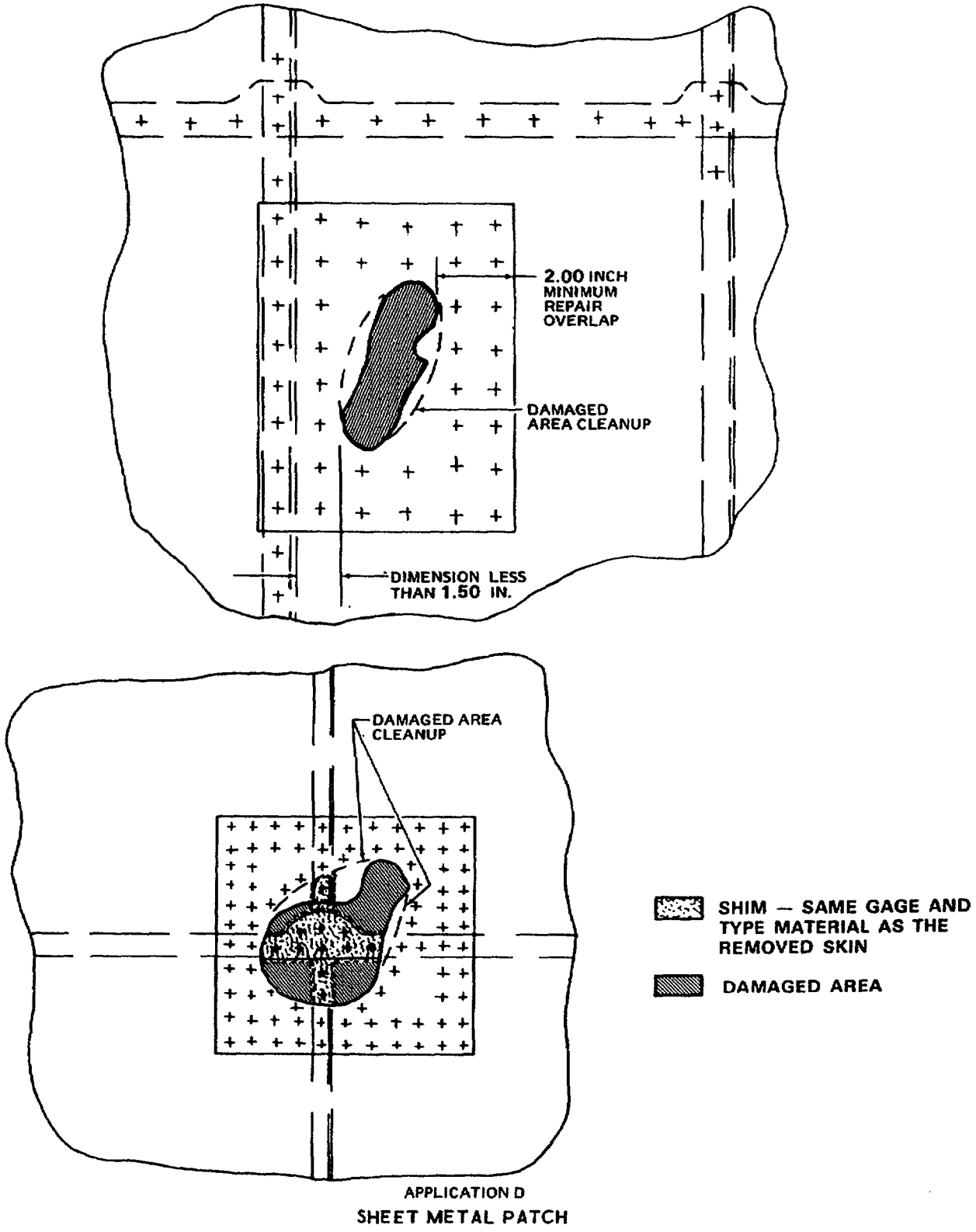


Figure 2-17. Sheet Metal Patch (Sheet 5 of 6)

REQUIRED D:

(1) One doubler the same gauge and type material as the damaged skin or web. Size to be sufficient to allow standard edge distance around edges for double row of rivets, or a minimum of 2.00 inches overlap each edge.

(2) Sealing compound (C244).

(3) Same type rivets installed in immediate area (1/8 inch minimum diameter rivet for repair).

(4) A filler the same gauge and type material as the damaged skin or web.

PROCEDURE D:

(1) Rout out damaged area to minimum diameter.
(2) Deburr and refinish damaged area.
(3) Fabricate skin to overlay the skin support structure in damaged area (same gauge as damaged skin).
(4) Fabricate doubler that is symmetrical with the shape of the damaged bay sections supporting structure, or oval in shape.
(5) Where more than 50 percent of the bay section skin is removed for cleaning, install double row of rivets around the outer perimeter of doubler and one row of rivets where possible around perimeter of damaged skin area cleanup.
(6) If repair is made on exterior surface, add bead of sealant (C244) to all external edges.

209030-159-78

Figure 2-17. Sheet Metal Patch (Sheet 6 of 6)

c. Separate hinge (17) from cowling by removing bolt (23) with nut and washer. Observe position of aluminum washers (26) and thin washers (27), used for alignment, for reassembly in same manner.

2-40. Inspection - Transmission Cowling.

a. Inspect hinges, latches and fitting for wear, damage and serviceability.

b. Inspect seals for deterioration and security of bonding.

c. Check cowling for dents, cracks and damage (table 2-6); use same limits as skins. If crack in transmission cowling is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

2-41. Repair or Replacement - Transmission Cowling. a. Repair damage to honeycomb in accordance with paragraph 2-18.

NOTE

Seals are installed using both adhesive and riveted retainer methods. Refer to Appendix D for retainer manufacture procedures.

b. Replace seals (13 or 15, detail A, figure 2-20) as follows:

(1) Remove old seal and remove old adhesive using 400 grit sandpaper (C233).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(2) Clean with methyl-ethyl-ketone (C177) to remove residue.

(3) Bond new seal in place using adhesive (C24) as follows:

(a) Remove rivets attaching retainer and seal.

(b) Remove old adhesive using 400 grit sandpaper (233) and clean with MEK (C177).

(c) Apply adhesive (C24) and install seal and retainer.

(d) To replace side latches (9) remove cotter pin, washer (11), and pin (10). Position replacement latch in support and install pin (10), washer (11), and cotter pin (24).

(e) Replace rod-end bearings (16) if worn sufficiently to prevent proper closing of cowling.

(f) To replace forward latch (14), remove attaching screws and remove latch. Position replacement latch to cowl and install screws.

2-42. Painting - Transmission Cowling. Touchup paint on transmission cowl as needed in accordance with TM 55-1500-345-23.

2-43. Installation - Transmission Cowl. a. If hinge assembly (17, detail A, figure 2-20) was removed from cowling, attach as follows:

(1) Position hinge assembly (17) in supports (22). Arrange aluminum washers (26) and thin steel washers (27) as necessary for alignment. Aluminum washers should be in contact with fitting (22).

(2) Install bolt (23), washer (21) and nut (20). Secure with cotter pin (24).

b. Position hinge assembly to fittings on cabin roof and install bolts (28), washers (29) and nuts (30). Secure with cotter pin (24).

c. Close cowling, check for proper fit and security Adjust as necessary.

(1) Rod-end bearings (16) can be adjusted to provide proper fit of cowling.

(2) U-bolt (33) can be adjusted if forward latch does not fasten securely.

2-44. ENGINE COWLING.

2-45. Description — Engine Cowling. Engine compartment between front and rear firewalls is covered by side and upper cowling assemblies (4 and 7, figure 2-20). Each side cowl opens by swinging aft on hinges of the rear firewall and can be secured open by a hinged support assembly attached to the cowling, and snapped into a snapplate forward of the tailboom. Upper cowl sections swing upward on hinges of a beam between tops of firewalls, and are held open by rods, Flush-type spring-locking latches provide closure.

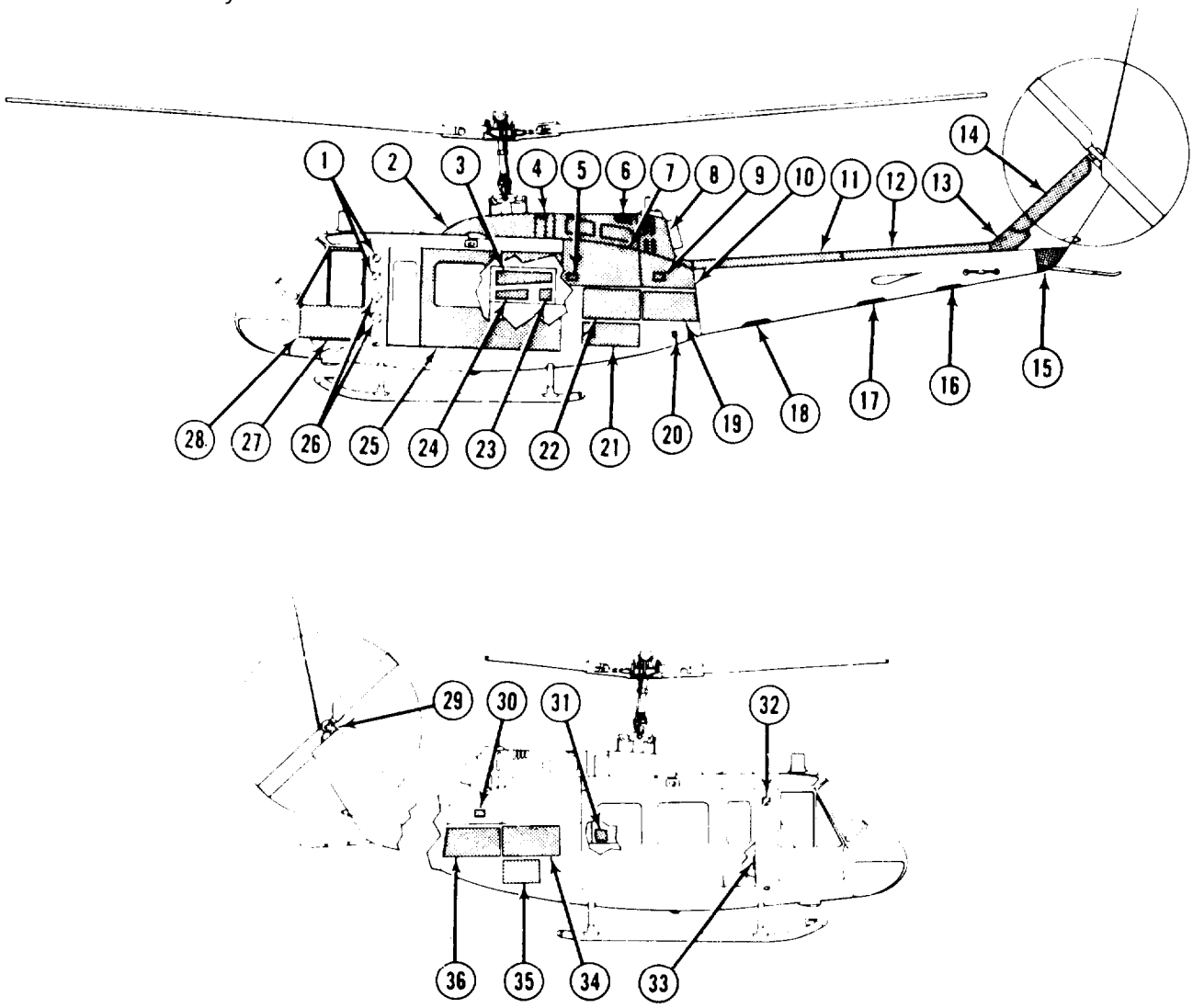


Figure 2-18. Access and Inspection Provisions (Sheet 1 of 3)

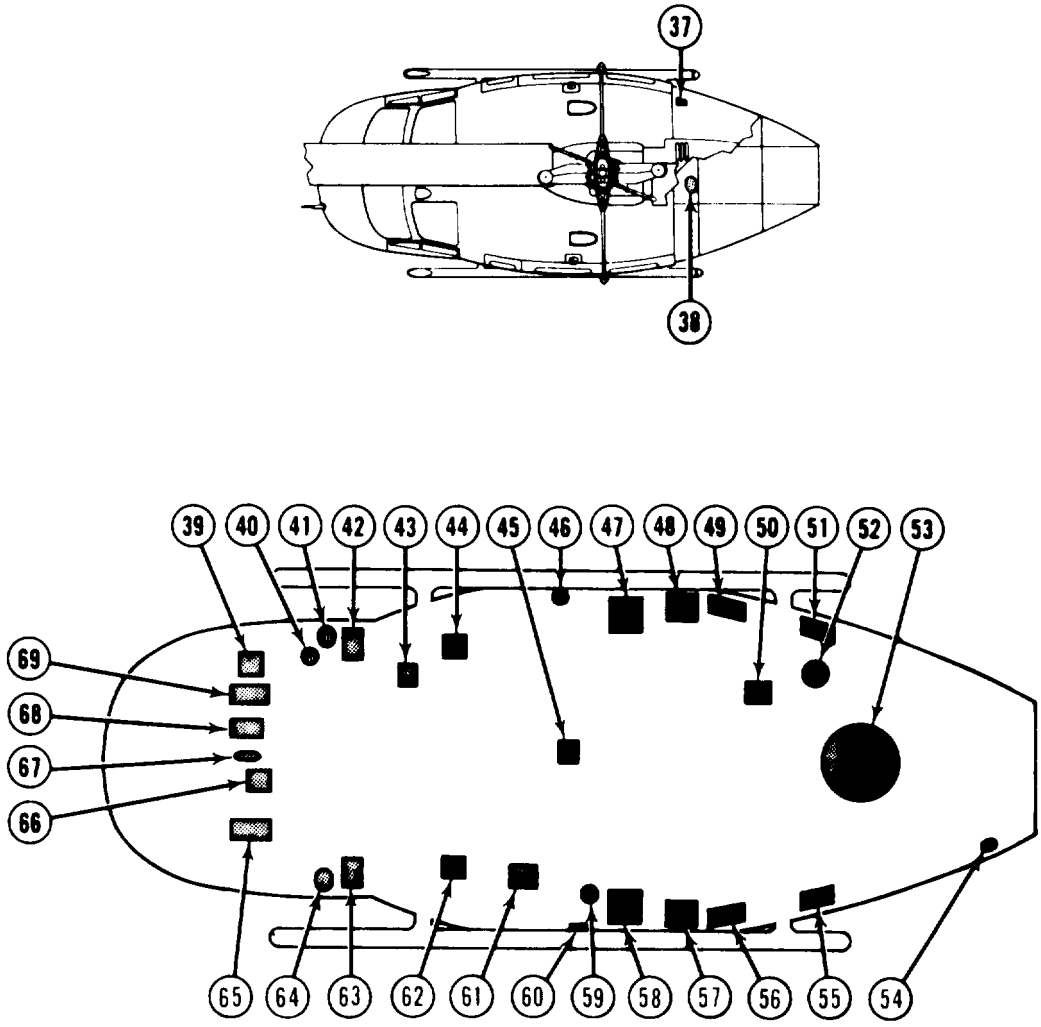
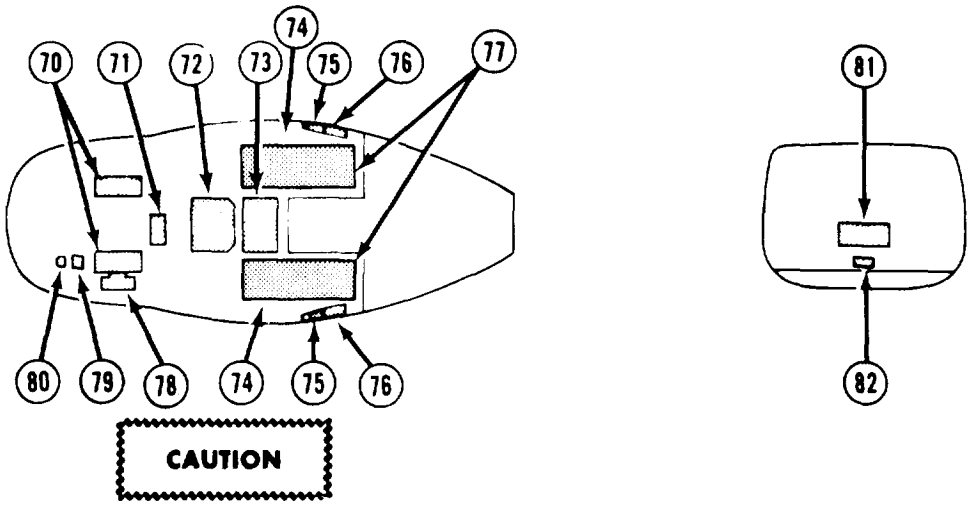


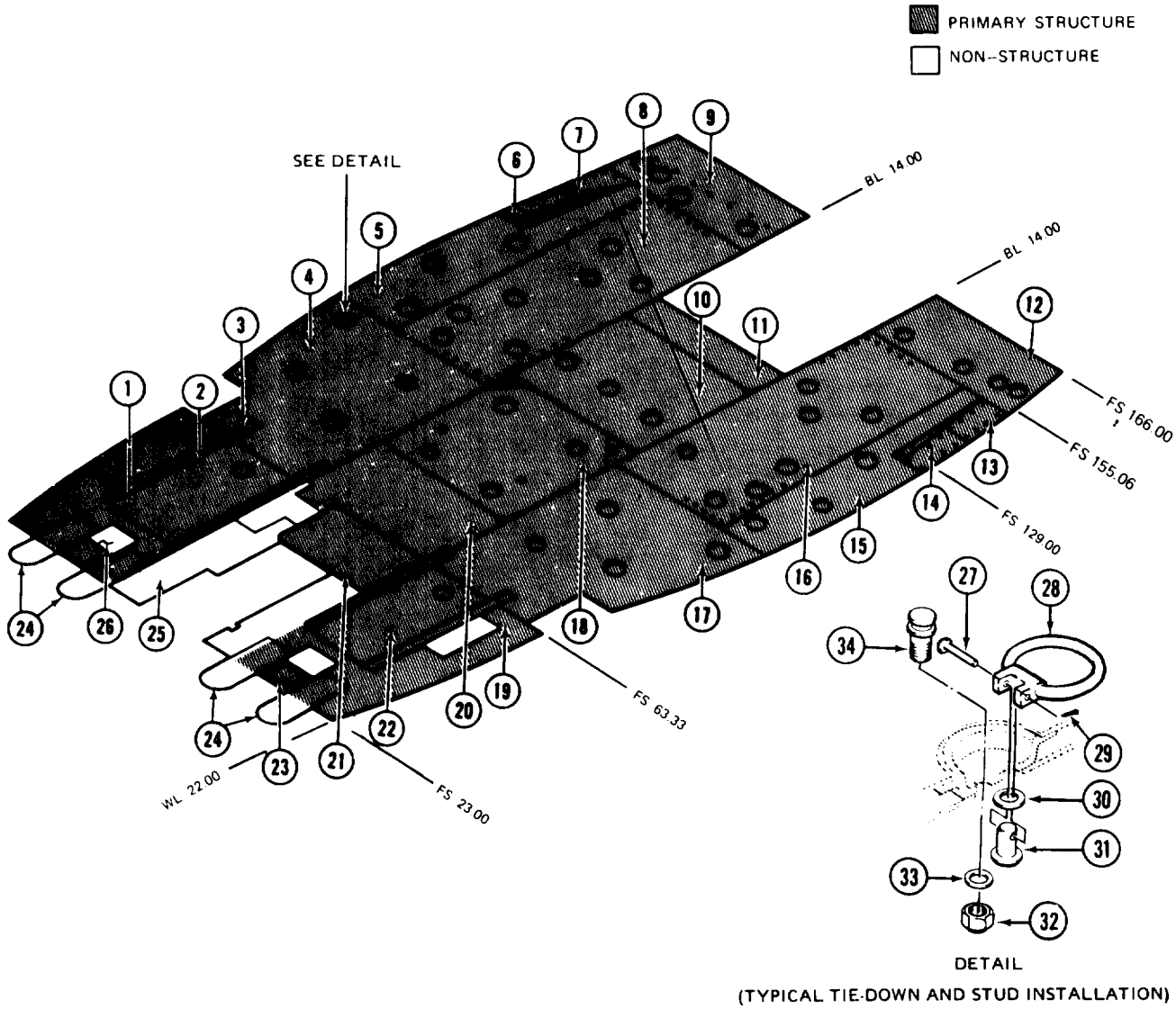
Figure 2-18. Access and Inspection Provisions (Sheet 2 of 3)



*All structural panels are marked with decals. Structural panels/doors. Installation required prior to jacking, towing, hoisting, or flight.

1. Stowage access door
2. Transmission fairing
* 3. Pylon access door
4. Engine cowl
5. Fire extinguishing access door
6. Upper engine cowl
7. Lower engine cowl
8. Tailpipe fairing (upper)
9. Driveshaft and electrical Disconnect access door
10. Tailpipe fairing (lower)
11. Forward tail rotor shaft access
12. Aft tail rotor shaft access
13. intermediate gearbox access
14. Vertical fin driveshaft access
15. Ventral fin fairing
*16. General access
*17. Flight controls access door
*18. Flight controls access door
19. Electrical controls access door
20. External power access door
21. Electronic equipment access door
22. General access door
*23. Fuel control access door
24. Lower pylon access door
25. Cargo door
26. Emergency door release cover plate
27. Lower window access door
28. Crew door
29. Tail rotor chain access cover
30. Driveshaft access door
*31. General access door
32. General stowage access door
33. General access cover plate
34. Cargo hook mirror access door
35. General access door
36. General access door
37. Engine oil tank access door
38. Fuel cell access door
39. Flight controls access door
40. Flight controls access door
41. Flight controls access door
*42. Flight controls access door
43. Flight controls access door
44. General access door
45. Fuel lines access door
46. External stores jettison cable access door
47. External stores disconnect access door
48. Fuel lines access door
49. Ammunition chute access door
50. Fuel lines access door
51. Cabin heater duct access door
52. Fuel lines access door
*53. General access door
*54. General access door
55. Cabin heater duct access door
56. Ammunition chute access door
57. Fuel lines access door
58. External stores disconnect access door
59. Fuel lines access doo,
60. External stores jettison cable access door
61. General access door
62. Cabin heater duct access door
*63. Cabin heater duct access door
64. Flight controls access door
*65. Flight controls access door
66. Flight controls access door
67. Antenna access cover
68. General access door
*69. Flight controls access door
*70. Controls access door
71. Controls access door
*72. General access door
*73. General access door
*74. Fuel cell access door
75. Auxiliary fuel tank fittings cover plate
76. Gun chute tunnel cover plate
*77. Fuel fitting access doors
78. Dual collective stick cover
79. Dual cyclic stick cover
80. Cyclic stick electrical access cover
*81. Hydraulic controls access
*82. Armament provisions access cover

Figure 2-18. Access and Inspection Provisions (Sheet 3 of 3)



1. Access door
2. Floor assembly
3. Track assembly
4. Floor panel assembly
5. Floor panel assembly
6. Cover plate
7. Cover plate
8. Floor panel assembly
9. Panel assembly
10. Door assembly
11. Skin
12. Floor panel assembly
13. Cover plate
14. Cover plate
15. Floor panel assembly
16. Floor panel assembly
17. Floor panel assembly
18. Door assembly
19. Floor panel
20. Panel assembly
21. Door assembly
22. Access door
23. Access door
24. Heel rest
25. Floor assembly
26. Control stick
27. Pin
28. Ring, tie-down
29. Cotter pin
30. Washer
31. Pin
32. Nut
33. Washer
34. Stud

Figure 2-19. Cabin Floor

2-46. Removal - Engine Cowling. a. Unlatch and open each lower cowling (7, figure 2-20). Pull pins from hinges on rear firewall to remove cowling sections.

b. To separate hinge (68, Detail C) from cowling remove cotter pin (76), nut (74), washers (75 and 77), and bolt (71) from hinge (73) and (70).

c. Unlatch upper cowl (4) and raise to open position at each side.

d. Disconnect fire detector wiring at connectors.

e. Disconnect flexible duct with clamp from starter-generator cooling air intake on cowling support beam.

f. Pull out pins at each end of beam (3) to detach from firewall. Remove beam with upper cowl sections attached.

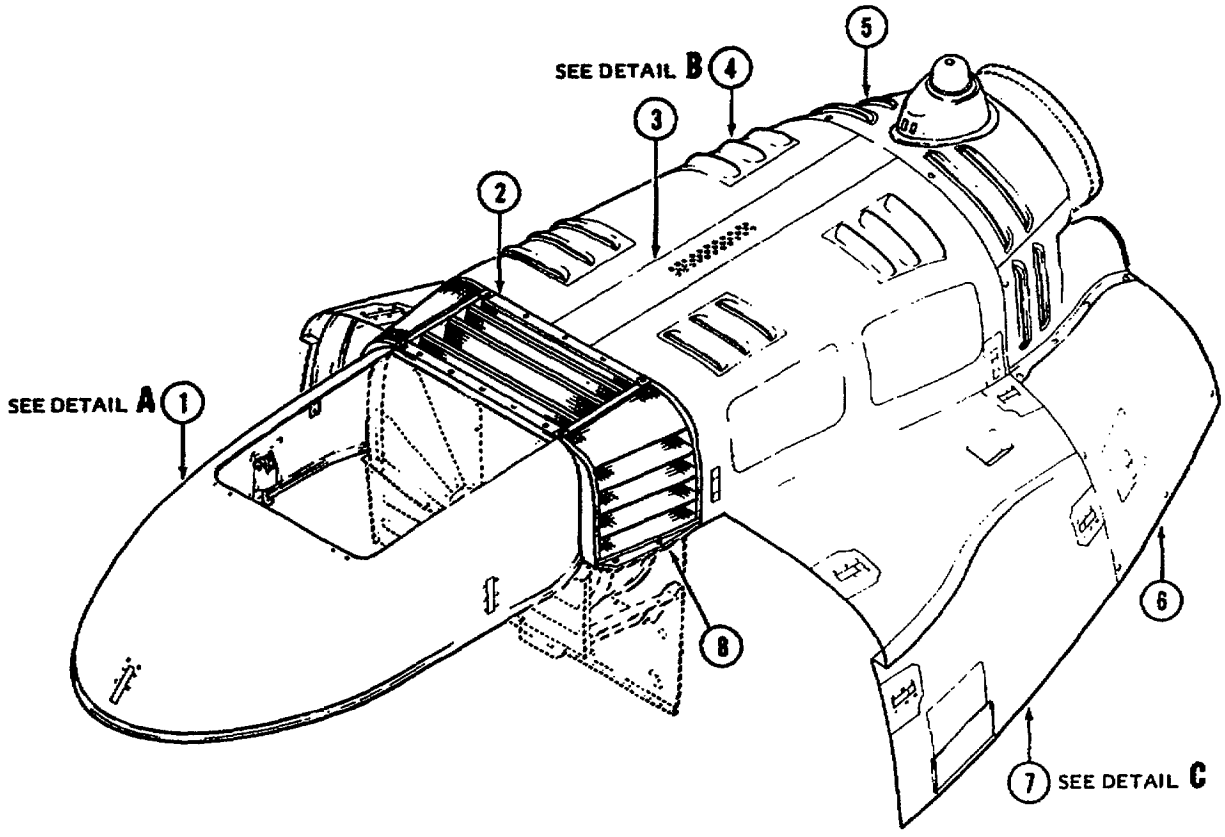
g. To separate upper cowl (4) from beam (3), remove cotter pin (42), washer (46) and pin (43) at three hinge points.

2-47. Inspection - Engine Cowling. a. Inspect cowling for dents, cracks, and holes (table 2-6). If crack in engine cowling is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

b. Inspect cowling seals for deterioration and security.

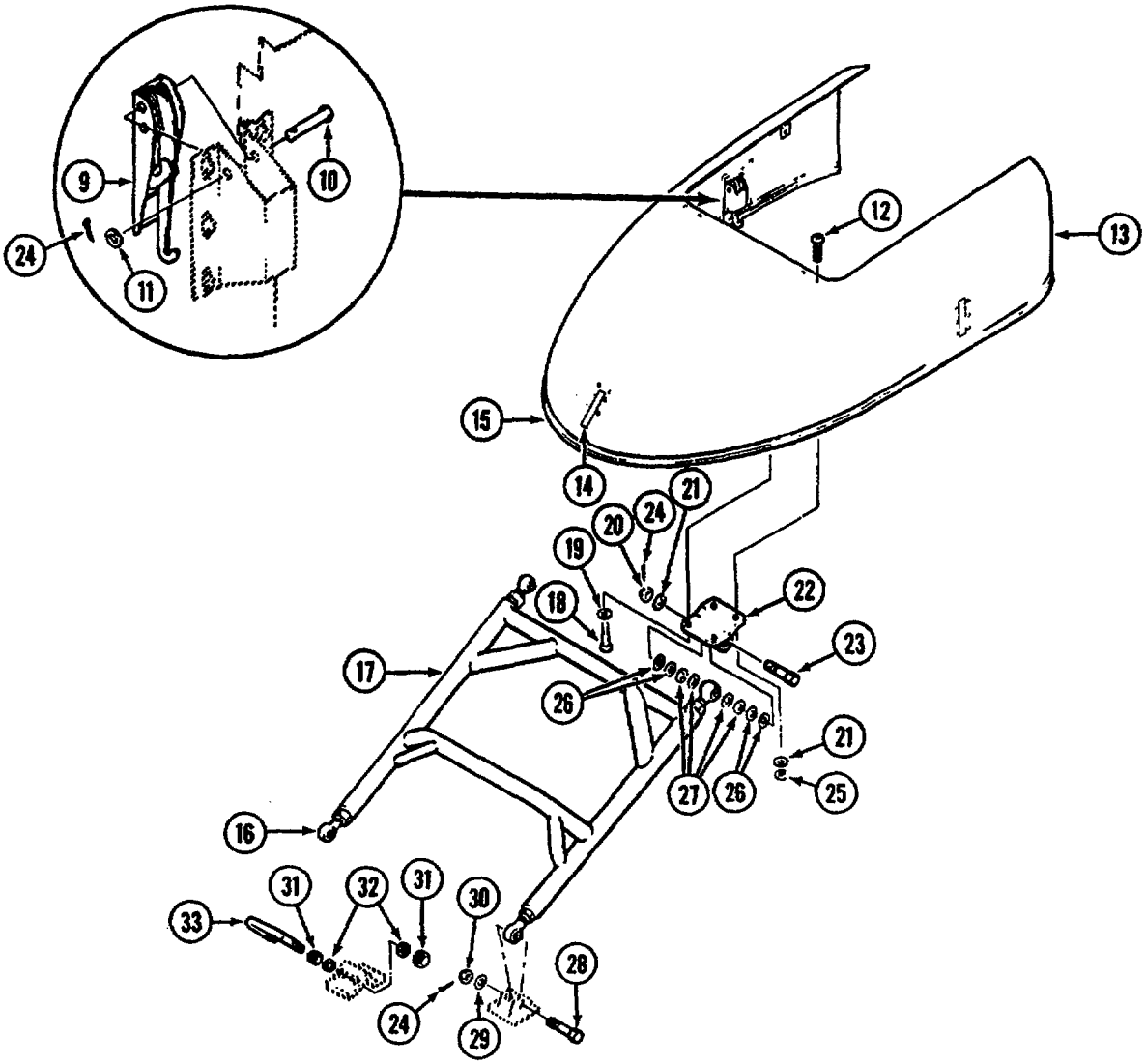
c. Inspect hinges, fittings, and latches for wear, damage, and proper operation. If wear is sufficient to prevent proper closing or security of cowling, worn parts should be replaced.

d. Inspect starter-generator air intake for cracks, dents, or holes. If crack in the starter-generator air intake is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.



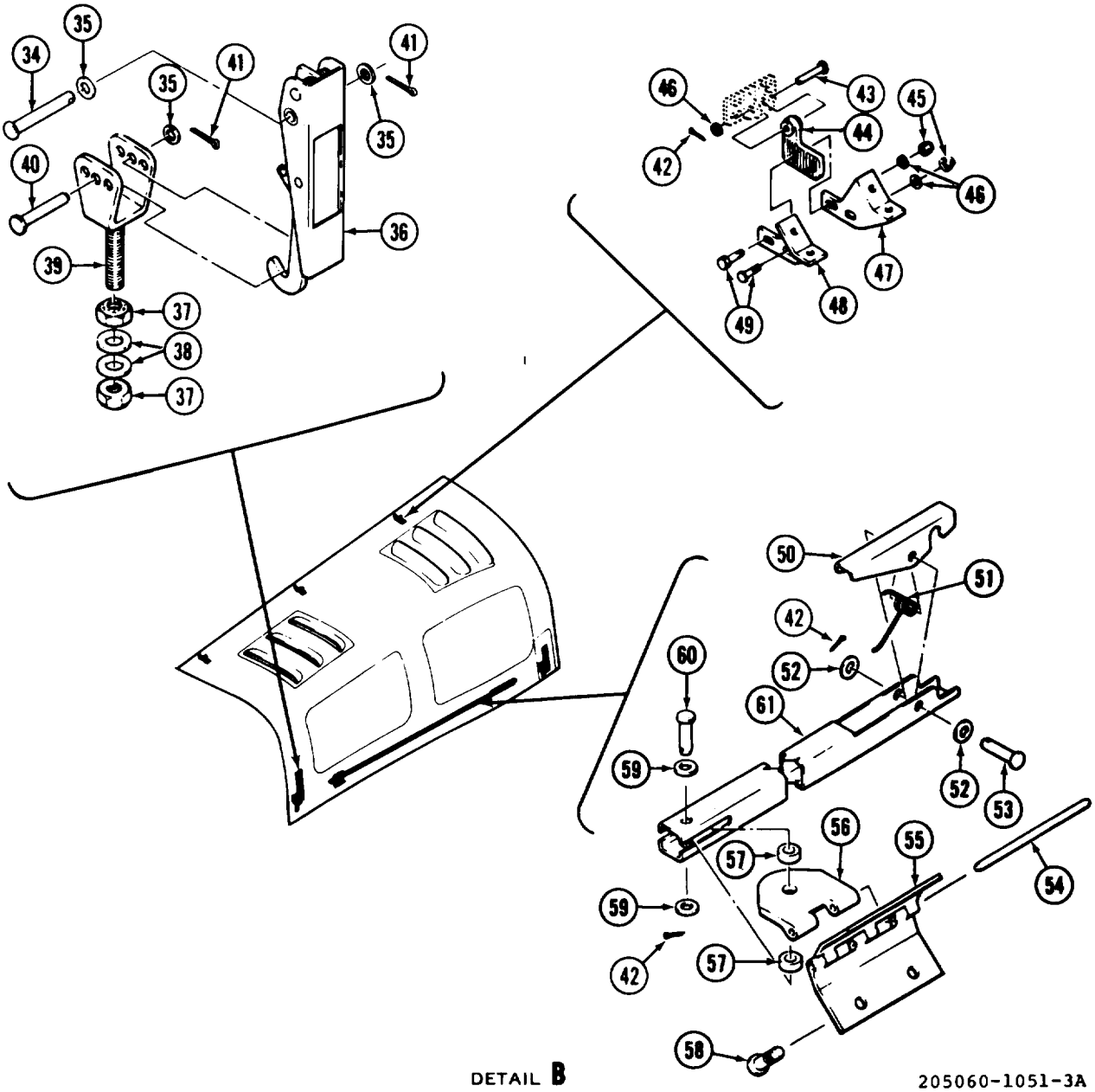
1. **Transmission fairing**
2. **Upper air inlet screen**
3. **Beam assembly**
4. **Engine upper cowl**
5. **Tailpipe upper fairing**
6. **Tailpipe lower fairing**
7. **Engine lower cowl**
8. **Side air inlet screen**

Figure 2-20. Transmission and Engine Cowling (Sheet 1 of 4)



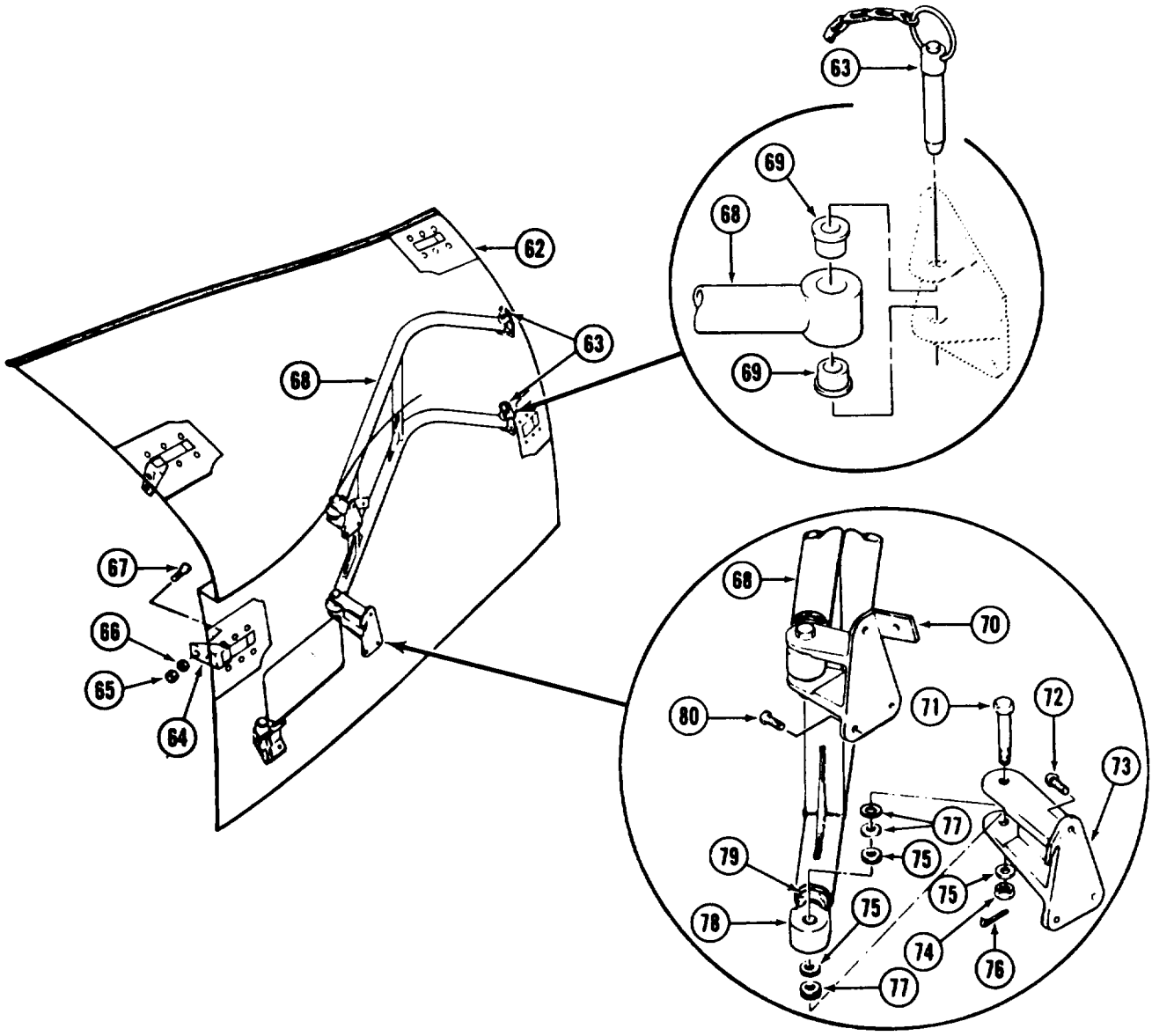
9. Latch	18. Bolt	27. Washer, thin steel
10. Pin	19. Washer, aluminum	28. Bolt
11. Washer	20. Nut	29. Washer, aluminum
12. Screw	21. Washer, aluminum	30. Nut
13. Seal	22. Support	31. Nut
14. Latch	23. Bolt	32. Washer, aluminum
15. Seal	24. Cotter pin	33. U-bolt
16. Bearing, rod end	25. Nut	
17. Hinge assembly	26. Washer, aluminum	

Figure 2-20. Transmission and Engine Cowling (Sheet 2 of 4)



34. Pin
35. Washer
36. Latch
37. Nut
38. Washer
39. Fitting
40. Pin
41. Cotter pin
42. Cotter pin
43. Pin
44. Fitting
45. Nut
46. Washer
47. Fitting
48. Fitting
49. Bolt
50. Latch
51. Spring
52. Washer
53. Pin
54. Pin
55. Fitting
56. Hinge
57. Spacer
58. Screw
59. Washer
60. Pin
61. Brace

Figure 2-20. Transmission and Engine Cowling (Sheet 3 of 4)



DETAIL C

62. Latch
63. Pin, quick-release
64. Fitting
65. Nut
66. Washer
67. Bolt
68. Hinge
69. Bushing
70. Hinge
71. Bolt
72. Screw
73. Hinge
74. Nut
75. Washer
76. Cotter pin
77. Washer, thin
78. Rod-end
79. Nut
80. Screw

Figure 2-20. Transmission and Engine Cowling (Sheet 4 of 4)

2-48. Repair or Replacement - Engine Cowling.

CAUTION

Blind rivets should not be used when repairing cowling in the area of engine air intake.

a. Repair damage to cowling in accordance with TM 1-1500-204-23 series. Ensure repairs do not interfere with fit of cowling.

b. Replace seals as follows:

(1) Remove old seal and remove old adhesive using 400 grit sandpaper (C233).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(2) Clean with methyl-ethyl-ketone (C177) to remove residue.

(3) Bond new seal in place using adhesive (C24).

c. Replace damaged or worn parts on upper cowling as follows (Detail B, figure 2-20).

(1) To replace latch (36), remove cotter pin (41), washers (35), and pin (34). Position latch in support and secure with pin (34), washers (35) and cotter pins (41).

(2) Repair or replace hold open brace assembly as follows:

(a) To replace brace assembly remove screws (58) and remove brace. Position replacement brace to cowling and install screws (58).

(b) To replace latch (50) and spring (51), remove cotter pin (42), washers (52), and pin (53). Position spring (51) and latch (50) in brace (61). Install pin (53), washers (52), and cotter pin (42).

(c) To replace hinge (56) remove pin (54) to separate hinge from fitting (55). Remove cotter pin (42), washers (59), and pin (60) and remove hinge (56) and spacers (57) from brace (61). Position hinge (56) and spacers (57) in brace (61) secure with pin (60), washers (59), and cotter pin (42). Connect hinge (56) to fitting (55) with pin (54). Bend ends of pin (54) to secure in place.

d. Replace damaged or worn parts on lower cowling as follows: (Detail C, figure 2-20).

(1) To replace latch (62), remove attaching screws and washers and remove latch. Position replacement latch to cowling and install screws with washers.

(2) To replace hinge (70 or 73), remove attaching screws (72) and remove hinge. Position replacement hinge to cowling and install screws (72).

e. Replace damaged or worn parts on hinge (68, Detail C) as follows:

(1) To replace rod-end (78) loosen nut (79) and remove rod-end. Install replacement rod-end (78) with nut (79). Tighten nut to secure rod-end in place.

(2) Replace bushings (69) as follows: (AVIM)

NOTE

Bushings in both arms of hinge should be replaced together to maintain proper alignment.

(a) Support arm of hinge (68) and press out bushings (69).

(b) Coat replacement bushings (69) with primer (C312) and press into arm of hinge (68) while primer is still wet.

(c) Line ream bushings **0.2495 TO 0.2505 inch.** Do not line ream top or bottom bushing separately. Bushings on top and bottom arms of hinge should be line reamed as a unit.

2-49. Painting - Engine Cowling. Touchup paint on engine cowl as needed in accordance with TM 55-1500-345-23.

2-50. Installation - Engine Cowling. a. Install upper cowl (4, figure 2-20) as follows:

(1) Attach upper cowl (4) to beam assembly (3) using pin (43, detail B), washers, and cotter pins (42).

(2) Lift upper cowling assem bly to position. Align ends of beam in brackets on front and rear firewalls and install pins.

(3) Engage support rods to hold upper cowling open.

(4) At right side of engine, connect flexible duct from starter-generator cooling blower to air intake on bottom of cowling support beam. Secure duct with clamp.

(5) Connect fire detector wiring from both cowl sections to connectors near top of front firewall, lockwire connector (C154).

b. Install lower cowl (7) as follows:

(1) if separated, attach hinge (68, detail C) to lower cowl with bolts (71). Arrange washers (75) and thin washers (77) as necessary for alignment. Install washer (75) and nut (74). Secure with cotter pin (76).

(2) Align side cowling sections to hinges on rear firewall and install quick-release pins (63).

c. Close upper cowling with support brace stowed in clips. Check for proper fit and adjust as necessary.

(1) Upper cowling hinge points can be adjusted by loosening nuts (45, detail B) on bolts (49) and repositioning fitting (44) as necessary. Tighten nuts after adjustment is complete.

(2) If latches do not fasten securely, adjust position of fitting (39), located on cabin roof as needed.

d. Close side cowling. Check for proper fit and adjust as necessary.

(1) If cowl does not fit, rod-ends (78, detail C) can be adjusted.

(2) If latches do not fasten securely adjust position of fitting (64) as needed.

2-51. TAILPIPE FAIRING.

2-52. Description - Tailpipe Fairing. An upper fairing (5, figure 2-20) and two lower fairings (6) cover exhaust tailpipe area behind engine rear firewall, and is secured by cowl fasteners. An anti-collision light is mounted on top of upper fairing.

2-53. Removal - Tailpipe Fairing. a. Through door in lower left fairing, disconnect anti-collision light wiring at deck connector.

b. Open forward section of tail rotor driveshaft cover.

c. Release fasteners and remove upper and two lower tailpipe fairings.

2-54. Inspection -- Tailpipe Fairing. a. Inspect fasteners for wear, damage and serviceability. If damage to fasteners is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

b. Inspect fairing for dents, cracks, holes and damage. If crack in the fairing is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

c. Inspect anti-collision light mounting for cracks, holes, and damage. If crack in the anti-collision light mounting is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

2-55. Repair - Tailpipe Fairing. a. Replace damaged or missing fasteners.

b. Repair damage to fairing in accordance with TM 1-1500-204-23 series. Ensure repairs do not interfere with fit of fairings.

2-56. Painting - Tailpipe Fairing. Touch-up paint on fairing as needed in accordance with TM 55-1500-345-23.

2-57. Installation -- Tailpipe Fairing. a. Install and fasten lower fairings and upper fairing. Close driveshaft cover.

b. Through door on lower left fairing, connect anticollision light wiring at deck connectors.

2-58. LIFT BEAM.

2-59. Description - Lift Beam. The lift beam absorbs or carries all vertical loads induced during flight. The beam is constructed of aluminum alloy web, stiffeners, and extrusions. Fittings are installed on the beam to provide attachment points for the lift link and cargo hook.

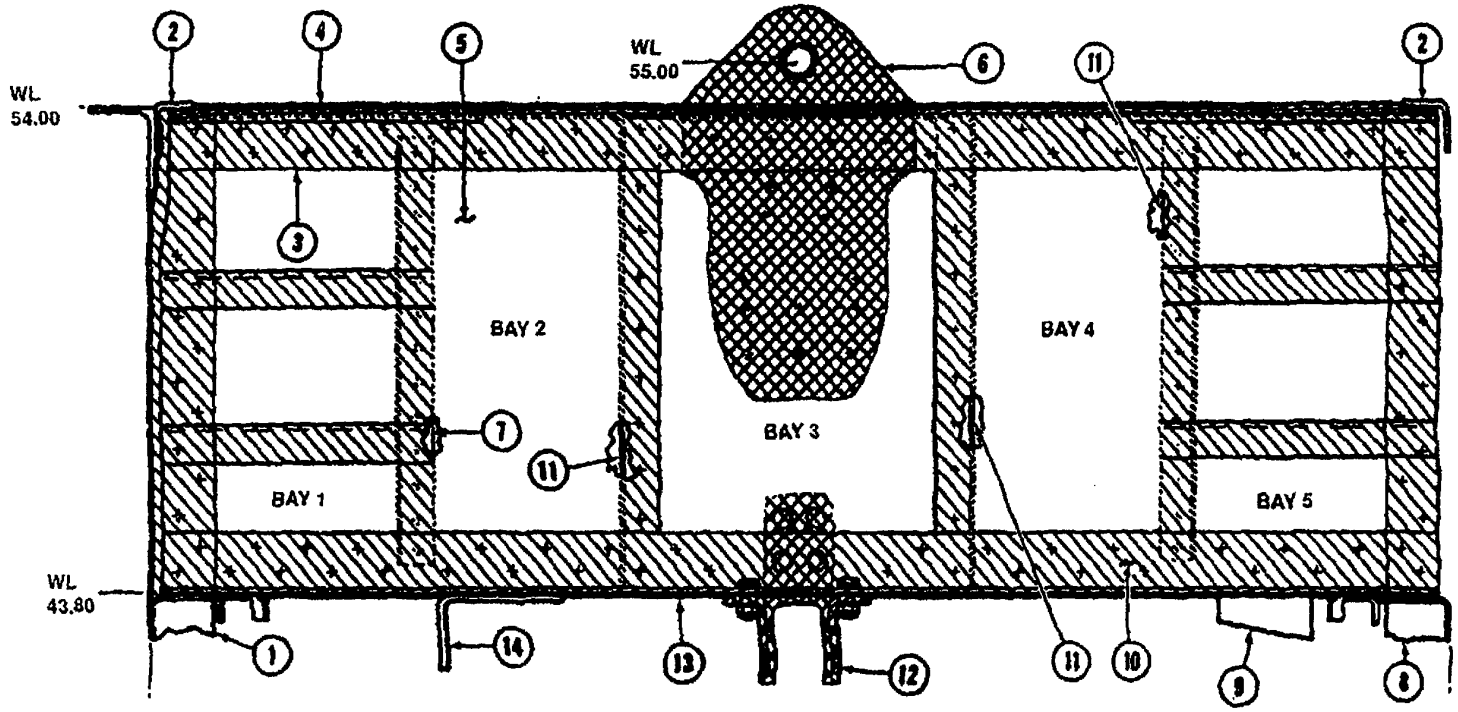
2-60. Classification of Damage - Lift Beam. a. Negligible damage; small nicks and scratches defined in figure 2-21.

b. Repairable damage as shown on figure 2-21.

c. Damage necessitating replacement of parts (figure 2-21). Refer to following note.

NOTE

Evacuate to depot if replacement of lift beam assembly is required. Fixtures or jigs are required for replacement.



LOOKING FORWARD

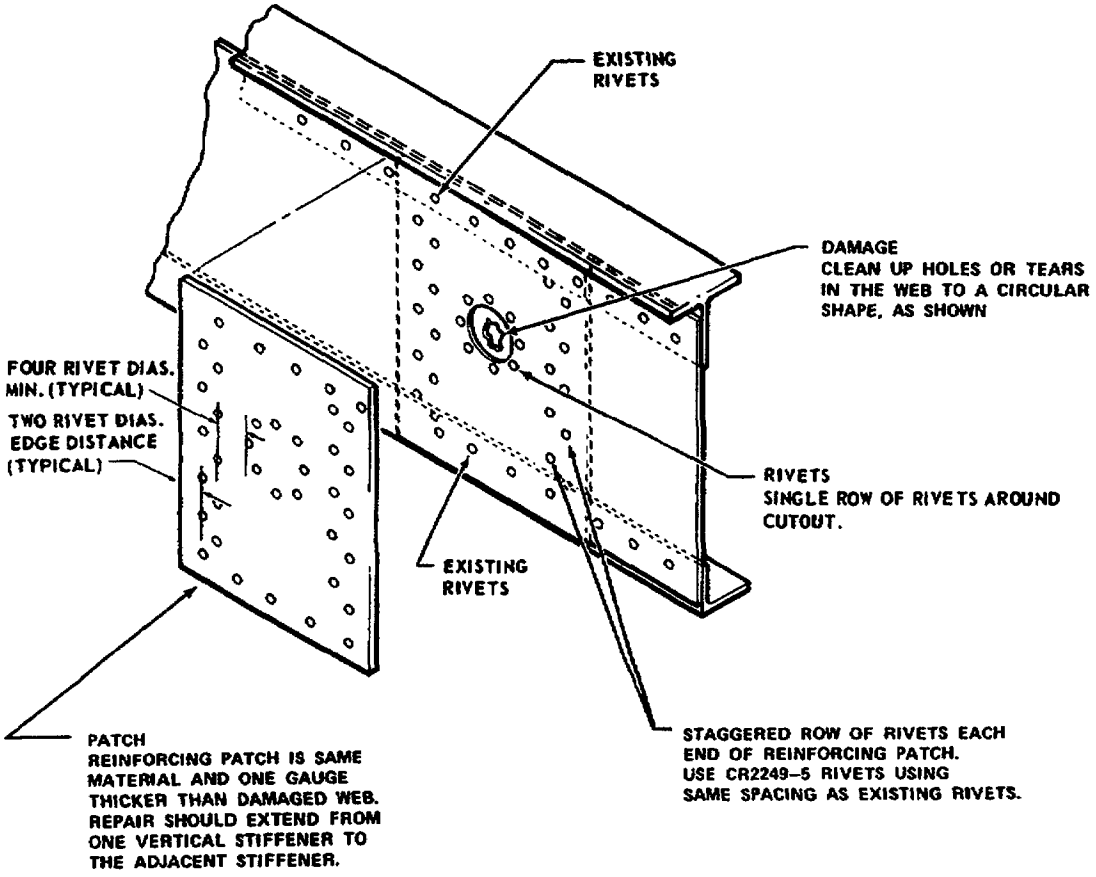
Critical fittings. No damage allowed other than negligible, such as small nicks and scratches. Damage beyond negligible is case for replacement of fitting.

Other critical areas. No damage other than negligible.

Other structural areas. See sheet 2 for damage limits and repair procedure.

1. **Stiffener, LH aft (A component of left main beam)**
2. **Clip**
3. **Cap, upper aft**
4. **Plate upper**
5. **Web**
6. **Fitting assembly**
7. **Stiffener**
8. **Stiffener, RH aft (A component of right main beam)**
9. **Bracket**
10. **Cap, lower aft**
11. **Doubler**
12. **Cargo sling fitting assembly**
13. **Plate, lower**
14. **Bracket**

Figure 2-21. Lift Beam Damage Limits and Repair (Sheet 1 of 2)



1. Maximum Diameter of Hole After Cleanup = 0.50 Inch.
2. Maximum Number of Repairs per Bay: One.
3. Minimum Distance From a Structural Member, or Fitting: 1 Inch.

Figure 2-21. Lift Beam Damage Limits and Repair (Sheet 2 of 2)

2-61. Repair or Replacement - Lift Beam. (AVIM) a. Radius Block Installation.

NOTE

Radius blocks provide additional support for load distribution at the forward and aft servo cylinder support mounting holes; and a field repair for cracks in the lift beam.

(1) To preclude failure of the lift beam assembly, accomplish the following inspections and modifications.

(a) Inspect lift beam for installation of radius blocks located on lower surface of the upper beam cap assemblies, forward and aft sides (figure 2-22).

(b) If radius blocks are not installed, inspect beam cap and adjacent structure of beam for cracks. If cracks are present, refer to step (2). If no cracks are noted, proceed as follows: Fabricate radius blocks from aluminum alloy 2024-T4, QQ-A-250/5, **0.125** inch thick (table 2-1). If crack in the lift beam cap or adjacent structure is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

(c) Locally fabricated radius blocks should be to the following dimensions (figure 2-22), 0.125 inch thick, 0.875 inch wide with a 0.125 inch radius on one edge as indicated in Radius Block

Details (figure 2-22). Length of radius blocks, P/N 205-030-845-127 and -129 is **8.00** and **8.38** inches respectively.

(d) Remove the rotor assembly, transmission and mast assembly, hydraulic servo cylinders, hydraulic lines, valves and filters, and servo cylinder supports from the lift beam.

(e) Locate area of repair (figure 2-22). Drill out and remove rivets only in locations where radius blocks are to be installed. Use care in drilling rivets to prevent elongating holes.

(f) Position and clamp fabricated radius blocks in place. Drill holes for rivets and servo cylinder support retention holes.

(g) Remove radius blocks: clean, deburr, and coat with primer (C312).

(h) Install radius blocks with rivets as indicated in figure 2-22.

(i) Reinstall servo support assemblies, hydraulic lines, valves and filters, hydraulic servo cylinders, transmission and mast assembly, and rotor assembly.

(2) If cracks are found in the beam cap, repair as follows:

(a) To gain access, proceed as in preceding paragraph a.(1) (d).

(b) Drill out rivets and/or remove bolts retaining effected beam cap. Use care in drilling rivets to prevent elongating holes. Remove cap from beam assembly.

(c) Using cap as pattern, fabricate new cap from AND10134-1205 (figure 2-22) extrusion 7075T6 aluminum alloy cut to length, drill holes for rivets and support retention and lift link attach fitting bolts.

(d) Clean, deburr, and coat new beam cap with primer (C312).

(e) Position, clamp in place and install beam cap using MS20470AD5 rivets except in area of servo support as indicated in figure 2-22. In area of lift link attach fitting, use two NAS1054-5-3 rivets each side of the fitting and four NAS1054-10-28 rivets where cap attaches to fitting.

(f) If cracks are found in the beam web, repairs may be accomplished as follows:

(1) Visible isolated cracks to **three** inches can be stop drilled and patched using aluminum alloy sheet (7075-T6, QQ-A-250/13, **0.040** inch thick), (table 2-1) overlapping length of crack.

(2) Cracks **3.0** or more inches in length or concentrated within a small area can be repaired by cutting out damaged area and using an overlapping patch of aluminum alloy (7075-T6, QQ-A-250/13, **0.050** inch thick) (table 2-1). (Refer to TM 1-1500-204-23 series.)

b. Repair Penetration - Type Damage.

(1) Repair acceptable penetration-type damage to lift beam (figure 2-21).

(2) Apply primer (C312) to repair area.

2-62. PYLON FIFTH MOUNT SUPPORT.

2-63. Classification of Damage - Pylon Fifth Mount Support. a. Negligible damage. Cracks in the fifth mount support beam of less than **1.25** inches may be considered negligible. However, all cracks should be stop drilled, where accessible, and inspected every 25 flight hours until the support beam can be replaced. The 25 flight hour inspection requirement should fall in line with the aircraft 25 hour service. The support beam must be replaced at the next scheduled phase or at the next major maintenance (e.g., transmission change) that re-quires removal of the support.

b. Deleted.

2-64. Deleted.

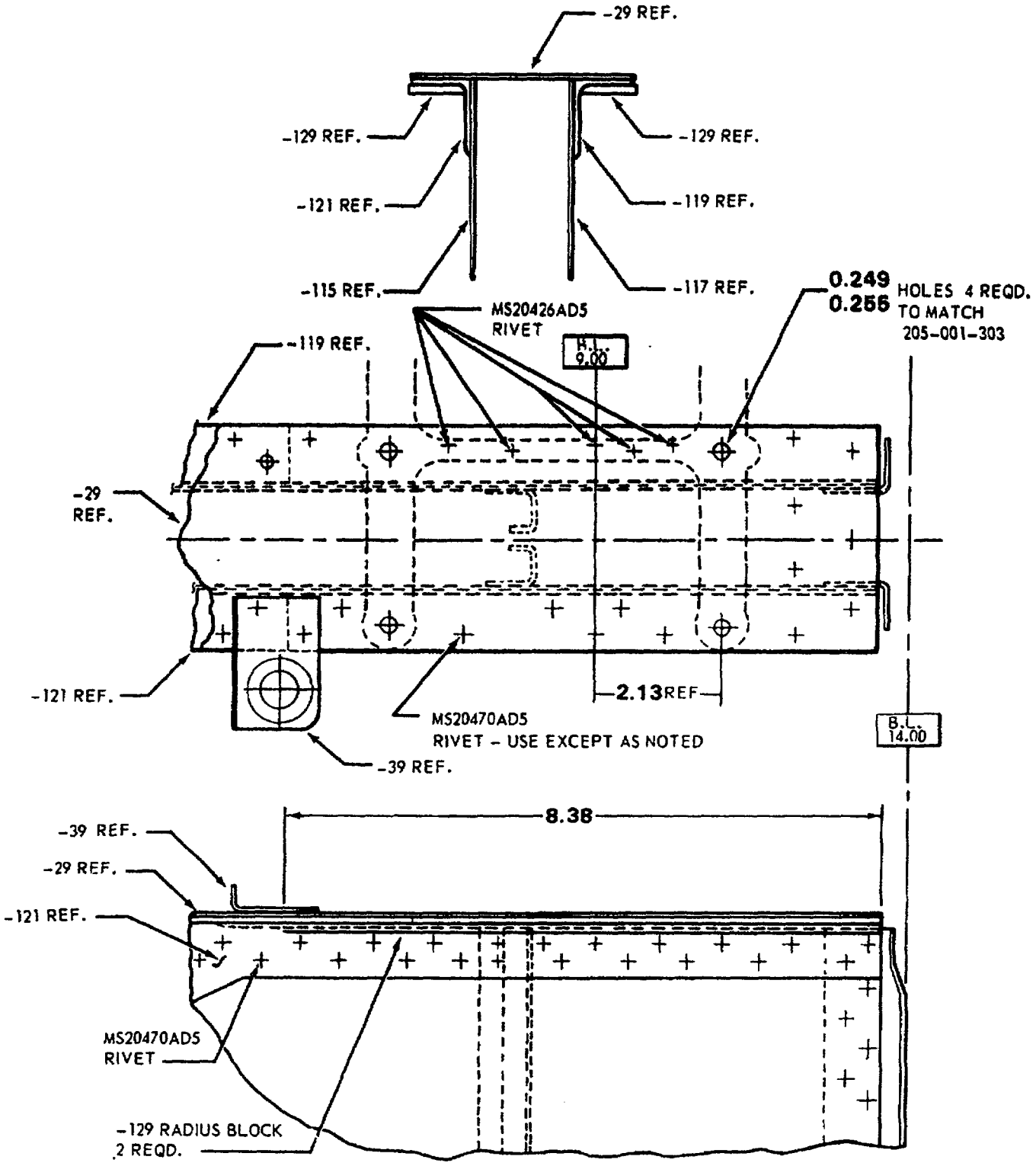


Figure 2-22. Lift Beam - Repair (Sheet 1 of 2)

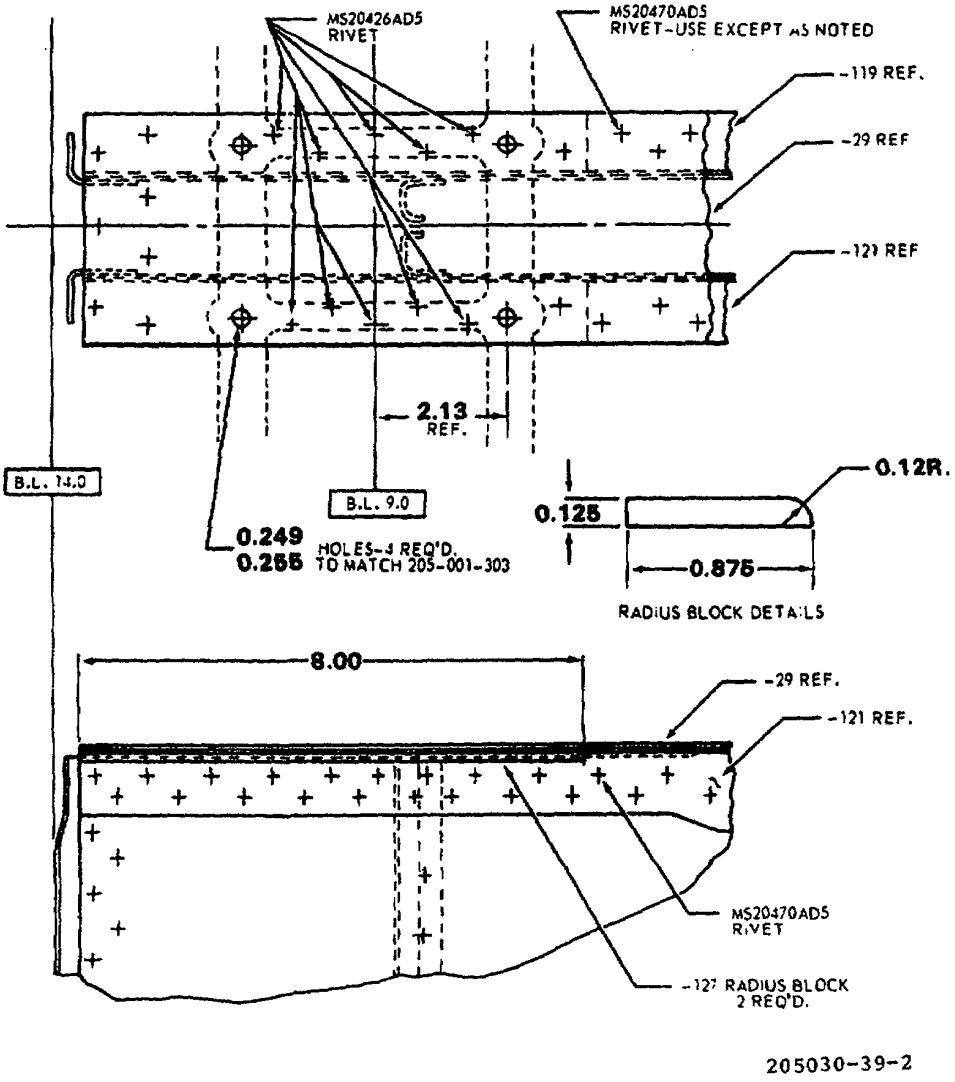


Figure 2-22. Lift Beam - Repair (Sheet 2 of 2)

c. Deleted.

d. Deleted.

e. Deleted.

2-64.1. Friction Damper Retaining Clip.

2-64.2. Inspection -Friction Damper Retaining Clip.

a. Gain access to work area on left hand side of aircraft by removing the blanket assembly (P/N 205-070-614-41) and transmission access covers (P/N 205-030-210-45, 205-030-219-19 and 205-031-221-1) in main beam.

b. Gain access to work area on right hand side of aircraft by removing the blanket assembly (P/N 205-070-614-42) and transmission access covers (P/N 205-030-210-47, 205-030-219-20 and 205-031-221-2) in main beam.

c. At the left hand aft and right hand aft pylon mounts in the area of the friction damper mount installation inspect rivets attaching support clip (6, figure 2-23.1) and retaining clip (3, figure 2-23.1) to the pylon support structure.

d. Inspect support clip and retaining clip for cracks or structural damage. Any cracks will necessitate replacement with no allowable repair. Nicks or scratches may be blended in accordance with standard maintenance actions. If crack is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

e. Inspect friction damper mount assembly (5, figure 2-23.1) for cracks or damage. Replace if cracked or damaged beyond repair. Inspect all holes for elongation or oversize. Hole damage is condition for mount assembly replacement. If crack is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

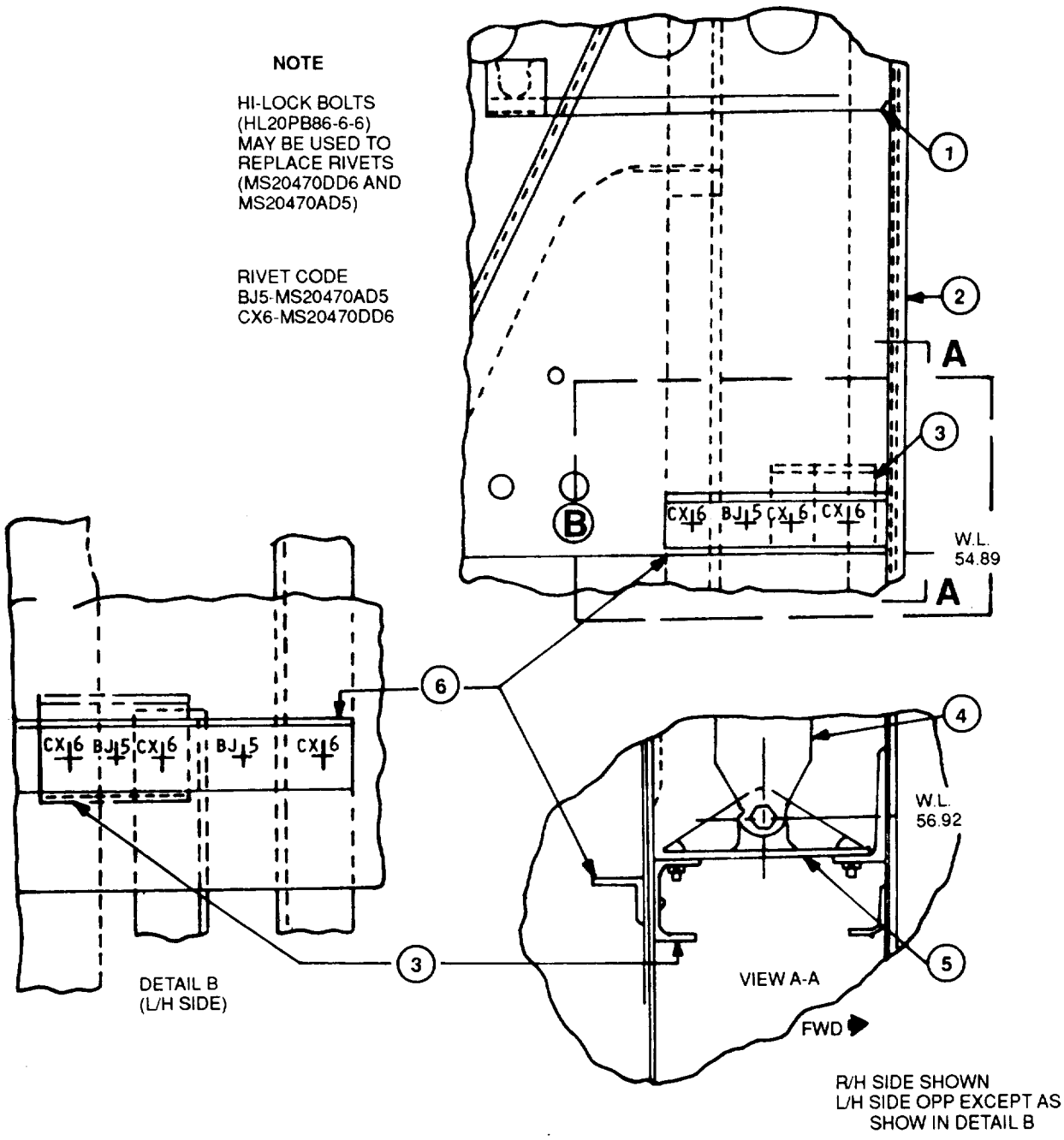
2-64.3. Repair-Friction Damper Retaining Clip.

a. If loose/working rivets are found or structural damage to the friction damper support structure is discovered proceed as follows:

(1) Remove all components above transmission.

(2) Remove transmission to unload pylon sup-port structure. Remove both left hand aft and right hand aft pylon mounts. Remove friction damper and friction damper mount.

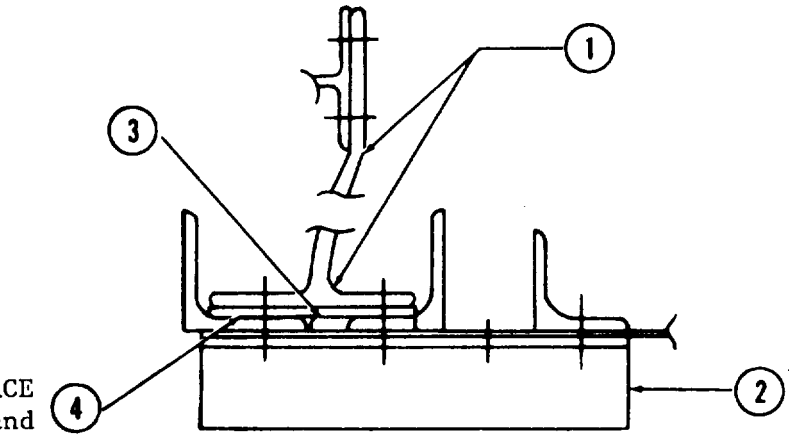
(3) Drill out loose or working rivets and replace with rivets (figure 2-23.1).

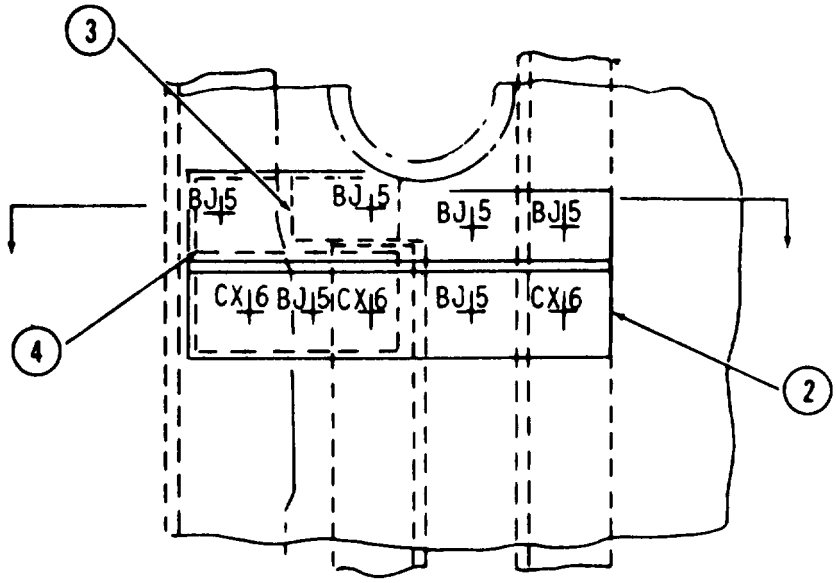


1. 204-031-246, FIFTH MOUNT FITTING
2. 205-030-919, PYLON SUPPORT STRUCTURE
3. 205-030-164-187, R/H, 205-030-163-187 L/H
4. FRICTION DAMPER MOUNT ATTACH CLIP 204-031-920-3, FRICTION DAMPER
5. 205-030-251-2, R/H - 1 L/H FRICTION DAMPER MOUNT ASSY
6. 205-030-919-28 R/H, 27 L/H, CLIP

Figure 2-23.1. Friction Damper Mount Clip Installation (S/N 62-2106 thru 70-15932)

NOTE
HI-LOCK BOLTS
(HL20PB86-6-6)
MAY BE USED TO REPLACE
RIVITS (MS20470DD6 and
MS20470AD5)



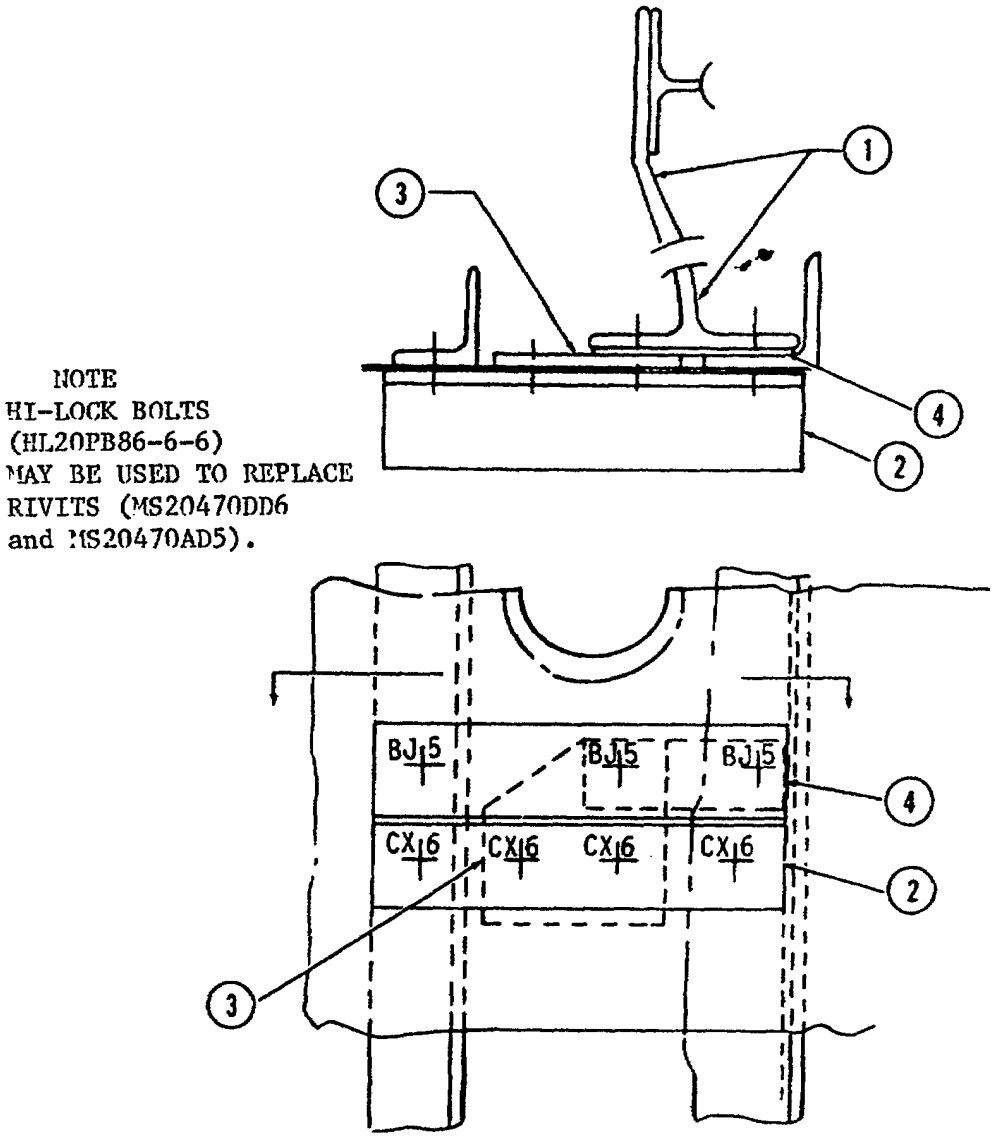


RIVET CODE
BJ5-MS20470AD5
CX6-MS20470DD6

VIEW LOOKING FWD
L/H SIDE

1. 205-031-151-1 DAMPER MOUNT SUPPORT ASSY
2. 205-031-154-1 STIFFENER
3. 2-50-31-152-1 FILLER
4. 205-031-152-3 FILLER

Figure 2-23.2. Friction Damper Mount Installation (Left Hand Side) (S/N 70-16200 and Subsequent)



VIEW LOOKING FWD
R/H SIDE

RIVET CODE
BJ5-MS20470AD5
CX6-MS20470DD6

1.	**205-031-151-2**	**DAMPER MOUNT SUPPORT ASSY**
2.	**205-031-154-3**	**STIFFENER**
3.	**205-031-152-5**	**FILLER**
4.	**205-031-152-1**	**FILLER**

Figure 2-23.3. Friction Damper Mount Installation (Right Hand Side) (SIN 70-16200 and Subsequent)

(4) Remove and replace cracked or damaged damper support structure as required to restore to original configuration.

b. At time of above maintenance or transmission overhaul/removal, remove and inspect both the left hand and right hand friction dampers (4, figure 2-23.1) for condition and replace as necessary. The dampers should be exercised to assure proper actuation at time of reinstallation.

c. Reinstall friction damper support assemblies, friction dampers, and pylon mounts.

d. Reassemble transmission assembly and rotor components.

2-64.4. FRICTION DAMPER MOUNT.

2-64.5. Inspection -Friction Damper Mount.

a. Gain access to work area on left hand side of aircraft by removing the blanket assembly (P/N 205-070-614-41) and transmission access covers (P/N 205-030-210-45, 205-030-219-19 and 205-031-221-1) in the main beam.

b. Gain access to work area on R/H side of aircraft by removing the blanket assembly P/N 205-070-614-42 and transmission access covers P/N 205-030-210-47, 205-030-219-20 and 205-031-221-2 in the main beam.

c. At the left hand and right hand aft pylon mounts in the area of the friction damper mount installation inspect rivets attaching the damper mount support assembly (1, figure 2-23.2 and-1, figure 2-23.3) and the damper stiffener (2, figure 2-23.2 and 2, figure 2-23.3) to the pylon structure. Working or loose rivets will necessitate removal and replacement.

d. Inspect damper stiffener for cracks or structural damage. Any cracks will necessitate replacement with no allowable repair. Nicks or scratches may be blended in accordance with standard maintenance actions. If crack in the damper stiffener is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

e. Inspect friction damper mount support assembly for cracks or damage. Replace if cracked or damaged beyond repair. Inspect all attachment holes for elongation or oversize. Hole damage is condition for mount assembly replacement. If crack in the friction damper mount support assembly is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

f. Inspect friction damper mount bearing for maximum allowable radial play of **0.006** inch and axial play of **0.012** inch.

2-64.6. Repair -Friction Damper Mount.

a. If loose or working rivets are found or structural damage to the friction damper support structure is discovered and replacement is required, proceed as follows:

(1) Support transmission with hoist at mast nut.

(2) Remove both left hand aft and right hand aft pylon mounts, friction dampers, and friction damper mounts (1, Figure 2-23.2 and 1, Figure 2-23.3).

(3) Drill out working rivets and replace with rivets or hi-lock bolts (Figure 2-23.2, and Figure 2-23.3).

(4) Remove and replace cracked or damaged damper support structure as required to restore to original configuration. Take care not to damage fillers between damper support assembly and the pylon web structure.

b. At time of above maintenance or transmission overhaul/removal, remove and inspect left hand and right hand friction dampers (P/N 204-031-920-3) for condition and replace as necessary. The dampers should be extended to assure proper actuation at time of installation.

c. Reinstall friction damper support assemblies, friction dampers and pylon mounts.

d. Reassemble transmission assembly and rotor components.

2-65. REPAIR OF CRACKED SPAR CAP ANGLES ON MAIN BEAMS AT STATION 129. (AVIM)

Spar Cap angles P/N 205-030-163-87/-275 and 205-030-164-87/-275 with cracks at fuselage station 129 may be repaired as follows (figure 2-24):

a. Carefully remove rivets in cracked spar cap from F.S. 107.38 to 141.38.

b. Cut spar cap within plus or minus **0.50** inch of F.S. 135 and remove damaged portion.

c. Fabricate a doubler **9.00** inches long from NAS 344-63 extrusion 7075-T6 aluminum alloy, or equivalent, to the cross section dimensions shown in figure 2-24.

d. Fabricate a filler strip from aluminum alloy (2024-T3,QQ-A-250/5), **0.032 X 0.65 X 9.0** inches (table 2-1).

e. Install a new spar cap with doubler and filler as shown in figure 2-24. Pick up existing rivet holes with next larger size rivets. Rivets shall be of same type as original rivets except all six rivets installed shall be type DD.

2-65.1. Aft Landing Gear Attachment Points Repair Procedures. If crack in the AFT landing gear attachments is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

NOTE

If inspection of the landing gear reveals excessive wear of the supports resulting in looseness of the landing gear or contact with the fuselage at any one of the four support locations, the supports shall be replaced.

a. Class A Repair Where Structure Failed.

(1) Remove landing gear and all access doors in area of aft landing gear cross tube and support aircraft at landing points.

(2) Remove floor at W.L. 22.00 over lower fuel cell.

(3) Remove lower fuel cell sump access door.

(4) Remove lower fuel cell.

(5) Remove fiberglass fairing at lower inboard edge of lower fuel cell cavity.

(6) Remove external skin rivets as required to provide access to damaged areas.

(7) Remove angles attaching lower part of center bulkhead, Sta 160 and Sta 166, to inboard face of beam at B.L. 14.

(8) Remove damaged inboard flange of lower cap angle on main beam at B.L. 14 and cut out.

(9) Fabricate new support parts from sheet steel material per figure 2-24.2.

(10) Fabricate new angles from sheet steel material for those removed in (7) above from like material but omit joggle in lower end. (See figure 2-24.3.)

(11) Fabricate filler blocks from aluminum alloy materials as shown in figure 2-24.3.

(12) Clean and prime all new parts and rework area with two coats primer (C312) prior to installation.

(13) Install new parts as shown in figure 2-24.3.

b. Class B repair where structure has yielded but did not fail.

(1) Perform steps a (1), (6), and (7) above.

(2) Straighten all deformed structure and perform a dye penetrant check on any major structural parts which appear questionable.

NOTE

Care should be exercised in straightening the lower beam cap angles.

(3) Fabricate parts. Refer to step a (9) and (10).

(4) Fabricate filler block from aluminum alloy, 0.125 thickness, as shown in figure 2-24.4.

(5) Reference step a. (12) above.

(6) Install new parts. (See figure 2-24.4.)

c. Reassembly:

NOTE

All parts damaged or found defective shall be replaced prior to installation.

(1) Reinstall all external skin rivets.

(2) Reinstall fiberglass fairing at lower inboard edge of lower fuel cell cavity if removed.

(3) Reinstall lower fuel cell and perform pressure test of system if removed.

(4) Reinstall floor W.L. 22 over lower fuel cell if removed.

(5) Reinstall all access doors.

(6) Install landing gear using new bolts An4-10A and washers AN960PD416.

2-66. FIREWALLS AND HEAT SHIELD.

2-67. Description - Firewalls and Heat Shield. The firewalls and driveshaft heat shield are installed in the engine compartment. Firewalls are constructed of MIL-T-9046 titanium sheet and the heat shield is constructed of rigidized AMS-5510 stainless steel (figure 2-25).

2-68. Classification of Damage - Firewalls and Heat Shield.

a. Negligible Damage. Surface scratches and dents are considered negligible and can be ignored unless the dents are deep enough to interfere with other installations. If this condition exists, it is necessary to bump out the dents until proper clearance is obtained or firewall is restored to its original shape.

FILLER STRIP (**0.032 x 0.65 x 9.0** 2024 AL ALY)

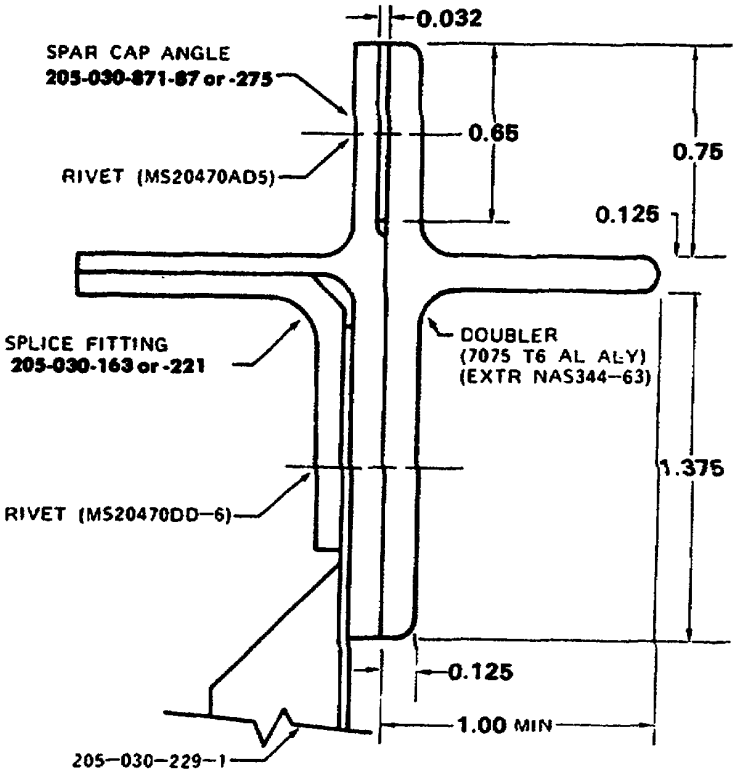


Figure 2-24. Spar Cap Angle Repair

b. Repairable Damage for Firewalls.

(1) Cracks **3.0** inches or less, repair by welding. Cracks exceeding **3.0** inches in length, repair by patching.

(2) Stiffeners, seal retainers, etc., repair by insertion. If damage warrants, replace parts.

c. Repairable Damage for Heat Shield. Damage not exceeding **2.0** inch diameter after cleanup, no closer than **1.0** inch to flange, boot or adjacent structure and a minimum **6.0** inches from similar type repair. Heat shield is not repairable by insertion repairs.

d. Damage Necessitating Replacement. Damage so extensive that time expended would warrant replacement.

2-69. Removal -Firewalls and Heat Shield.

a. Remove power plant (paragraph 4-9).

b. If forward firewall is to be removed, remove air particle separator (paragraph 4-38 or 4-53).

c. Remove forward section of tail rotor driveshaft (paragraph 6-163).

d. Remove aft lower firewall as follows:

(1) Remove screws (8, figure 2-25) and washers (9) attaching heat shield (2) to firewall (4).

(2) Remove screws (10) and washers (11) attaching firewall to service deck. Remove screws (10) and washers (11) from forward and aft legs of firewall. Retain shims under legs for reuse.

(3) Remove firewall from helicopter.

(4) If firewall is to be replaced, remove cowling mounting brackets and hardware from firewall. Save for reuse on replacement firewall.

Loosen clamp (14) securing driveshaft boot (15). Remove fireshield. Remove screws (16) to remove boot (15),

f. Remove forward firewall (1) as follows:

(1) Remove lower left access panel from pylon island.

(2) Disconnect fuel shut-off-valve, check valve manifold and fuel inlet hose from firewall.

(3) Disconnect and remove droop compensator control bellcrank at left lower corner of firewall,

(4) Disconnect power plant electrical cable from firewall. Retain screws, nuts, washers and spacers together to use during reinstallation,

(5) Disconnect hydraulic lines at right lower corner of firewall.

(6) Remove mounting screws (12) and washers (13) along both sides and bottom of forward firewall (1). Remove firewall from helicopter.

2-70. Repair or Replacement — Firewalls and Heat Shield. a. Replace damaged or worn seals.

(1) Drill out rivets securing retainer and seal to firewall. Remove seal.

(2) Position replacement seal and retainer on firewall and secure with metal fasteners. Check that seal is positioned to make proper contact with cowling (figure 2-25).

(3) Drill holes through seal and install rivets.

b. Replace latch fittings and hinge fittings if broken or unserviceable.

c. Repair firewall webs that are cracked, torn, or hole damage.

(1) Stop drill cracks. If damage is a hole or tear, cut a round or elongated hole according to shape of damage (figure 2-26). Remove only a sufficient amount of material to clean-up damage Deburr hole.

(2) Fabricate a patch of the same material and gage or next heavier gage, Allow approximately three-fourths inch overlap around cleaned area, The three-fourths inch overlap will give the required edge distance for riveting,

(3) Drill holes through firewall and patch, maintaining a minimum 4 rivet diameter spacing and a 2 rivet diameter edge distance. Remove patch and deburr holes.

(4) Position patch and rivet in place with mone rivets.

d. Replace damaged or broken fasteners.

e. Replace damaged or worn gaskets on firewall

(1) Remove gasket and aged adhesive from firewall.

(2) Abrade metal surface and replacement seal with 180 grit abrasive paper (C2). Clean abraded areas with toluene (C288). Wipe dry with clean cloths.

(3) Apply adhesive (C34) to gasket and metal surface. Position gasket on metal surface and air dry minimum four hours.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(4) Remove adhesive squeeze-out with methyl-ethyl-ketone (C177).

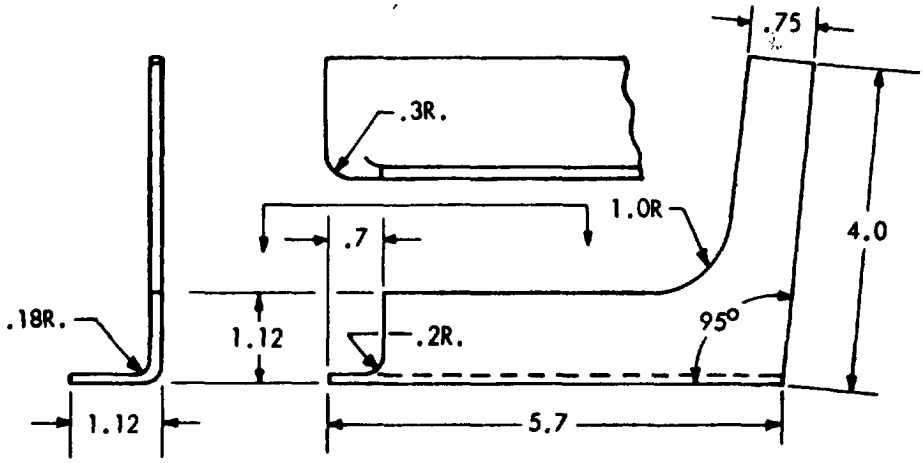
f. Repair heat shield.

(1) Clean up damage area not to exceed limits of paragraph 2-68, step c. Stop drill cracks.

(2) Fabricate a patch of 0.016 inch rigidized corrosion resistant steel AMS-5510. Patch must overlap cutout by 0.50 inch. Patch should be of uniform shape according to shape of damage. Shape patch to contour of heatshield.

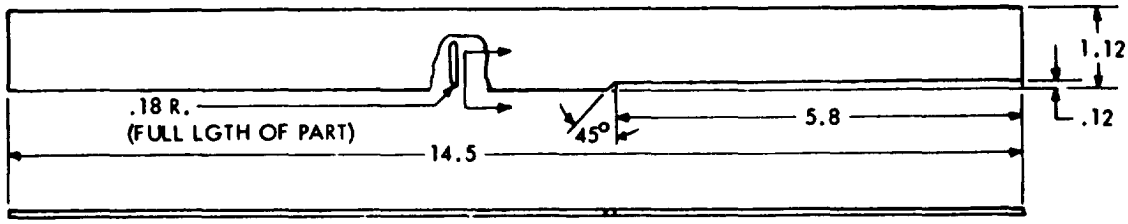
(3) Apply sealtant (C238) to mating sufaces of patch and heatshield.

(4) Install patch using CR2539-4 rivets at approximately 0.75 inch spacing.



L.H. SHOWN
R.H. OPPOSITE
MAKE FROM .125 TK.
STEEL SHEET - 4130
MIL-S-18729, COND. "N"

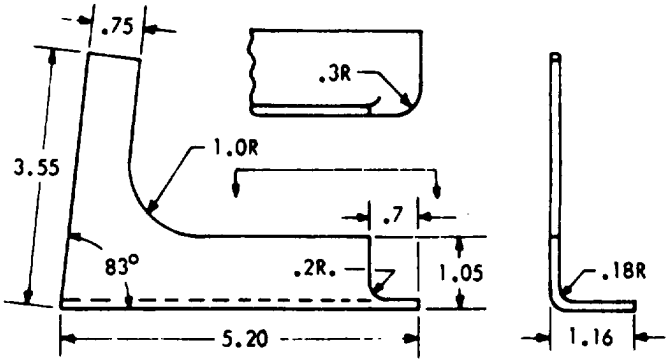
SUPPORT SPLICE – FORWARD SIDE OF SADDLE



L. H. SHOWN
R. H. OPPOSITE
MAKE FROM MIL-S-18729, STEEL SHEET
.090 TK, 4130, COND. "N"

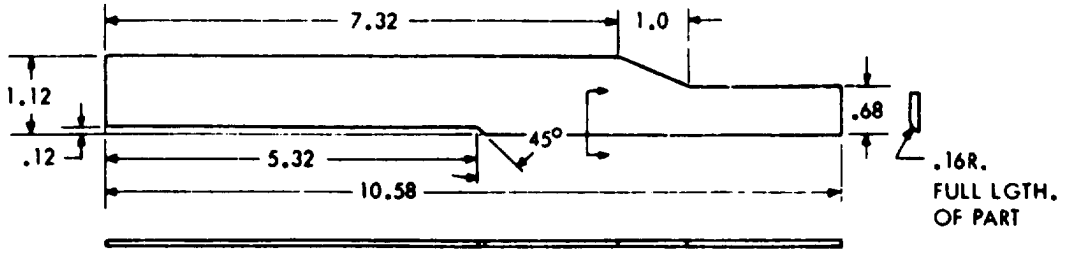
STRAP SPLICE – FORWARD SIDE OF SADDLE

Figure 2-24.2. Splice fabrication (Sheet 1 of 2)



LH SHOWN
RH OPPOSITE
MAKE FROM .125 TK.
STL. SHEET, 4130
MIL-S-18729, COND. "N"

SUPPORT SPLICE – AFT SIDE OF SADDLE



LH SHOWN
RH OPPOSITE
MAKE FROM .090 TK. STL. SHEET,
4130, MIL-S-18729, COND. "N"

STRAP SPLICE – AFT SIDE OF SADDLE

Figure 2-24.2. Splice fabrication (Sheet 2 of 2)

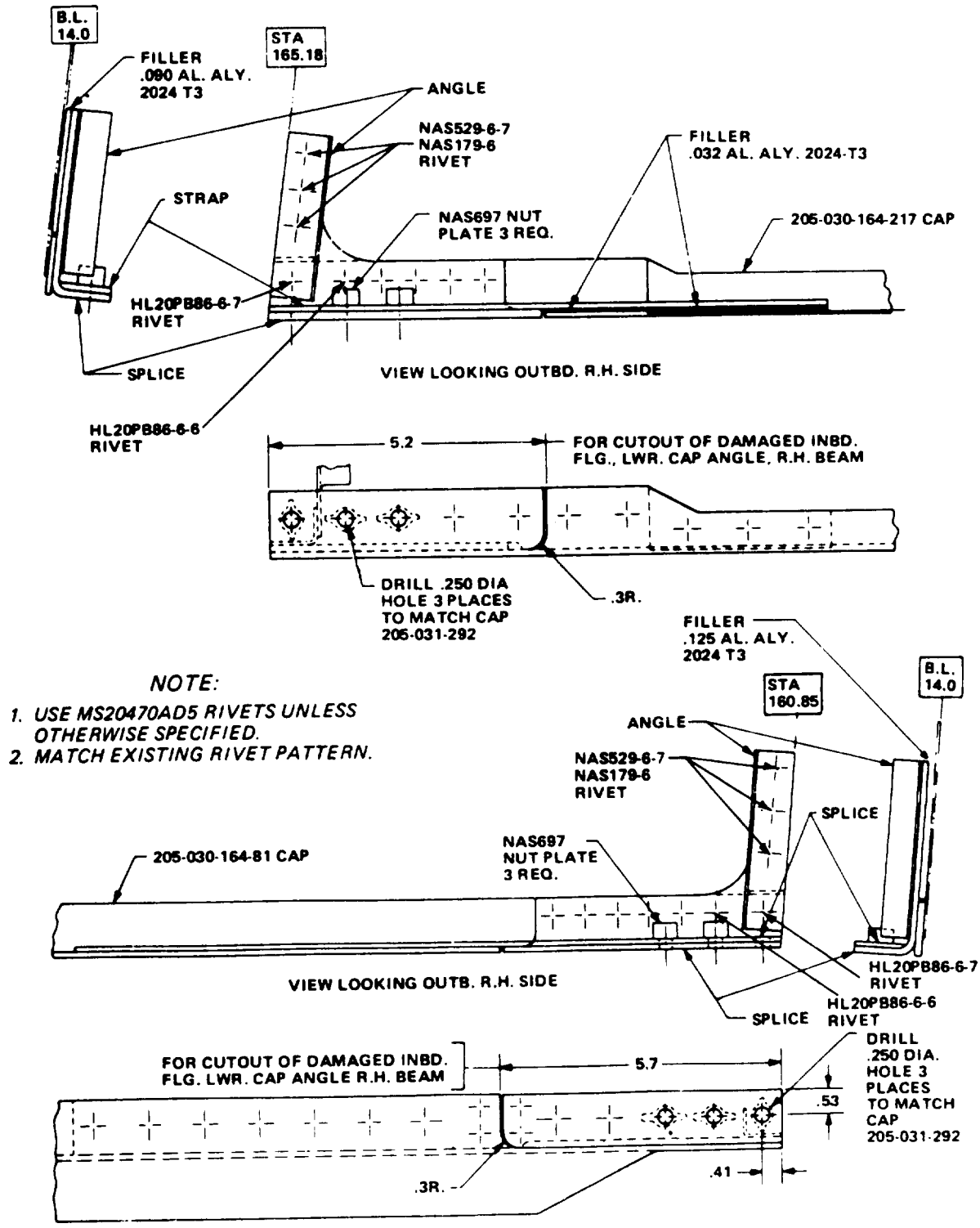


Figure 2-24.3 Strap Splice-Installation at Station 160.85 and Station 165.18.

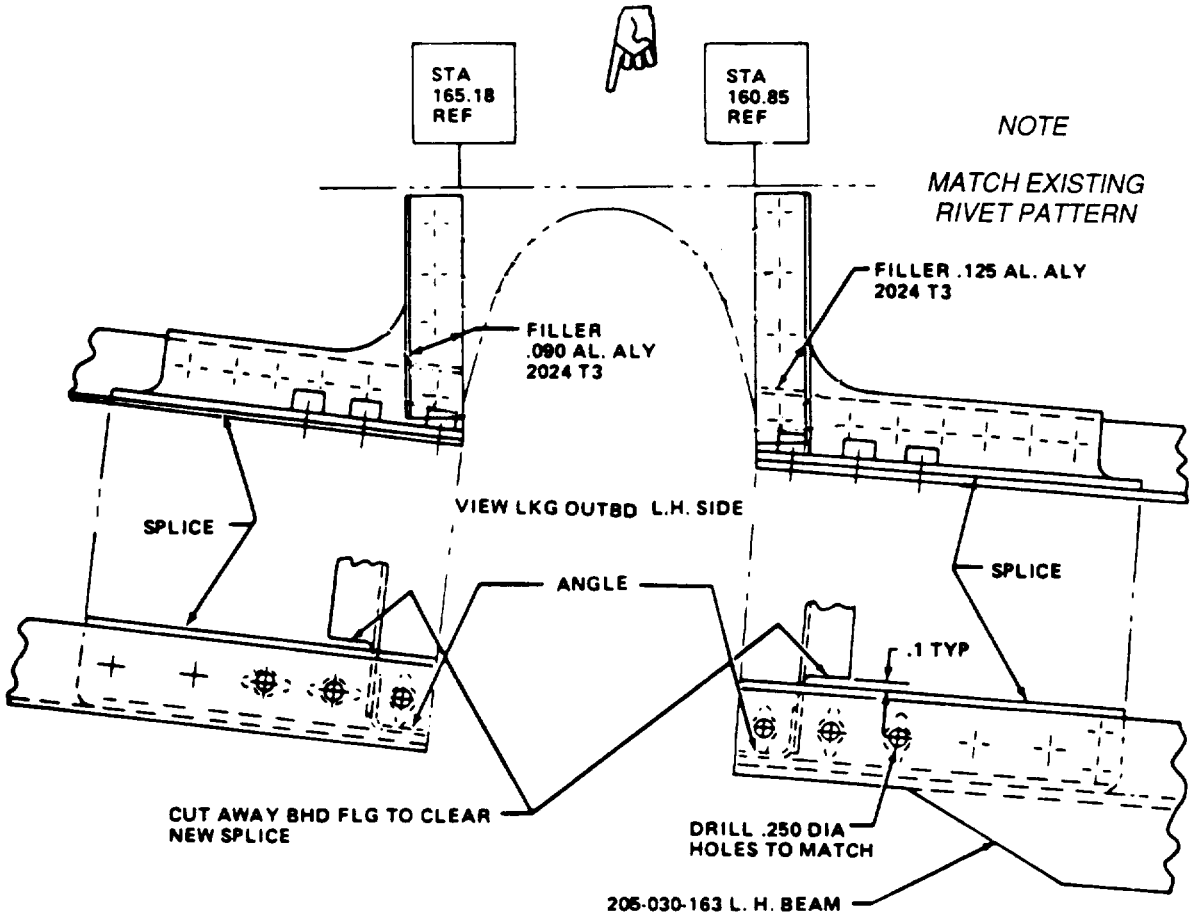


Figure 2-24.4 Aft Landing Gear Attachment Point (Class B Repair).

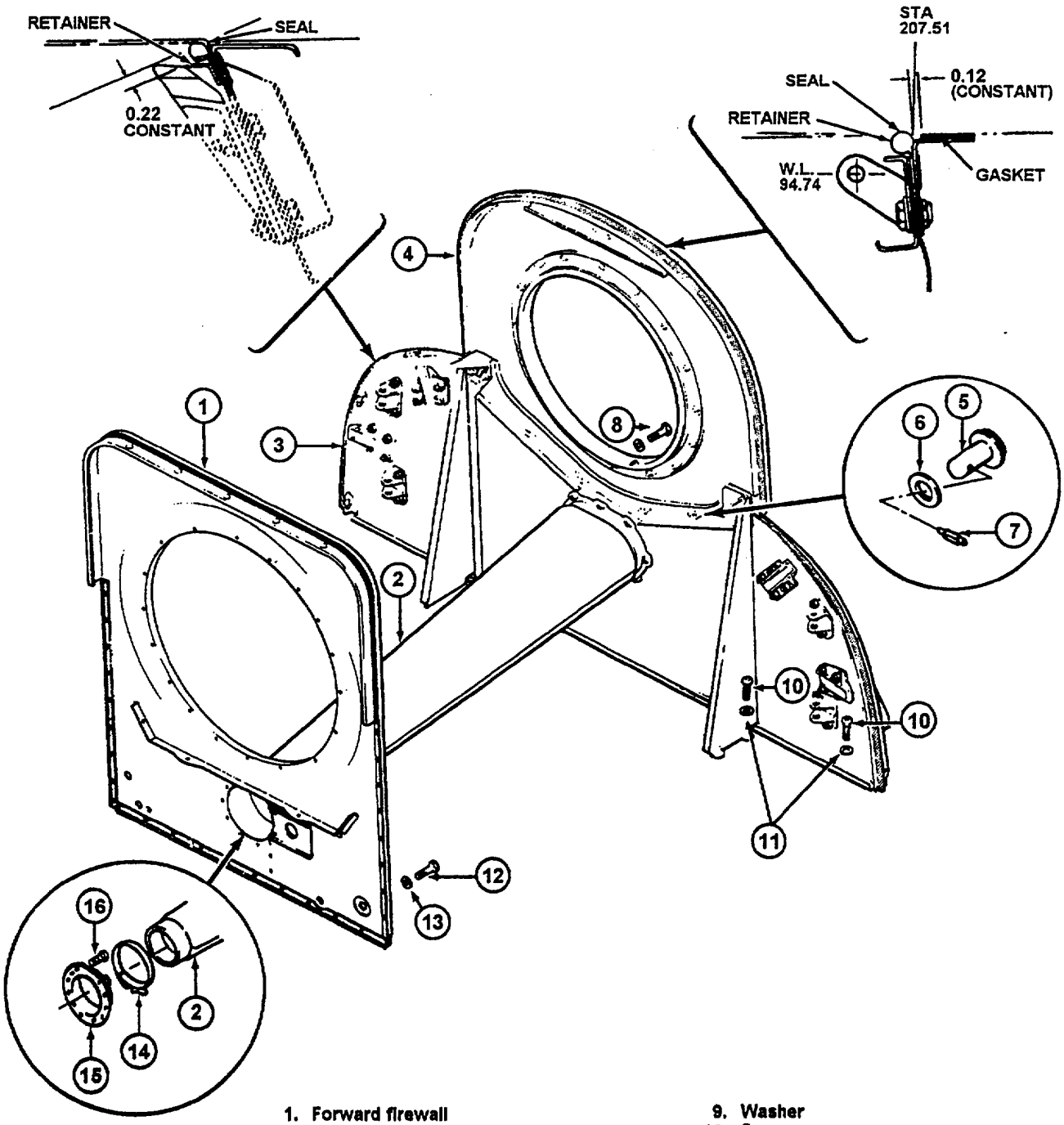


Figure 2-25. Firewall and Heat Shield

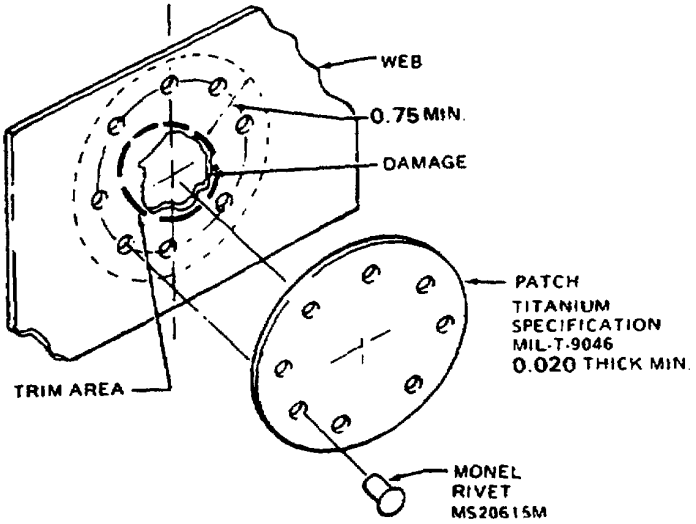


Figure 2-26. Firewall Repair

2-71. Installation - Firewalls and Heat Shield.

a. Install forward firewall (1, figure 2-25) as follows:

(1) Coat surfaces of firewall which mate with service deck and side structure with sealant (C239).

(2) Position firewall in place and install screws (12) and washers (13) along sides of bottom of firewall. Install all screws before tightening.

(3) Connect power plant electrical wiring to forward firewall using previously removed screws, nuts, washers and spacer.

(4) Connect hydraulic lines at right lower corner of firewall.

(5) Install and connect droop compensator bellcrank at left lower corner of firewall.

(6) Install fuel shutoff valve and check valve manifold on forward side of firewall. Connect fuel inlet line to fitting on shutoff valve.

b. Position clamp (14) and driveshaft heat shield (2) on boot (15) and tighten clamp. Support driveshaft fireshield until aft lower firewall is installed.

c. Install aft lower firewall (3) as follows:

(1) Install cowling mount brackets on firewall if new firewall is being installed.

(2) Position aft firewall (3) in place and install sufficient shims under forward and aft legs to prevent legs from bending when mounting screws are tightened.

(3) Install screws (10) and washers (11) through firewall lower flange and screws (10) and washers (11) through forward and aft legs. Install all screws before tightening.

(4) Install screws (8) and washers (9) to secure driveshaft heat shield (2) to aft firewall (3).

d. Install forward sections of tail rotor driveshaft (paragraph 6-166).
.

e. Install firewall (4) on engine (paragraph 4-11). Install power plant in helicopter (paragraph 4-11).

f. Install air particle separator (paragraph 4-42 or 4-57).

g. Check rigging of power turbine governor controls (paragraph 4-151).

CAUTION

Ensure throttle is closed and STARTER-GENERATOR switch is in STANDBY position.

h. Turn battery switch ON, move MAIN FUEL switch to ON. Check for leaks at fuel shut off valve and check valve manifold. Move MAIN FUEL switch to OFF, turn battery switch OFF.

i. Install access panel on pylon island.

2-72. INDUCTION BAFFLE ASSEMBLY.

2-73. Description -Induction Baffle Assembly. The three piece baffle assembly forms the bottom and forward areas of the engine air induction system. The baffle in conjunction with the forward firewall provides a mounting surface for the air inlet filters.

2-74. Removal -Induction Baffle Assembly (paragraph 4-18).

2-75. Repair -Induction Baffle Assembly. Use standard repair methods (TM 1-1500-204-23 series). Do not use blind type fasteners in baffle assembly repairs.

2-76. Installation -Induction Baffle Assembly (paragraph 4-22).

2-77. NOSE DOOR.

2-78. Description -Nose Door. The cabin nose door is constructed of aluminum alloy honeycomb core with glass fabric inner and outer skins. The door is mounted on two hinge assemblies and secured in the locked position by spring loaded latches. (Figure 2-27.)

2-79. Removal -Nose Door.

a. Remove screws (2, figure 2-27) and washers (1) attaching door to hinge bracket (11). Release latches and remove door.

b. Remove hinge (8) and stay installation (7).

(1) Remove pin (5), nut (6), bolt (3), and washers (4).

(2) Remove bolt (15, detail A), nut (13), washers (14, 16, 19) and spacer (17). Remove hinge and stay.

(3) Separate hinge and stay by removing nut (26) and saddle washers (25).

(4) Remove screw (10), nut (12), and saddle washers (9) to separate bracket (11) from hinge (8).

(5) Remove pin (23, detail A), pin (21), washers (22), and eyebolt (24).

c. Disassemble plunger assembly (20).

(1) Remove nut (18).

(2) Separate plunger (27) and spring (29) from retainer (28).

2-80. Inspection -Nose Door.

a. Inspect door for cracks, holes or damage. Refer to table 2-5 for limits. Inspect seal for damage. If damage to the nose door is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

b. Inspect latches for damage and security.

c. Inspect hinge and plunger for damage. Replace if damaged.

d. Inspect mounting brackets for damage.

2-81. Repair or Replacement -Nose Door.

a. Repair door panel in accordance with paragraph 2-18.

b. Replace hinge (8, figure 2-27) and plunger (20) if unserviceable.

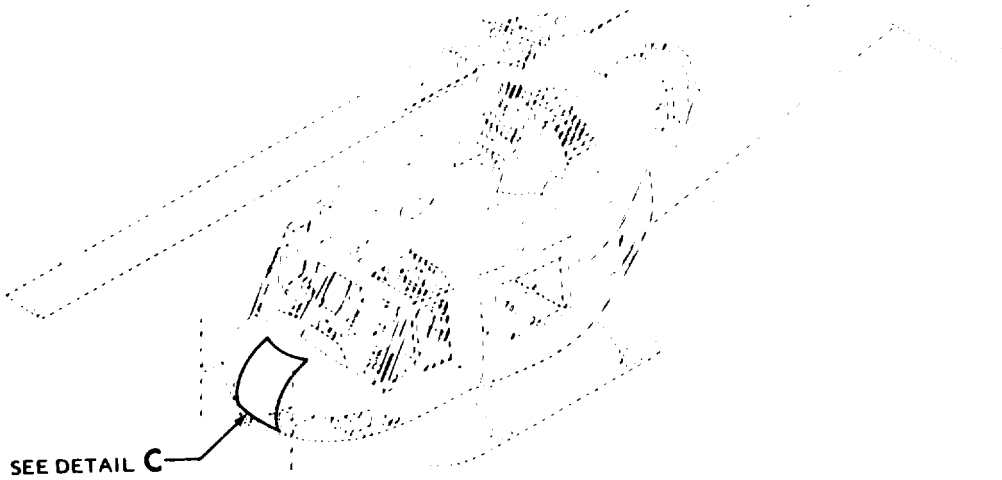
c. Repair mounting brackets by standard repair methods. (TM 1-1500-204-23 series).

d. Replace damaged seal (30, detail C). Bond replacement seal with adhesive (C22).

2-82. Installation -Nose Door.

a. Assemble plunger (20, figure 2-27, detail B).

(1) Apply film of grease (C127) to plunger (27), and retainer (28).



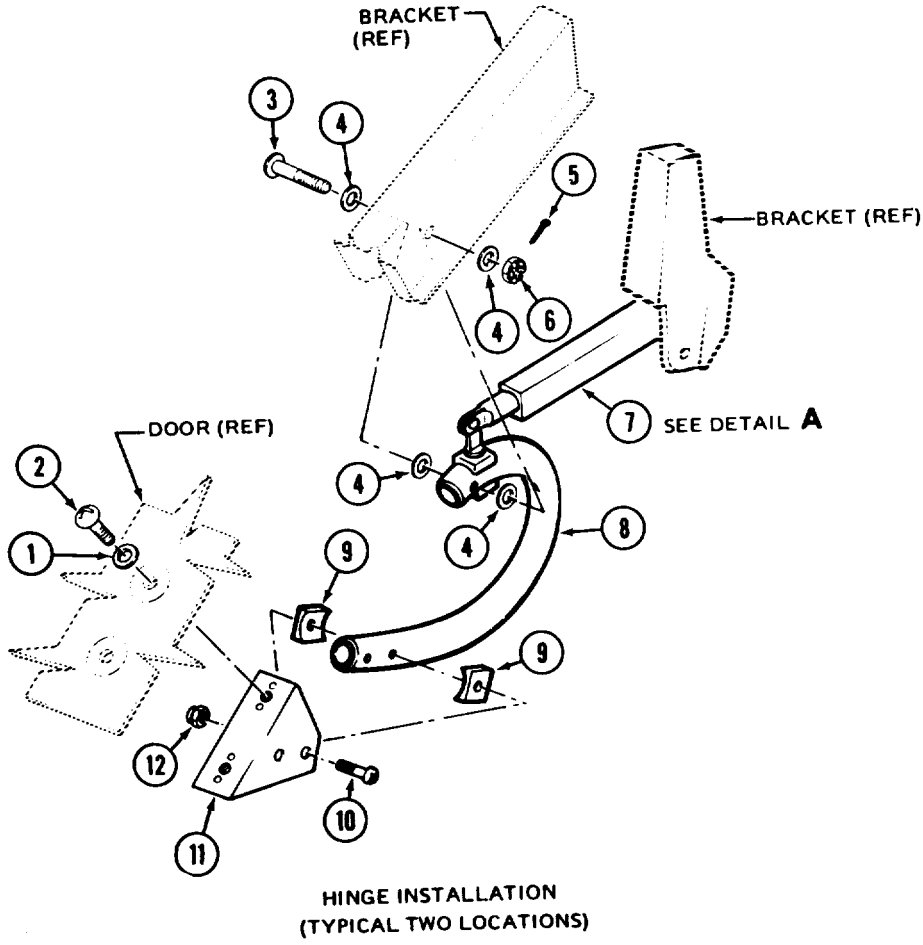
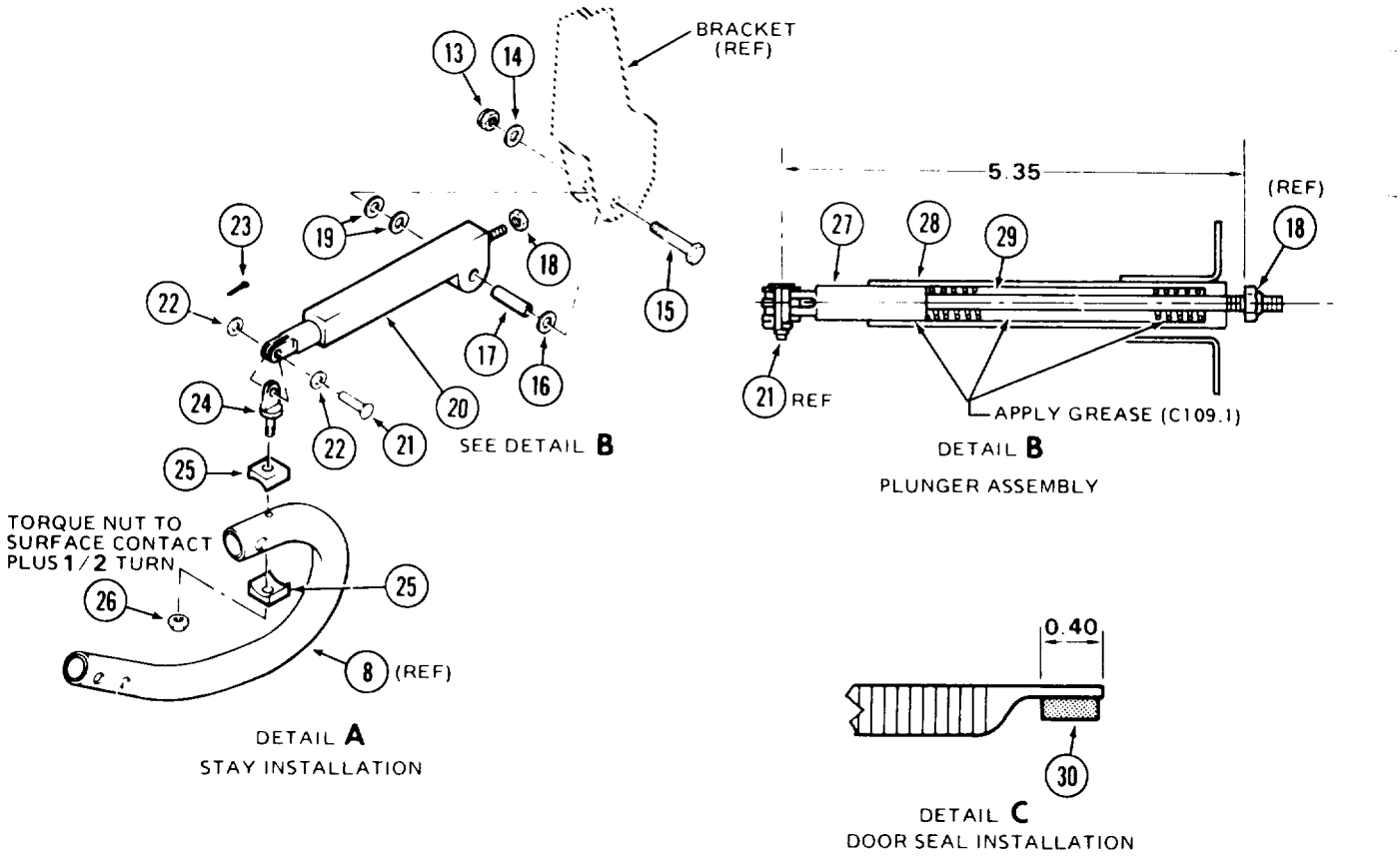


Figure 2-27. Nose Door Installation (Sheet 1 of 2)



1. Washer
2. Screw
3. Bolt
4. Washers
5. Cotter pin
6. Nut
7. Stay installation
8. Hinge assembly
9. Saddle washers
10. Screw
11. Bracket
12. Nut
13. Nut
14. Washer
15. Bolt
16. Washer
17. Spacer
18. Nut
19. Washers
20. Plunger assembly
21. Pin
22. Washers
23. Cotter pin
24. Eye bolt
25. Saddle washers
26. Nut
27. Plunger
28. Retainer
29. Spring
30. Seal

Figure 2-27. Nose Door Installation (Sheet 2 of 2)

(2) Position spring (29) on plunger shaft and insert spring and plunger in retainer (28). Install nut (18) and adjust to dimension shown in Detail B, Final adjust is made at installation.

b. Position eye bolt (24, detail A) in clevis end of plunger (20) and install pin (21) washers (22) and pin (23).

c. Insert spacer (17) in plunger (20). Position plunger (20) in mounting bracket with one washer (16) and two washers (19) located between spacer ends and bracket, Install bolt (15), washer (14) and nut (13),

d. Position saddle washers (25) on each side of hinge (8) and insert eyebolt (24) through washers and hinge. Install nut (26). Tighten nut to surface contact plus 1/2 turn.

e. Position saddle washers (9) on each side of hinge (8) and install bracket (11) with screw (10) and nut (12). Align hole in hinge with hole in bracket and install bolt (3), washers (4), and nut (6). Install cotter pin (5).

f. Position nose door on frame and align holes in door with bracket (11). Install screws (2) and washers (1).

g. Functionally check door and latches. If required, adjust nut (18) to limit or extend travel length of plunger (20).

2-83. Painting -Nose Door (TM 55-1500-345-23).

2-84. CREW DOORS.

2-85. Description -Crew Doors. The two crew doors (14, figure 2-1) are hinged on the forward side and are equipped with a latch assembly, which may be operated from either side of the door, to secure the door in the closed position. Each door incorporates three transparent acrylic plastic windows, which may be termed the forward, upper, and adjustable windows. In an emergency, doors may be jettisoned by pulling the EMERGENCY RELEASE handle mounted inside the cabin forward of each door.

2-86. Inspection -Crew Doors (Installed).

NOTE

The following inspections should be performed, to determine serviceability, prior to removing door.

a. Visually inspect seal strips around inner edge of door for deterioration and damage.

b. Examine door hinges (10, figure 2-28) for cracks, condition of spring assemblies, rubber bumper, and shim. Door hinges may be inspected by fluorescent penetrant method. Maximum allowable wear limit dimensions for crew door hinge halfs on fuselage are as follows: If crack in the door hinge is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

	PN	Wear Limit
Upper	204-031-837	0.193 I.D.
Lower	204-031-467	0.193 I.D.

	Hinge Halfs Door	
Upper	204-031-658	0.193 I.D.
Lower	204-031-468	0.193 I.D.

c. Visually inspect sliding window stop assembly, located at forward end of lower window channel. If required used adhesive, synthetic rubber (item C39, Table 1-1).

d. Check roller assemblies (2) for smoothness of operation in channel and for condition of threads.

NOTE

With door in locked position, tops of roller assemblies (2) should clear channel by 0.08 inch.

e. Visually inspect all components of the ejection mechanism. Adjust emergency jettison device so rounded end of pins are visible above the upper hinge and below the lower hinge.

NOTE

Actuate emergency jettison device to make certain pins clear hinges and door can be properly jettisoned. If door does not jettison, readjust as necessary.

f. Inspect door for cracks, dents and damage. If damage to the door is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

2-87. Removal Crew Doors.

a. Open crew door and hold in open position.

b. Pull EMERGENCY RELEASE ejection handle assembly (9, figure 2-28) and lift door from helicopter.

2-88. Repair or Replacement -Crew Doors.

a. Replace seal strips around inner edge of door if deteriorated or damaged. Attach new seal with adhesive (C24).

b. Replace door hinges, spring assemblies, rubber bumper, or shim if unsuitable for continued use.

NOTE

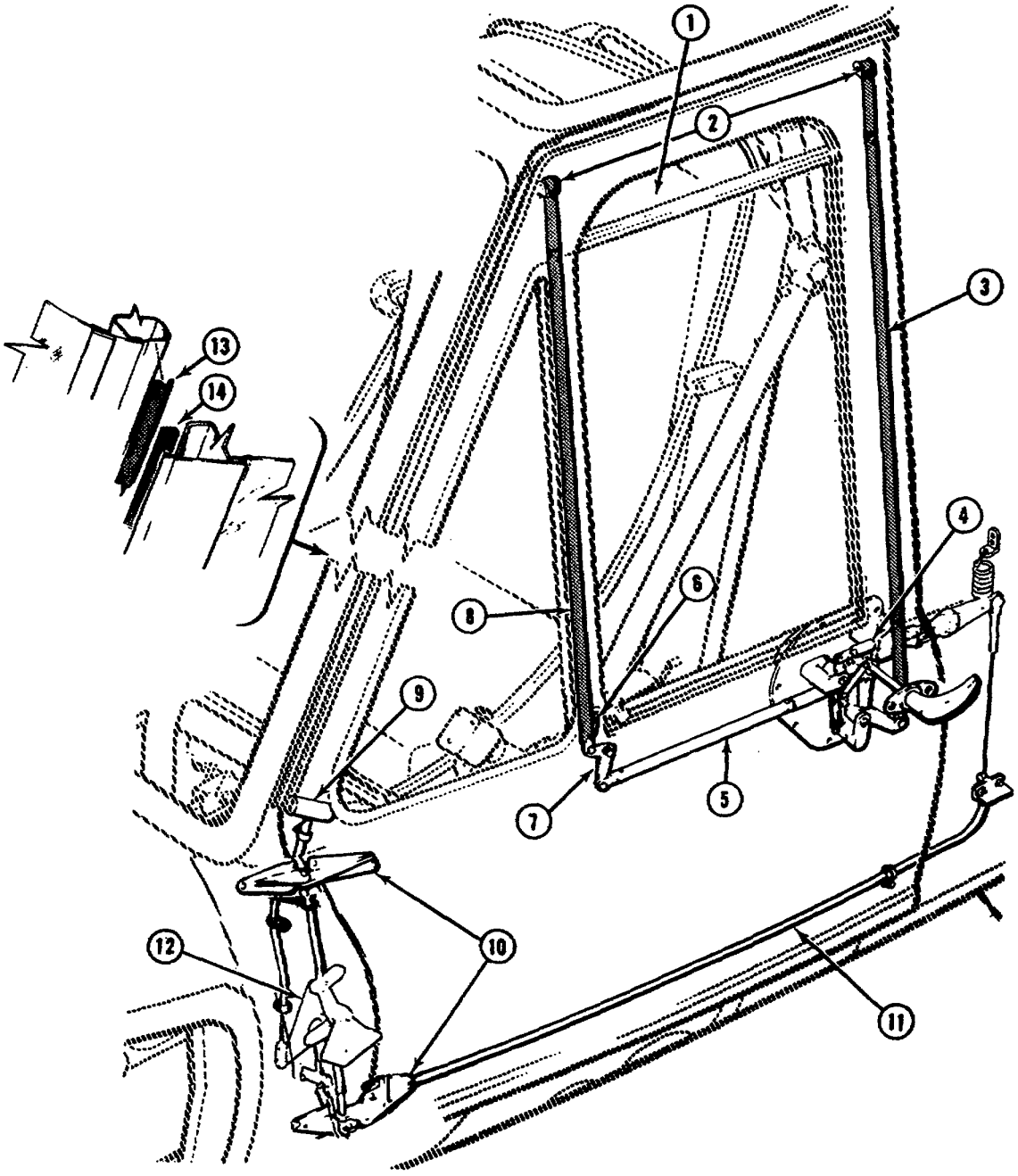
Bond rubber bumper in place with cement (C57). Shim is to be bonded with adhesive (C26) or with adhesive (C28).

c. Replace any part of sliding window stop assembly located at forward end of lower window channel which appears to be unsuitable for continued use.

d. Replace components of latching mechanism if unserviceable (paragraph 2-91).

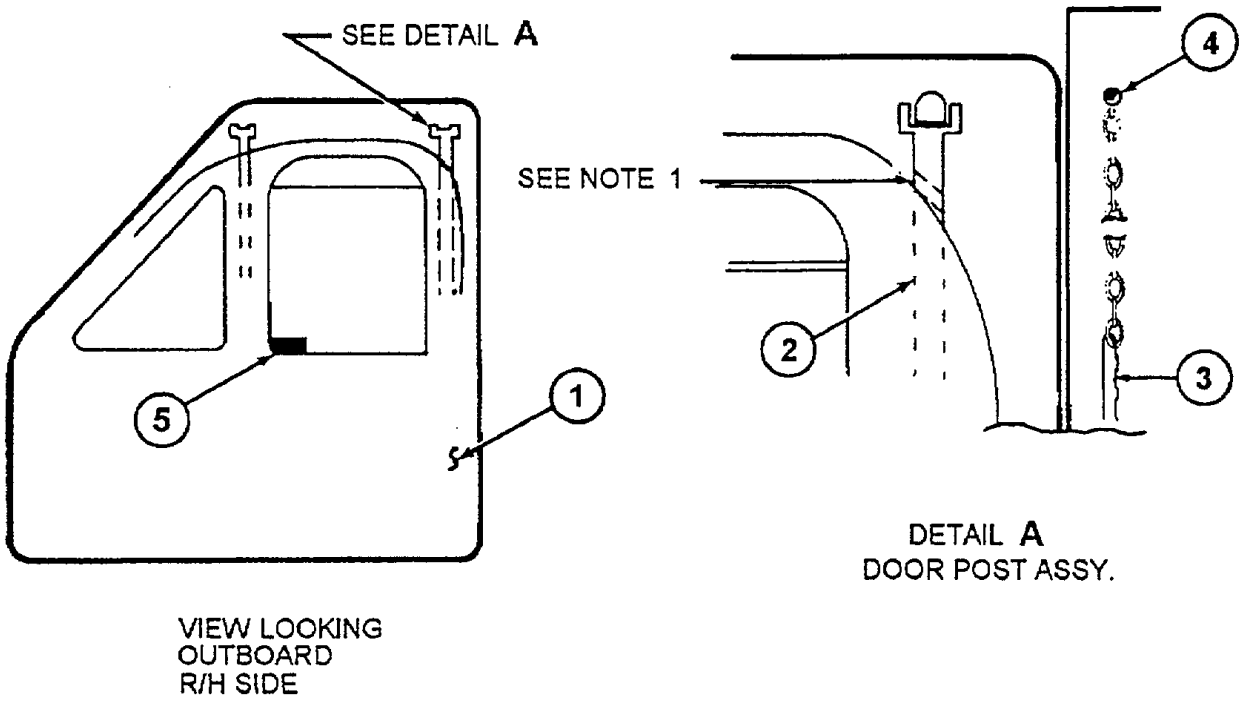
e. Replace components of ejection mechanism assembly if unserviceable (paragraph 2-98).

f. Repair skin and structure (TM 55-1500-204-25/1).



1. Acrylic plastic panels
2. Door roller assemblies
3. Aft vertical latch tube
4. Door latch
5. Lower horizontal latch tube
6. Latch release spring
7. Bellcrank
8. Forward vertical latch tube
9. Ejection handle assembly
10. Door hinges
11. Striker ejection cable
12. Ejection mechanism
13. Seal
14. Seal

Figure 2-28. Crew Doors



NOTE 1. 3/32 in. dia. hole is drilled in upper aft locking rod, parallel to adjacent door structure, to accomodate pin.

1. Door assy. 204-030-853
2. Locking rod, 204-030-483
3. Pin assy, AN415-2
4. Rivet, CR3243-4-2
5. Block, 1560-UH-1-761

Figure 2-28.1. Installation of Security Device, Pilot's Door (1560-UH1-762)

2-89. Painting — Crew Doors. Refer to TM 55-1500-345-23 for painting information.

2-90. Installation — Crew Doors. a. Lift door to position, pull ejection handle to retract hinge pins, align hinge halves, and release handle to engage hinge pins.

b. Close door slowly, observing action of latch, Slowly move handles to lock position, observing engagement of latch rods with upper strikers and for clearance above each rod when fully extended.

c. Check adjustment of latching and ejection mechanism (paragraph 2-91).

2-91. Adjustment — Crew Doors. a. With door handle in locked position, adjust latch tubes as follows:

(1) Adjust aft vertical latch tube so a clearance of 0.08 inch is obtained between top of door roller assembly (2, figure 2-28) and bottom of channel.

(2) Adjust forward vertical latch tube so a clearance of 0,08 inch is obtained between top of door roller assembly and bottom of channel.

b. Loosen screws and adjust strikers located on upper door structure as necessary for proper engagement with rollers (2).

c. Adjust ejection mechanism as follows:

(1) Adjust linkage of ejection mechanism so rounded ends of pins are visible above the upper hinge and below the lower hinge.

(2) Support door and pull ejection handle (9), Ensure pins clear hinges and door can be jettisoned. Adjust ejection linkage as necessary.

(3) Safetywire ejection handle with 0.020 inch copper wire (C305) after adjustments are complete.

d. If hinge halves, located on cabin nose, are replaced, adjust shims as needed for proper alignment.

2-92. LATCHING MECHANISM, CREW DOORS.

2-93. Description — Latching Mechanism. The latching mechanism (figure 2-29) consists of a latch assembly, with inside and outside handle, rods, and bellcrank. Actuation of either handle will release rollers on vertical rods and latch catch from strikers mounted on cabin structure.

2-94. Removal — Latching Mechanism. a. Remove crew door (paragraph 2-87).

NOTE

Remove latch mechanism only to extent necessary for parts replacement.

b. Disconnect latch rod (15, figure 2-29) from latch arm by removing cotter pin and pin (18).

c. Remove inner access door and lower plug button from inner face of door.

d. Disconnect rod (11) from bellcrank (6) by removing cotter pin and pin (10). Unscrew aft end of rod from rod-end on latch assembly (14). Remove rod through inboard side of door.

e. Remove attaching screw and remove inner handle (13).

f. Remove nine screws (12) to detach latch plate from inner face of door. Hold latch shaft (19) while sliding latch assembly (14) off inboard end,

g. To disassemble latch proceed as follows:

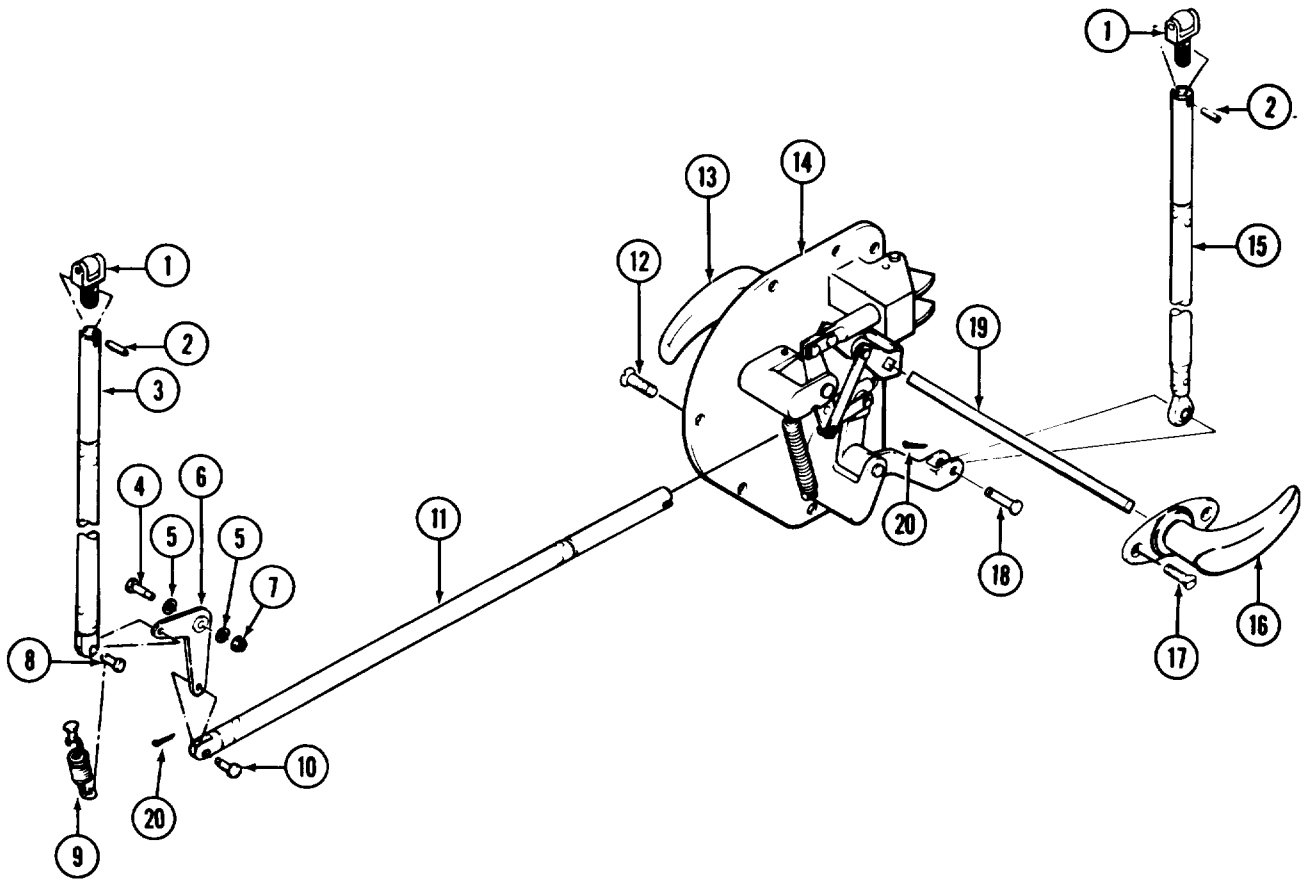
(1) Remove cotter pin and pin (2, figure 2-30) holding latch spring (3) in catch (6). Remove pin (5) fastening roller assembly (4) to ram (29) and unscrew roller assembly from ram assembly.

(2) Remove cotter pin and pin (28) attaching ram assembly (29) to lever assembly (27) and remove ram assembly.

(3) Back off setscrew (18) attaching spindle (8) to arm assembly (17) and remove spindle.

(4) Unhook and remove latch centering spring (15), spacer (14), and pin (7).

(5) Remove cotter pin and pin (24) attaching arm assembly (17) to upper latch links (26) and remove arm assembly. Remove snap rings (30) attaching upper latch links (26) to latch lever (27) and remove links.



1. Roller
2. Pin
3. Latch rod
4. Shouldered bolt
5. Washer
6. Bellcrank
7. Nut
8. Pin
9. Spring
10. Pin
11. Rod
12. Screw
13. Inner handle
14. Latch assembly
15. Latch rod
16. Outer handle
17. Screw
18. Pin
19. Latch shaft
20. Cotter pin

Figure 2-29. Crew Door Latching Mechanism

(6) Remove cotter pin and pin (22) attaching lower latch links (23) and rod end (25) to jackshaft (21), and remove links and rod end.

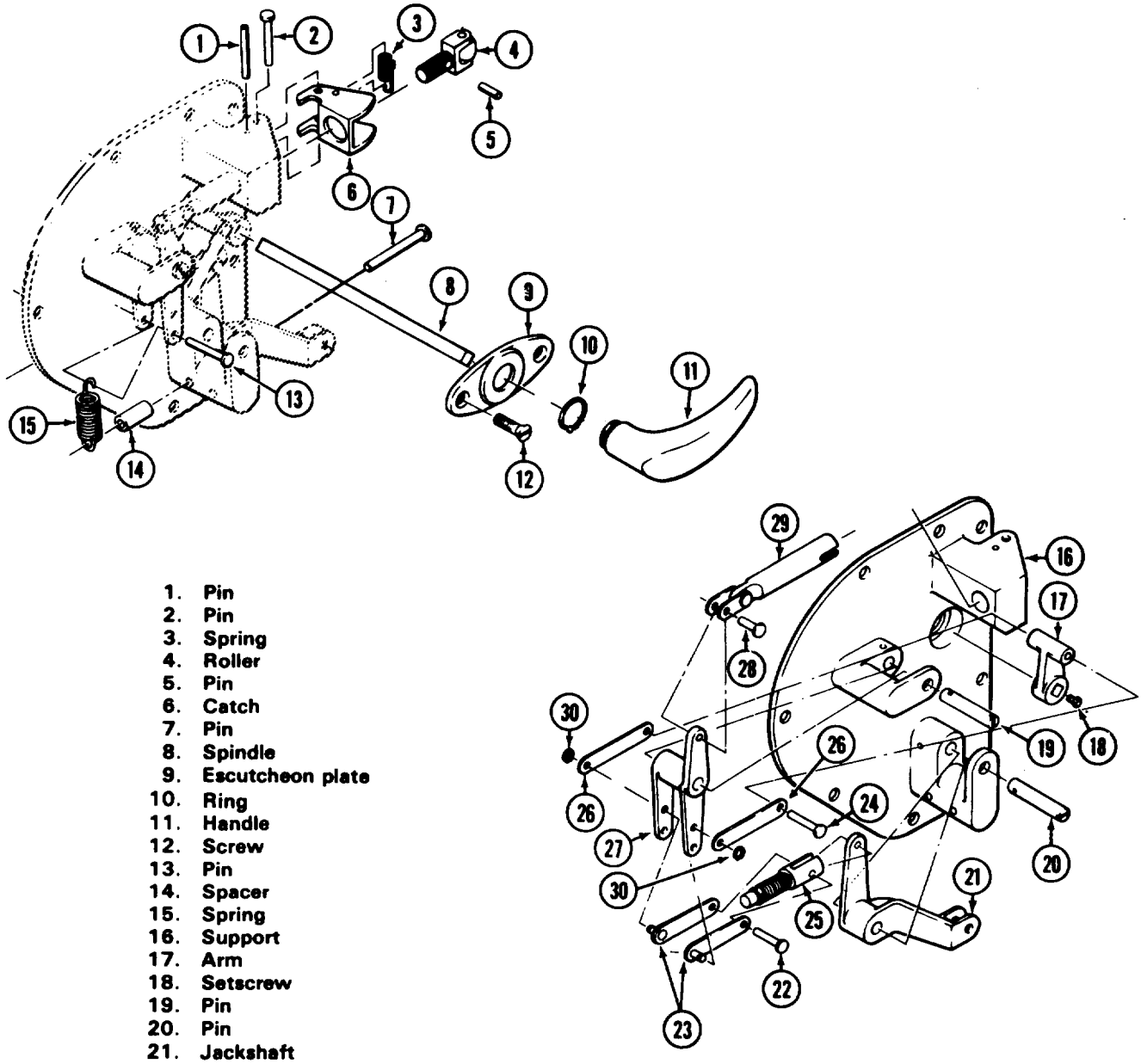
(7) Remove cotter pin and pin (20) attaching jackshaft (21) and remove jackshaft.

(8) Remove cotter pin and pin (19) attaching lever assembly (27) and remove lever.

h. Remove outer handle (16, figure 2-29) by removing two screws (17) attaching escutcheon to door. Loosen set screw (or remove pin) in handle (11, figure 2-30) and separate handle from spindle (8). Remove ring (10) and separate handle (11) and escutcheon plate (9).

i. Disconnect latch rod (3, figure 2-29) from bellcrank (6) by detaching spring (9) and removing pin (8). Remove upper plug button from inner face of door and remove shouldered bolt (4) with nut (7) and washers (5) to detach bellcrank from its support.

j. To remove either latch rod (3 or 15), remove spring pin (2), unscrew latch rod roller (1), and remove rod downward through door.



1. Pin
2. Pin
3. Spring
4. Roller
5. Pin
6. Catch
7. Pin
8. Spindle
9. Escutcheon plate
10. Ring
11. Handle
12. Screw
13. Pin
14. Spacer
15. Spring
16. Support
17. Arm
18. Setscrew
19. Pin
20. Pin
21. Jackshaft
22. Pin
23. Links
24. Pin
25. Rod end
26. Link
27. Lever
28. Pin
29. Ram
30. Rings

Figure 2-30. Crew Door Latch Disassembled View

2-95. Inspection — Latching Mechanism. e. Inspect rollers (1, figure 2-29) for roughness and wear.

b. Inspect rods (3, 11, and 15) for wear in clevis pin holes, damage to internal threads or damage to rod which would hinder proper operation.

c. Check bellcrank (6) for bushing wear. If bushing appears worn, and is loose on shouldered bolt (4), bushing should be replaced.

d. Inspect components of latch assembly as follows:

(1) Inspect. roller assembly (4, figure 2-30), ram assembly (29), latch links (23 and 26), spindle (8), pins (19 and 20), jackshaft (21), and lever assembly (27) for damage, wear, and serviceability.

(2) Inspect internal threads of ram (29), arm assembly (17), and threads of rod end (25) for damage.

(3) Check arm assembly (17) for spindle fit

(4) Inspect links (23 and 26) for damage or wear of end pin, hole elongation or distortion.

(5) Inspect latch centering spring (15) for initial tension of 1.66 pounds, spring rate of 9.15 pounds per inch, and a load of 15.39 (plus or minus 1.5) pounds at 2.96 inches extended length.

(6) Inspect latch release spring (3) for initial tension of 0.30 pound, spring rate of 3.54 pounds per inch, and a load of 2.0 pounds (plus or minus 0.030 pound) at 1.75 inches extended length.

2-96. Repair or Replacement — Latching Mechanism. Replace components that fail to meet inspection requirements,

2-97. Installation — Latching Mechanism.

NOTE

Lubricate hinge and pivot points with a light coat of grease (C123) during assembly.

a. Assemble latch as follows (figure 2-30):

(1) Install jackshaft (21) with pin (20) and cotter pin.

(2) Position ram assembly (29) in latch housing of support.

(3) Position lower latch links (23) and upper latch links (26) on lever assembly and secure with snap rings (30).

(4) Position lever assembly (27) on support (16) and secure with pin (19) and cotter pin.

(5) Connect rod end (25) and lower latch links (23) to arm of jackshaft (21) with pin (22) and cotter pin.

(6) Connect forward end of upper latch links (26) to arm assembly (17) with pin (24) and cotter pin.

(7) Install spindle (8) through arm assembly (17) and secure with set screw (18).

(8) Attach ram assembly (29) to arm of lever assembly (27) with pin (28) and cotter pin.

(9) Insert pin (7) in support (16) and position spacer (14) on pin. Insert pin (13) in lever (27) and install cotter pin. Connect latch centering spring (15) to hole in pin (7) and on pin (13).

(10) Position catch (6) and spring (3) in latch housing. Install pin (2) and cotter pin. Install pin (1) engaging loops in ends of spring (3).

(11) Screw roller assembly (4) into ram assembly (29) and install pin (5) to secure in place.

b. Insert latch rods (3 and 15, figure 2-29) up through door structure, forward and aft of sliding window opening, until ends pass through guides at top of door. Install a latch rod roller (1) into end of each rod with not less than 0.30 inch thread engagement. Install spring pin (2).

c. Position bellcrank (6), with longest arm down, in support. Install shouldered bolt (4) from inboard side with washers (5) under head and nut (7), using access hole in inner face of door.

d. Connect spring (9) to end of pin inserted through hole in window frame. Connect latch rod (3) to short arm of bellcrank (6) with pin (8) and cotter pin. Hook spring into end of pin.

e. Position latch assembly (14, figure 2-29) on inboard end of latch shaft, Attach plate of latch to door with nine screws (12).

f. Position handle (11, figure 2-30) on escutcheon plate (9) and install ring (10). Position handle (11) on spindle (8), and tighten setscrew (or reinstall pin). Attach escutcheon (9) to door with two screws (12).

g. Install inboard handle (13, figure 2-29) with screw.

h. Position rod (11) horizontally in door and screw threaded end on mating rod-end on latch assembly until bottomed. Adjust by backing off rod to connect to lower arm of bellcrank (6) with pin (10) and cotter pin, with rod (3) fully extended. Final adjustment will be made with door installed.

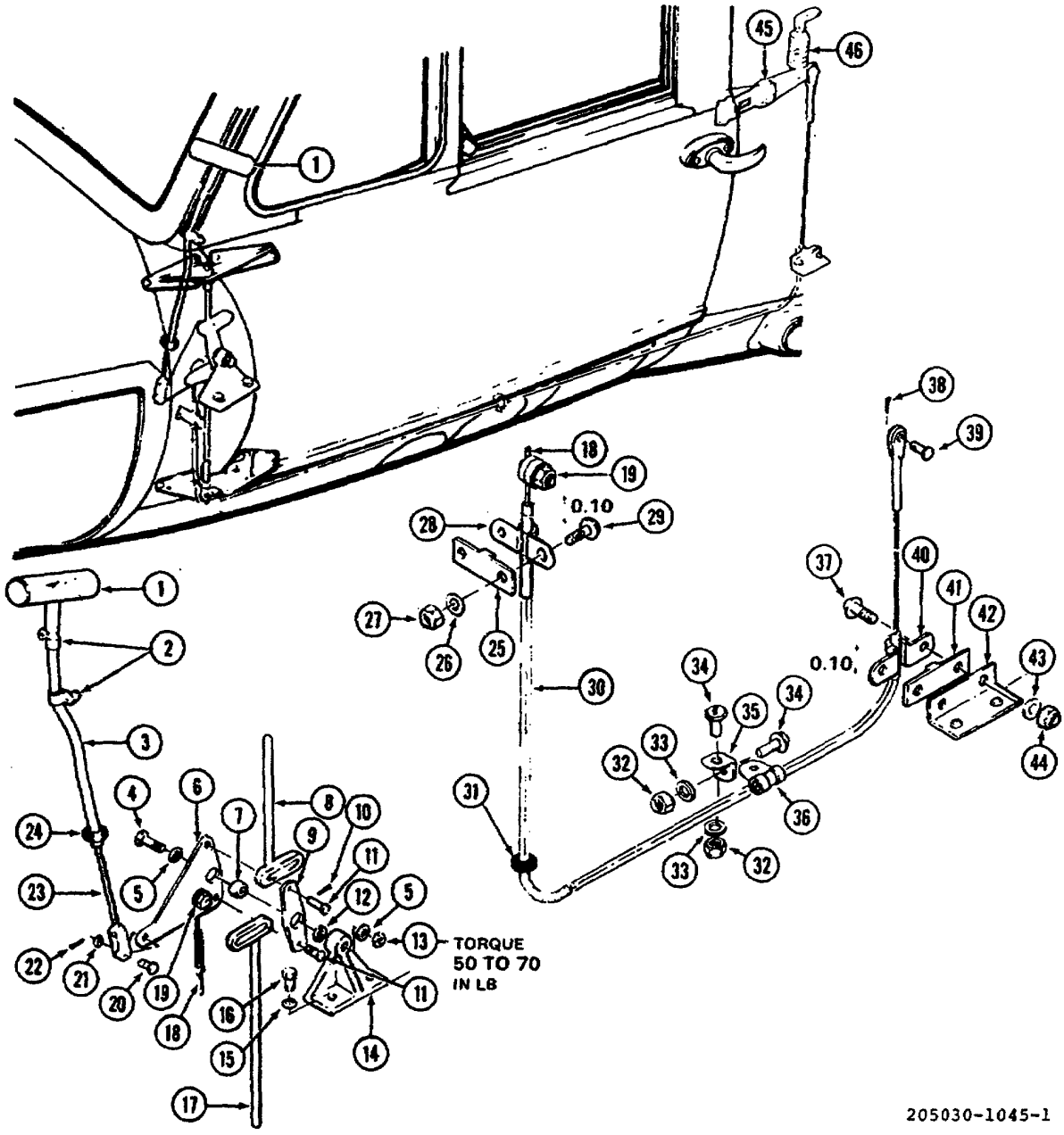


Figure 2-31. Crew Door Jettison Mechanism (Sheet 1 of 2)

1.	Ejector handle	13.	Nut	25.	Spacer	37.	Screw
2.	Clamps	14.	Support	26.	Washer	38.	Cotter pin
3.	Tube	15.	Washer	27.	Nut	39.	Pin
4.	Bolt	16.	Bolt	28.	Clamp	40.	Clamp
5.	Washer	17.	Lower hinge pin	29.	Screw	41.	Spacer
6.	Plate	18.	Ejection cable	30.	Flexible casing	42.	Bracket
7.	Spacer	19.	Swivel	31.	Grommet	43.	Washer
8.	Upper hinge pin	20.	Pin	32.	Nut	44.	Nut
9.	Link	21.	Washer	33.	Washer	45.	Latch striker
10.	Cotter pin	22.	Cotter pin	34.	Screw	46.	Spring
11.	Pin	23.	Cable	35.	Bracket		
12.	Washer	24.	Grommet	36.	Clamp		

Figure 2-31. Crew Door Jettison Mechanism (Sheet 2 of 2)

i. Connect latch rod (15) to arm on latch assembly (14) with pin (18) and cotter pin.

j. Install door (paragraph 2-90). Check adjustment of latching mechanism (paragraph 2-91).

k. Install access doors and plug buttons on door after adjustment of latching mechanism.

2-98. CREW DOOR JETTISON (EJECTION) MECHANISM.

2-99. Description - Crew Door Ejection Mechanism. The crew door ejection mechanism consists of an ejection handle, hinge pins and a cable assembly. When the ejection handle is pulled the hinge pins (8 and 17, figure 2-31) are retracted and allow the door hinge halves to separate. The cable assembly will cause the door post latch striker (45) to pivot upward and release from latch on door.

2-100. Removal -Crew Door Jettison (Ejection) Mechanism.

NOTE

Remove ejection mechanism only to extent necessary for parts replacement.

a. Remove cotter pin (22, figure 2-31) washer (21), and pin (20) to detach cable assembly (23) from plate (6).

When required, detach two clamps (2) which secure tube (3) to support angle and pull handle assembly up through grommet (24) to remove.

b. Detach swivel (19) from plate (6) by removing nut and washer. Pull swivel from end of ejection cable (18). Keep nut and washer with swivel.

c. Remove two bolts (16) and washer (15) to detach support (14) from structure. Pull hinge pins (8 and 17) free of hinge bushings, and remove assembled ejection mechanism from inboard side of nose structure.

d. Disassemble ejection mechanism as follows:

(1) Remove cotter pins (10) and headed pins (11) to detach upper and lower hinge pins (8 and 17) from plate (6) and link (9).

(2) Remove bolt (4) with nut (13) washers (5 and 12) and spacer (7) to separate plate (6) and link (9) from support (14).

e. To remove ejection cable, disconnect aft end fork of ejection cable (18) from latch striker (45) by removing cotter pin (38) and headed pin (39). Pull cable aft out of flex tube (30) leaving tube in place.

2-101. Inspection -Crew Door Jettison (Ejection) Mechanism.

a. Inspect cable assembly (23, figure 2-31) and tube (3) for kinks or damage which would prevent operation.

b. Inspect hinge pins (8 and 17) and link (9) for damage and wear. Maximum allowable wear limits for hinge pins, 204-030-658, 0.174 O.D.

c. Inspect plate (6) and support (14) for damage and wear. If crack in the plate or support is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

d. Inspect ejection cable (18) for kinks which would prevent operation.

e. Inspect ejection cable (18) for adequate lubrication (Refer to TM 1-1500-204-23-1 Series).

2-102. Repair or Replacement-Crew Door Jettison (Ejection) Mechanism. Replace components that fail to meet inspection requirements.

2-103. Installation — Crew Door Jettison (Ejection) Mechanism. a. Check ends of flexible casing (30, figure 2-31) for proper installation.

(1) Aft end of flexible casing (30) should be positioned vertically at Station 68.96 in door post, secured between clamp (40) and spacer (41) attached to bracket (42) on structure with two screws (37), washers (43) and nuts (44). End of casing should extend 0.10 inch above clamp.

(2) Forward end of casing (30) should pass up through grommet (31) in nose structure forward of door opening, and be secured between clamp (28) and spacer (25) attached to structure with two screws (29), washers (26) and nuts (27). End of casing should extend 0.10 inch above horizontal angle at W.L. 30.

b. Thread plain end of ejection cable (18) through flexible casing (30) from aft end. Attach ejection cable fork terminal to aft end of latch striker (45) with headed pin (39) secured by cotter pin (38). Check that spring (46) is attached between striker and bracket in door post. Forward end of cable will be attached during installation of ejection mechanism.

c. Install ejection handle and hinge pins as follows:

(1) Insert spacer (7) through pivot holes of plate (6) and link (9). Place washer (5) on bolt (4), and insert bolt from plate side through spacer. Place washer (12) on bolt next to spacer, and insert bolt through support (14). Install nut (13) and washer (5) on outboard end of bolt and torque 50 TO 70 inch-pounds:

(2) Position slotted ends of hinge pins {8 and 17) between plate (6) and link (9), align holes, and install headed pins (11) secured by cotter pins (10).

(3) Position assembly in nose structure, with hinge pins inserted in hinge bushings and support (14) resting on horizontal structural member at W.L. 30. Align support to holes with plate nuts, and install two bolts (16) with aluminum alloy washers (15).

(4) Position ejection handle (1) with cable tube (3) inserted through grommet (24) at W.L. 35.56. Align tube clamps (2) to mounting holes in angle and attach with two screws, washers and nuts.

(5) Connect fork terminal of cable (23) to forward end of plate (6) with headed pin (20), washer (21), and cotter pin (22).

d. Connect ejection cable (18) with swivel (19) to hole with bushing in middle of plate (6). Adjust cable length to remove slack with hinge pins extended and latch striker (45) held in latching position, and tighten nut on swivel to hold end of cable securely.

e. Pull ejection handle and check for smooth operation, with hinge pins retracting and latch striker moving up to release position. Allow handle to return to normal position, observing that hinge pins extend and latch striker moves down to latching position.

f. Safety ejection handle with 0.020 inch copper wire (C305).

2-104. HINGED PANEL.

2-105. Description — Hinged Panel. A hinged panel is attached to the door post, forward of each cargo door to provide a wider cargo-passenger opening. The panel is attached to the fuselage with hinges and quick release pins. A positioning spring with detent is provided to hold panel open during loading and unloading operations.

2-106. Inspection and Adjustment – Hinged Panel (Installed). a. With hinged panel closed and latched, check that upper and lower latch pins (9, figure 2-32) are securely engaged in holes in structural channels of door opening.

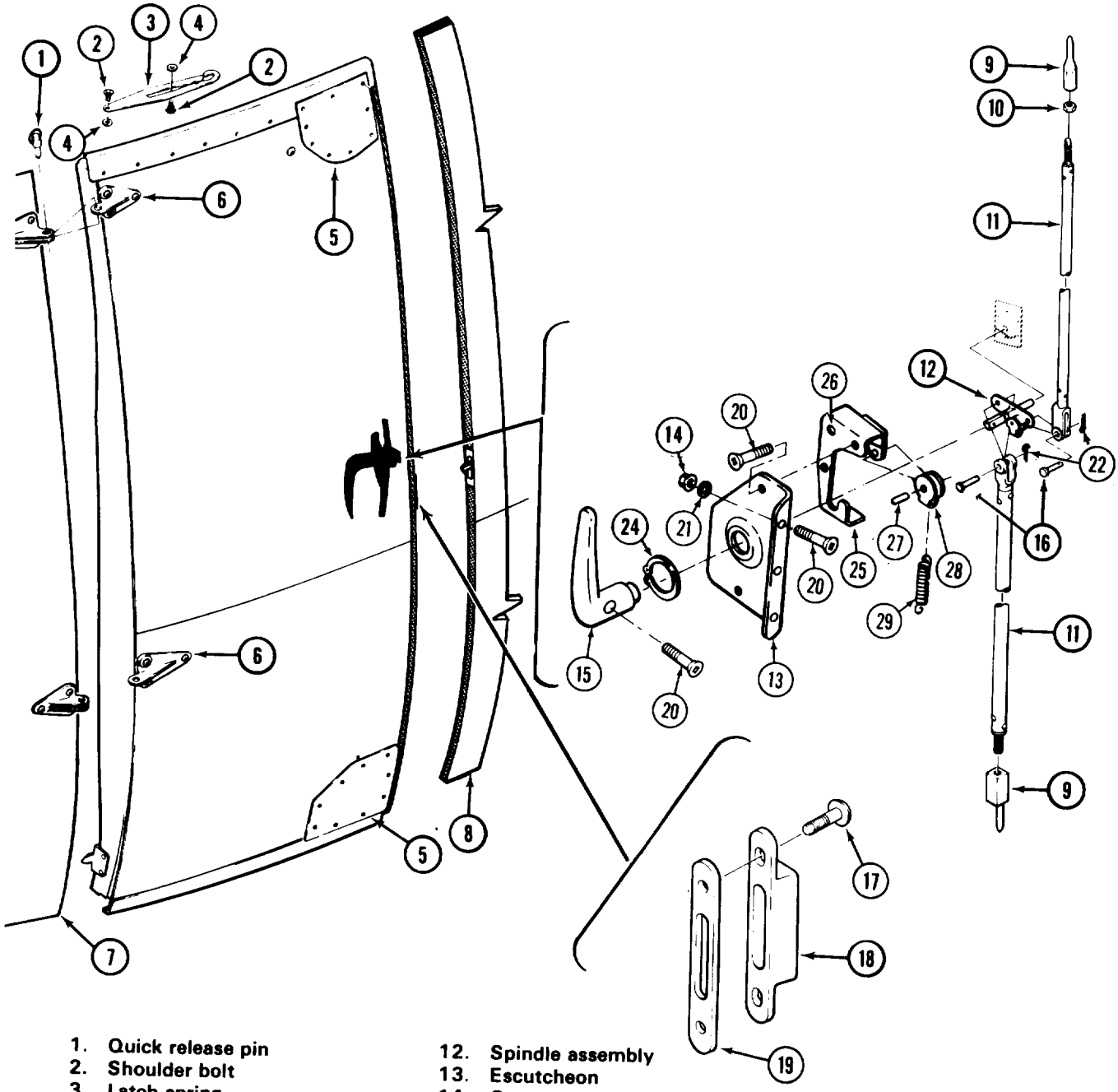
b. Operate handle (15) to open panel, checking that upper and lower latch pins retract to clear top and bottom of door opening.

c. Check action of latch spring (3) on shoulder bolt (2) as panel is opened. Detent in spring slot should catch and hold panel at approximately ninety degrees to fuselage, and hook of spring should catch when door is forced beyond detent.

d. If necessary to adjust either or both latch pins, remove covers (5) for access. Adjust pins (9) on threaded ends of latch tubes (11) to obtain secure engagement and proper release. Install covers after adjustment.

e. Check condition of hinges, hinge pins, and seals. Replace unserviceable parts.

f. With panel closed and latched, slowly close cargo door to check for proper position of catch (18). When necessary, adjust catch by means of slotted holes or by peeling laminated shim (19) under catch.



1. Quick release pin
2. Shoulder bolt
3. Latch spring
4. Washer
5. Covers
6. Hinges
7. Door post
8. Cargo door
9. Pins
10. Check nut
11. Tube assembly
12. Spindle assembly
13. Escutcheon
14. Cap nut
15. Handle
16. Pin
17. Screw
18. Catch
19. Laminated shim
20. Screw
21. Washer
22. Cotter pin
24. Ring, retainer
25. Support
26. Nut, self-locking plate
27. Pin
28. Guide latch spring
29. Spring

Figure 2-32. Hinged Panel Assembly

2-107. Removal - Hinged Panel.

a. Unlatch and slide cargo door aft. Unlatch and open hinged panel.

b. Unhook spring (3, figure 2-32) from shoulder bolts (2) at top of door opening.

c. Pull quick release pins (1) from hinges (6) and remove panel.

2-108. Disassembly-Hinged Panel.

NOTE

Disassemble hinged panel only to extent necessary for replacement of unserviceable parts.

a. Remove eight screws (20, figure 2-32) and three cap nuts (14) with washers (21) to detach escutcheon (13). Remove handle (15) and escutcheon as an assembly. Remove support (25) and disassemble by removing pin (27), guide spring (28) and spring (29).

b. Remove screws securing upper and lower covers (5).

c. Remove cotter pins (22) and headed pins (16) to disconnect tube assemblies (11) from spindle assembly (12). Pull tubes inward until pins (9) are free of guides in panel.

d. Unscrew pins (9) from ends of tubes (11). Re-move tubes and pins through upper and lower access openings.

2-109. Inspection -Hinged Panel.

a. Inspect hinged panel for cracks, dents, holes, or other structural damage.

b. Inspect seal for deterioration.

c. Inspect hinges (6, figure 2-32) for cracks. Hinge can be inspected by fluorescent penetrant TM 55-1500-335-23.

d. Check supports (11) for damage or distortion. Check clevis ends for wear and threaded ends for dam-aged threads.

e. Check pins (9) for wear and distortion.

f. Check spring (3) for cracks and distortion.

g. Inspect support (25), pin (27), guide spring (28) and spring (29), for cracks and distortion. If crack in any hinged panel assembly hardware part is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

2-110. Repair or Replacement -Hinged Panel.

a. Repair structural damage to hinged panel (TM 1-1500-204-23-1).

b. Replace components that fail to meet inspection requirements.

NOTE

Clips P/N 205-031-423-31/-32/-33/-34 may be manufactured of stainless steel MIL-S-6721, Type 321.

c. Replace seal on door as follows:

(1) Remove old seal and remove old adhesive using 400 grit sandpaper (C233).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(2) Clean with MEK (C177) to remove residue.

(3) Bond new seal in place using adhesive (C24).

2-111. Assembly -Hinged Panel.

a. Insert tube assemblies (11, figure 2-32) into panel through access openings.

b. Screw pin (9) on threaded end of lower tube (11), and check nut (10) and pin (9) on upper tube (11). Insert pins (9) through guides at top and bottom of panel.

c. Position each tube (11) clevis on spindle (12), and install a headed pin (16) secured by a cotter pin (22).

d. Position handle and escutcheon assembly (13 and 15), secure spring (29), to support (25), and guide (28), with pin (27), to escutcheon (13), with screw (20) and attach to inner side of panel, with handle engaged on spindle. Install eight attaching screws (20) and three cap nuts (14) with washers (21).

e. Install panel (paragraph 2-113) and make adjustments of latch pins as required (paragraph 2-106).

f. Install covers (5).

2-112. Painting - Hinged Panel. Refer to TM 55-1500-345-23 for painting instructions.

2-113. Installation - Hinged Panel.

a. Position panel to align hinges (6, figure 2-32) and install quick release pins (1).

b. Hook spring (3) on shoulder bolts at top of door opening.

c. Close panel and check operation and adjustment (paragraph 2-106).

2-114. CARGO DOOR.

2-115. Description - Cargo Doors. A large sliding door operating on rollers and tracks gives access to cargo-passenger area on each side of cabin. Each sliding door has a latch for closed position, and two jettisonable windows which can be used as emergency escape hatches. The door can be secured in open position by a retainer located on rear bulkhead of cabin.

2-116. Removal -Cargo Doors.

a. Unlatch door. Remove retainer (1, figure 2-33) by removing screw (6) with washer (5) and spacer (2) and bolt (4) with washers (3).

b. Remove bolts (16), washers (17), and straps (15) from aft end of upper and lower tracks on fuselage behind door.

c. Slide door aft, guiding rollers and slider out of tracks.

d. Remove cargo door window as required:

(1) Pull window latch handle (21, figure 2-34) up and aft to retract plates (29) from guide blocks (30). Hold handle and pull lower edge of window inward and downward until upper edge is free of guides.

(2) Remove window.

(3) Window Latch. With window removed, perform disassembly and reassembly of latch to extent necessary to replace unserviceable parts:

(a) Remove cap nut (23) and washer (24) from inboard ends of screw (27) to detach handle (21) and two latch plates (29) from window structure. Remove latch assembly (handle, plates, and channel). Remove washers (25), spacer (26), and screw (27) from structure at each of three attachment points.

(b) Remove nuts (23), washers (24), and screws (22) to separate handle (21) and plates (29) from channel (28).

2-117. Inspection -Cargo Door.

a. Inspect door for dents, damage and cracks. If crack in the door is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

b. Inspect latch for binding, wear or damage.

c. Inspect slider (13, figure 2-34) or roller (13A), whichever is installed for excessive wear or damage.

d. Inspect rollers (5) for excessive wear.

e. Inspect cargo door window to limits of figure 2-41.

f. Inspect retainers (1 and 13, figure 2-33) for cracks, wear, and misalignment. Replace if cracked, worn, or bent. Inspect retainers for cracks using not less than a 4 power magnifying glass. If crack in the retainer is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

NOTE

If spacer (10) and doubler (11) require replacement, they must be bonded together with adhesive (C32).

g. Inspect strap (15) for cracks, wear, and misalignment. Replace if cracked, worn, or bent. If crack in retainer strap is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

2-118. Repair or Replacement -Cargo Door.

a. Repair structural damage to door in accordance with TM 1-1500-204-23-10.

b. Replace seals that are cut, torn or show signs of deterioration. Rubber seals with fabric reinforcement shall be installed with reinforcement on the inboard side. Bond new seals with adhesive (C24).

c. For repair of door latch, refer to paragraph 2-122.

d. To replace worn rollers (5, figure 2-34), remove cotter pin (3), washer (4) and roller. Install roller (5) on roller support (1, 8, or 10) and install washer (4) and cotter pin (3).

NOTE

When replacing either the slider (13), or roller (13A), install slider or roller with snap ring toward head of mounting screw (12).

e. Either slider (13) or roller (13A) may be installed on slider assembly (19). If slider (13) or roller (13A) is worn excessively, remove nut (17), washer (16), spacer (14), screw (12) and slider or roller. Slider can be rotated 180 degrees and reinstalled, or nylatron insert replaced as necessary (bond with C31). Replace slider when nylatron is worn down to the metal. Replace roller when nylon material is cracked and/or the diameter of the groove is less than 0.7 inches. Position slider (13) or roller (13A) and spacer (14) on slide assembly (19). Install screw, washer and nut previously removed.

f. Replace door window if damaged or inspection limits are exceeded.

2-119. Painting - Cargo Door. Refer to TM 55-1500-345-23 for painting instructions.

2-120. Installation - Cargo Door.

a. Position door with forward edge in line with aft end of door tracks.

b. Start rollers and slider through cutouts at aft ends of tracks. Push door forward.

c. Install strap assemblies (15, figure 2-33) with washers (17) and bolts (16) at aft end of upper and lower tracks on fuselage.

d. Position retainer (1) with two spacers (2) on cargo door and secure with two screws (6), washers (5), bolt (4), and washers (3).

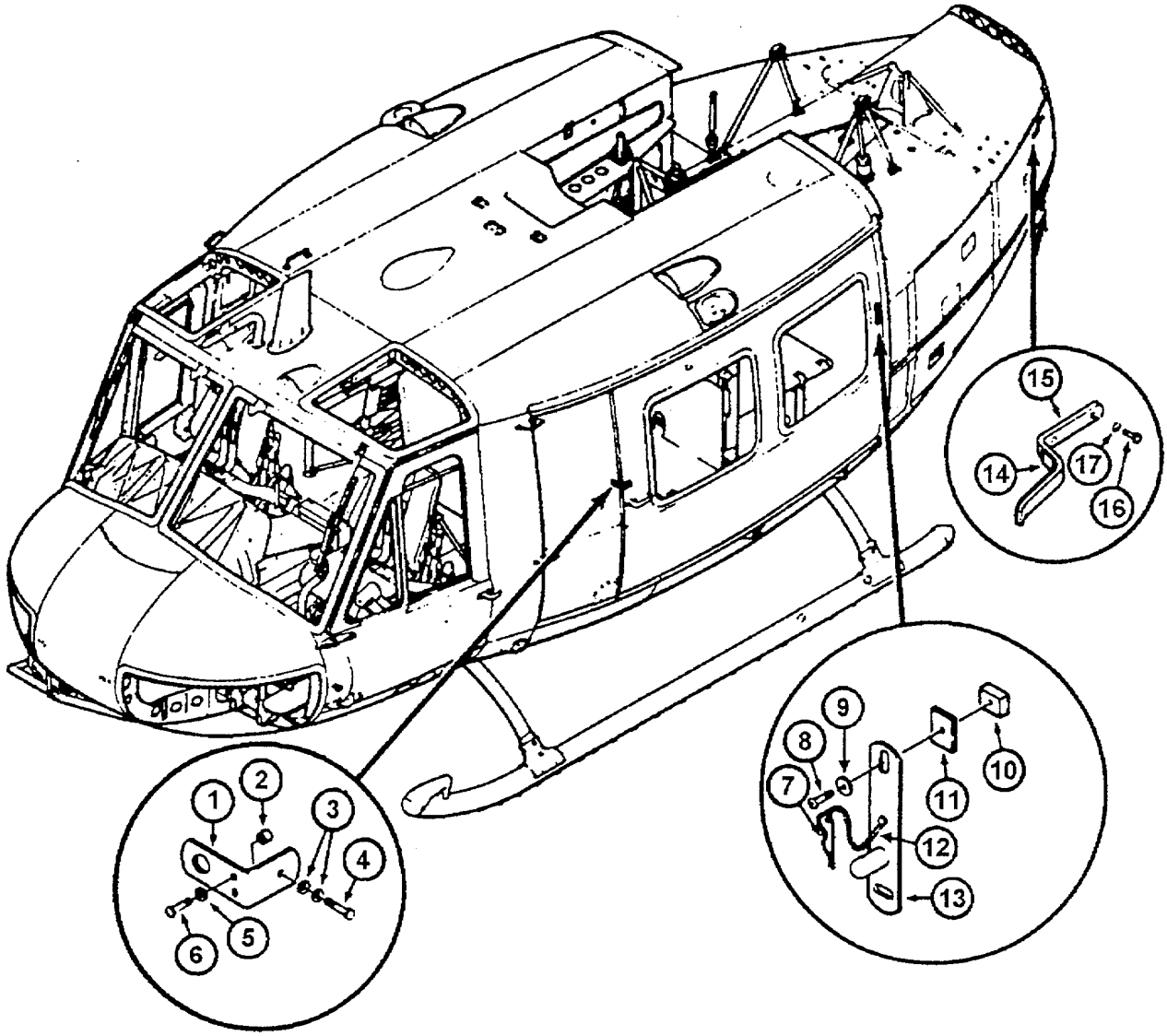
e. Install window and latch assembly.

(1) Insert a spacer (26, figure 2-34) from inboard side of window, into each of three mounting holes in lower edge of window frame. Insert screw (27) from outboard through window and spacer (26), and place two steel washers (25) over inboard end of each spacer (26). Position latch handle (21) with pivot holes of handle and plates (29) over ends of spacers (26). Install washers (24) and cap nuts (23) on each screw (27).

NOTE

Screw (27) may be reversed if interference between nut (23) and airframe cannot be eliminated by cargo door adjustment.

(2) Attach handle (21) to flat side of channel (28) with screw (27) and washer (24) between handle and channel and washer (24) under nut (23). Attach two latch guide plates (29) to ends to channel (28) in same manner.



1. Retainer
2. Spacer
3. Washer
4. Bolt
5. Washer
6. Screw
7. Pin
8. Screw
9. Washer
10. Spacer
11. Doubler
12. Chain
13. Retainer assembly
14. Padding
15. Strap assembly
16. Bolt
17. Washer

Figure 2-33. Cargo Door Installation

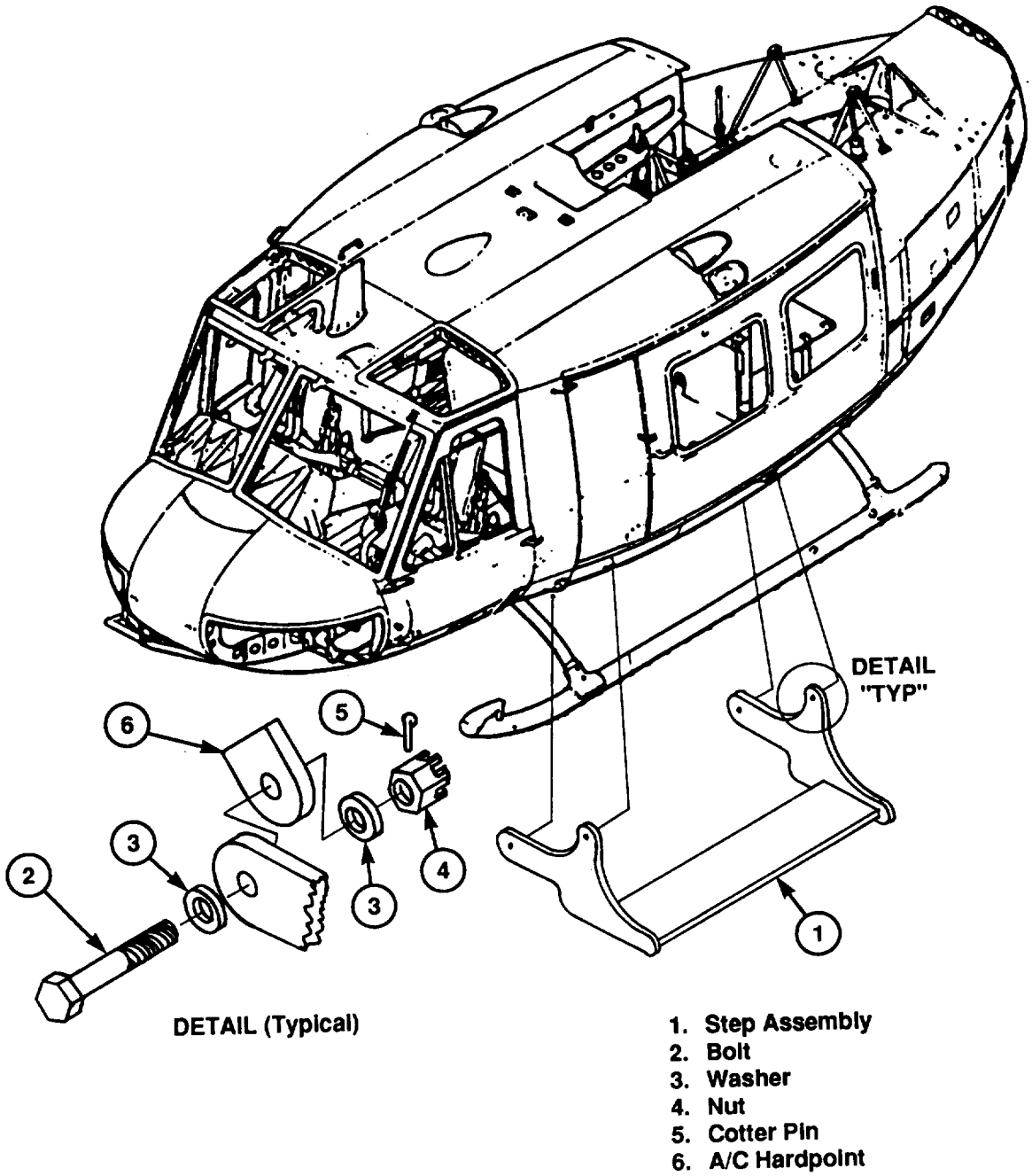


Figure 2-33.1 Passenger Steps

(3) Insert window (32) into opening from inside of cargo door, engaging upper edge plates in guides.

(4) With latch retracted, bring lower edge of window into position. Move latch handle (21) down to extend the plates into the lower guide blocks.

(5) Lockwire handle with 0.020 inch copper wire (C305).

f. Check adjustment of door (paragraph 2-121).

2-121. Adjustment-Cargo Door. Both sliding cargo doors must be properly aligned to be secure in all flight conditions and to operate correctly. Check and adjust fit of each door according to procedure outlined below.

a. Place door to full closed and latched position. Check that upper edge of door is parallel to top of cabin door frame.

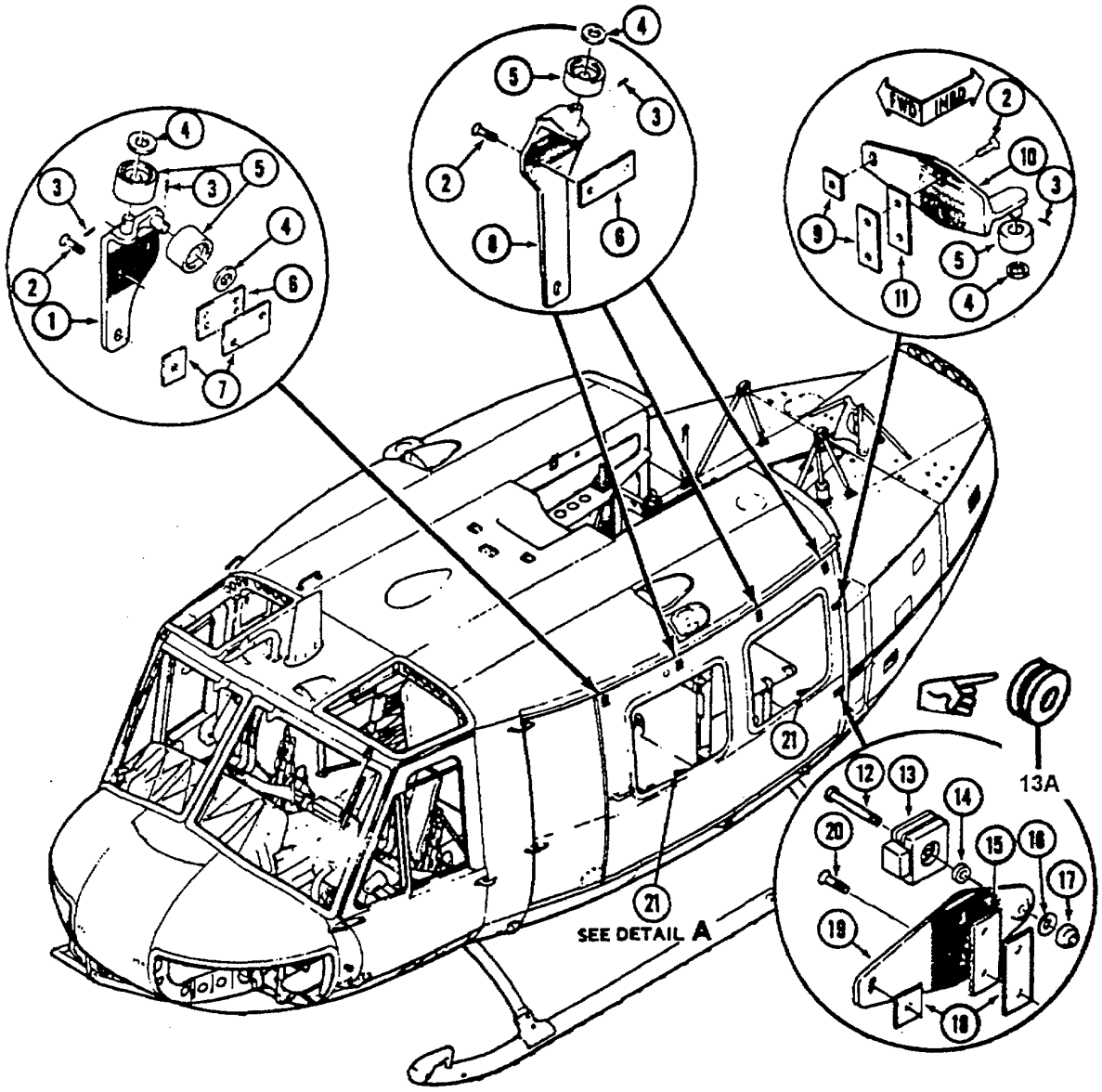
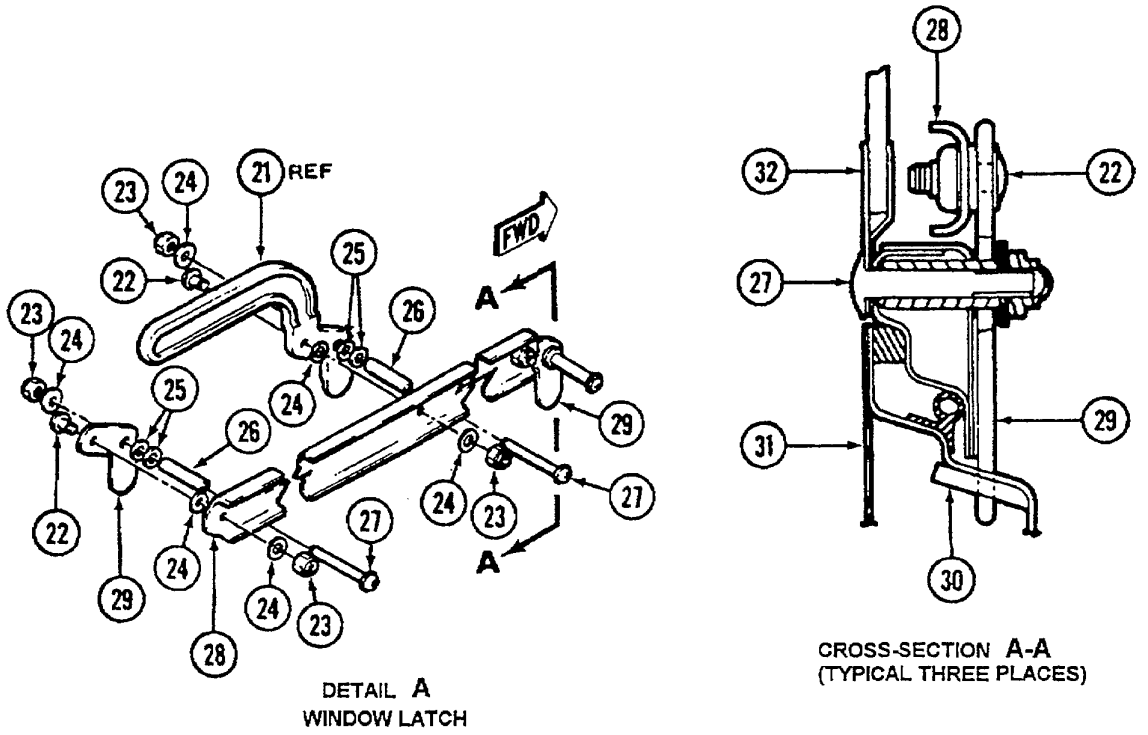


Figure 2-34. Cargo Door - Parts Replacement (Sheet 1 of 2)



1.	Forward roller support	12.	Screw	22.	Screw
2.	Screw	13.	Slider	23.	Nut
3.	Cotter pin	13A.	Roller	24.	Washer
4.	Washer	14.	Spacer	25.	Washer
5.	Roller	15.	Serrated plate	26.	Spacer
6.	Serrated plate	16.	Washer	27.	Screw
7.	Shims	17.	Nut	28.	Channel
8.	Upper roller support	18.	Shims	29.	Plate, latch guide
9.	Shims	19.	Slide assembly	30.	Guide block
10.	Aft upper roller support	20.	Screw	31.	Door
11.	Serrated plate	21.	Window latch handle	32.	Window

Figure 2-34. Cargo Door - Parts Replacement (Sheet 2 of 2)

b. If door is out of alignment adjust as follows:

(1) Loosen mounting screws in slide assembly (19, figure 2-34) and aft upper roller support (10).

(2) Adjust slide assembly (19) to raise or lower door to align upper edge parallel to door frame. Tighten screws (20).

(3) Adjust roller support (10) so that roller (5) is fully engaged in track. Tighten mounting screws (2).

c. Operate door through full travel while checking that all rollers on upper edge are fully engaged in track at all positions. Adjust roller supports as required.

d. With door fully closed and latched, check that lower door track is engaged not less than 0.25 inch in cabin door channel. If required, loosen screws attaching lower track on door and adjust track to provide maximum engagement in cabin doorchannel without restricting doortravel through

full range from closed to open positions. Be sure door track attaching screws are tightened after adjustment.

e. Check door latch for proper operation and adjust if required (paragraph 2-126, step g).

2-122. CARGO DOOR LATCH.

2-123. Description - Cargo Door Latch. A latch is provided for each door to maintain the door in the closed position.

2-124. Removal - Cargo Door Latch.

a. Unhook tension spring (1, figure 2-35) from latch hook (10) and front hanger directly below on door structure.

b. Remove outer handle (6) of latch.

(1) Remove setscrew (5) which secures handle to latch shaft (9).

(2) Remove two screws (13) to detach escutcheon plate (7) from door. Pull handle (6) and escutcheon plate (7) assembly off end of shaft (9). When necessary, remove retaining ring (8) to separate parts.

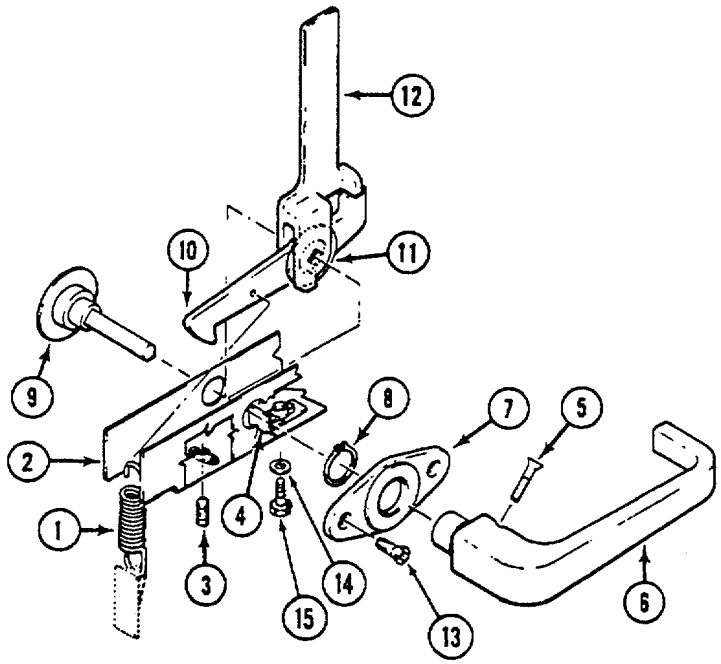
c. Withdraw latch shaft (9) to remove inner handle (12) hook (10), and shim (11).

d. Leave hook adjusting screw (3) and handle stop (4) in place, unless replacement is necessary.

2-125. Inspection and Repair-Cargo Door Latch.

a. Inspect components of latch for wear or damage.

b. Replace parts which are worn or damaged sufficiently to prevent proper operation.



1. Tension spring
2. Door structure channel
3. Hook adjusting screw
4. Stop
5. Setscrew
6. Outer handle
7. Escutcheon plate
8. Retaining ring
9. Latch shaft
10. Hook
11. Shim
12. Inner handle
13. Screw
14. Washer
15. Bolt
15. Bolt

Figure 2-35. Cargo Door Latch - Typical

2-126. Installation – Cargo Door Latch.

NOTE

Lubricate hinge and pivot points with a light coat of grease (C122) during assembly.

a. Check that hook adjusting screw (3, figure 2-35) and angle fitting which serves as stop (4) for inner handle (12) are installed in door structure channel (2) of door.

b. Place latch hook (10) in fork of inner handle (12). Insert a washer (11) between hook and handle at outboard side.

c. Place hook and handle assembly in door structure channel (2) of door, with hook through guide slot. Align holes and insert latch shaft (9) from inboard side.

d. Check that escutcheon plate (7) is secured on outer handle (6) with retaining ring (8).

e. Place outer handle (6) over end of latch shaft (9). Check alignment of parts before installing setscrew (5) through handle (6) into shaft (9).

(1) Outer handle (6) should be pointing aft and horizontal when inner handle (12) is upright, with stop (4) face against angle fitting in bottom of channel (2). If necessary, change position of latch shaft (9) to align holes for setscrew, and adjust position of stop fitting.

(2) Secure escutcheon plate (7) to door with two screws (13).

f. Connect tension spring (1) between latch hook (10) and hanger located below on door structure.

g. Check operation of latch. Adjust screw (3) under latch hook so that hook will positively engage striker in panel door.

2-127. CARGO DOOR TRACKS.

2-128. Inspection — Cargo Door Tracks. a. Inspect track for damage or wear caused by roller or slider vibration.

b. Inspect inboard and lower surface of track for wear in roller areas when cargo door is full open and full closed. Wear pads should be installed when wear is evident.

c. Inspect hinged panel latch hole in upper track for damage or wear. Hole can be repaired by installation of bushing.

d. Inspect hinged panel latch hole in lower track for damage or wear, Repair can be made by installation of striker plate.

NOTE

For replacement of forward upper and lower cargo door tracks, remove cargo door (paragraph 2-116). If forward lower track is to be replaced, drain fuel and remove fuel cell (paragraph 10-6 or 10-12). Installation of the track is accomplished by using standard sheet metal techniques TM 55-1500-204-25/1). Replacement of aft upper and lower tracks, including any repairs other than installations of wear pads, is to be accomplished by depot maintenance only.

2-129. Repair of Cargo Door Tracks by Patching (AVIM), a. Using a suitable tool, clean up damaged area of door track, caused by roller or slider vibration (figure 2-36). Radius corners of cleaned up area and break all sharp edges.

b. Fabricate patch from 0.032 inch stainless steel material. Length and width of patch will be determined by amount of cleanup required to remove damage to track.

c. Drill out rivets retaining skin to track, in damaged area. Install patch in position (as shown in figure 2-36), drill holes in patch picking up existing rivet holes.

d. Remove patch, clean, deburr; and install, using MS20470AD4 or MS20470AD5 rivets, depending on condition of rivet holes. Where flush rivets are required, use MS20426AD4 or MS20426AD5 rivets.

e. If damage to the cargo door track is found on the forward section in the fuel cell area, it will be necessary to drain the fuel and remove fuel cell (paragraph 10-6 or 10-1 2).

f. After installation of rivets in patch, exposed rivets inside fuel cell bulkhead should be covered with sealant (C244) to protect fuel cell. Clean fuel ceil area of debris from drilling operation.

g. Where blind rivets are required, or can be more conveniently installed, use CR2249-4 or CR2249-5 depending on rivet hole condition.

h. After installation of patch on track, fill any existing gaps between track and ends of patch with adhesive (C32) or adhesive (C38). Smooth flush and refinish as necessary.

2-130. Repair of Cargo Door Tracks Installation of Wear Pads (AVIM).

NOTE

At the first indication of wear (0.010 to 0,020 inch) on the cargo door tracks in the full open and full closed positions, stainless steel wear pads should be installed.

a. Remove cargo door (paragraph 2-116).

b. Defuel helicopter and remove lower fuel cell on side of helicopter that wear pads are being installed on (paragraph 10-3 or 10-9).

c. Fabricate wear pads from 0.016 inch stainless steel, quarter hard, three inches in length and wide enough to cover the inboard and lower track surface where roller or slider would rest (figure 2-37).

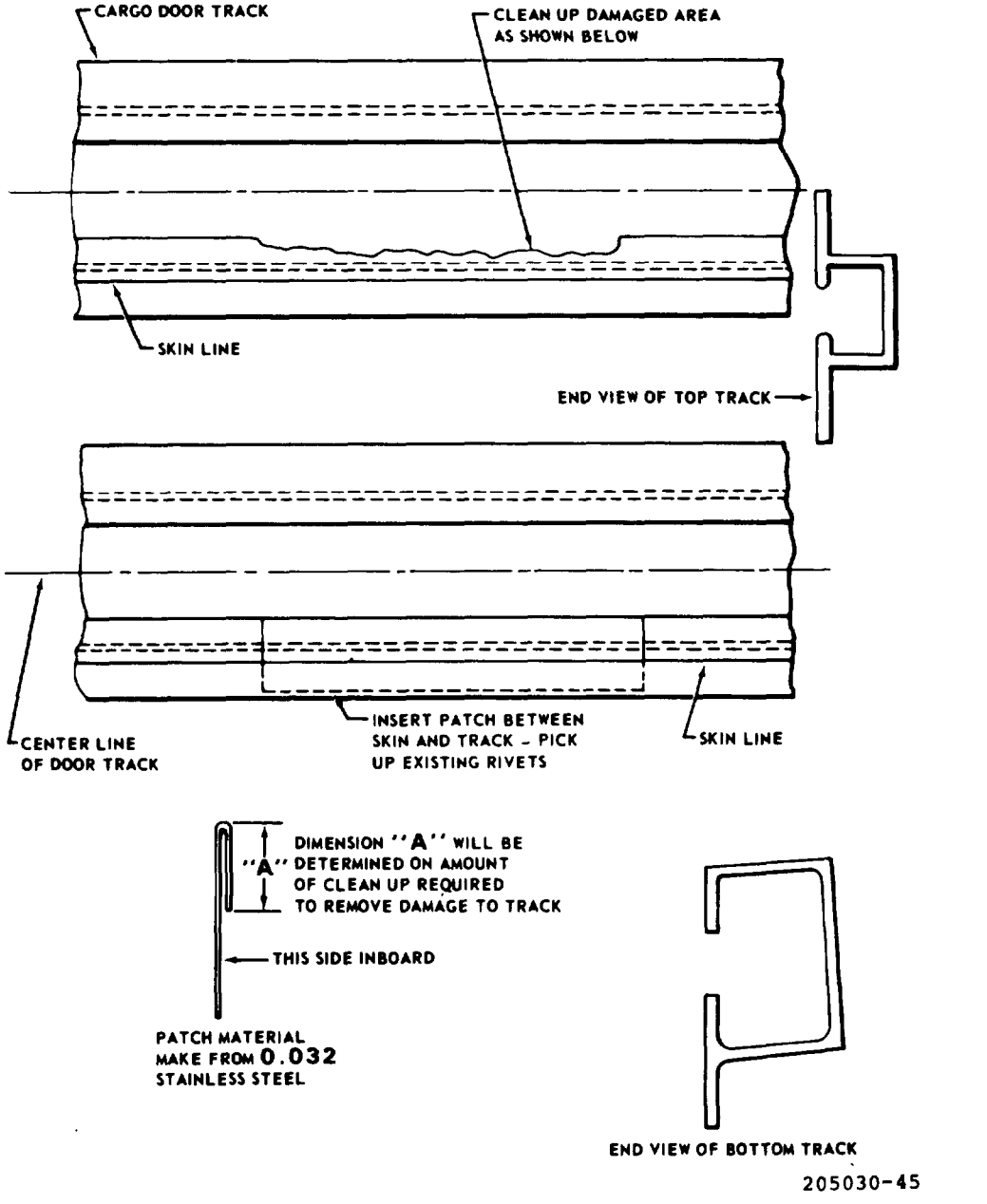


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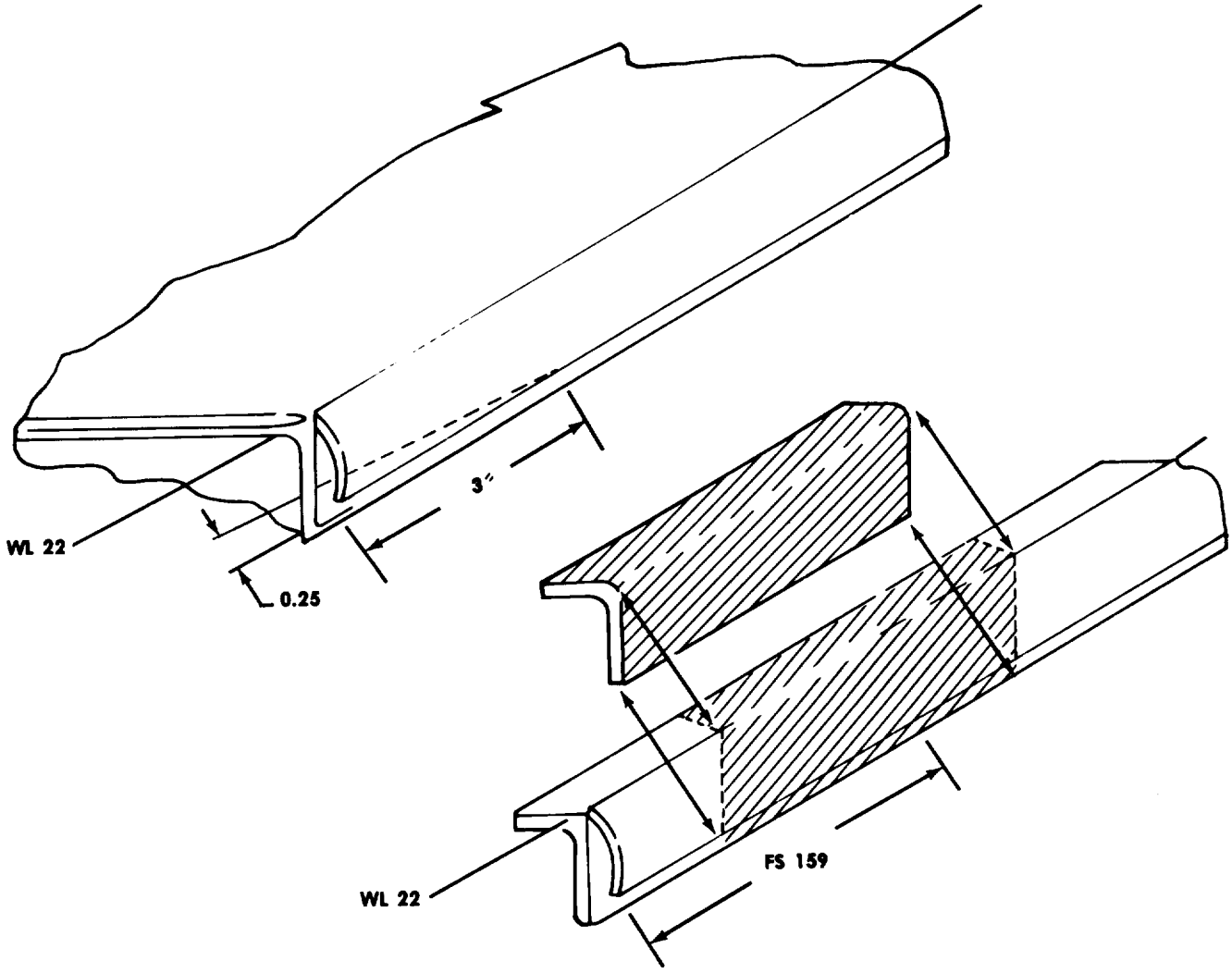
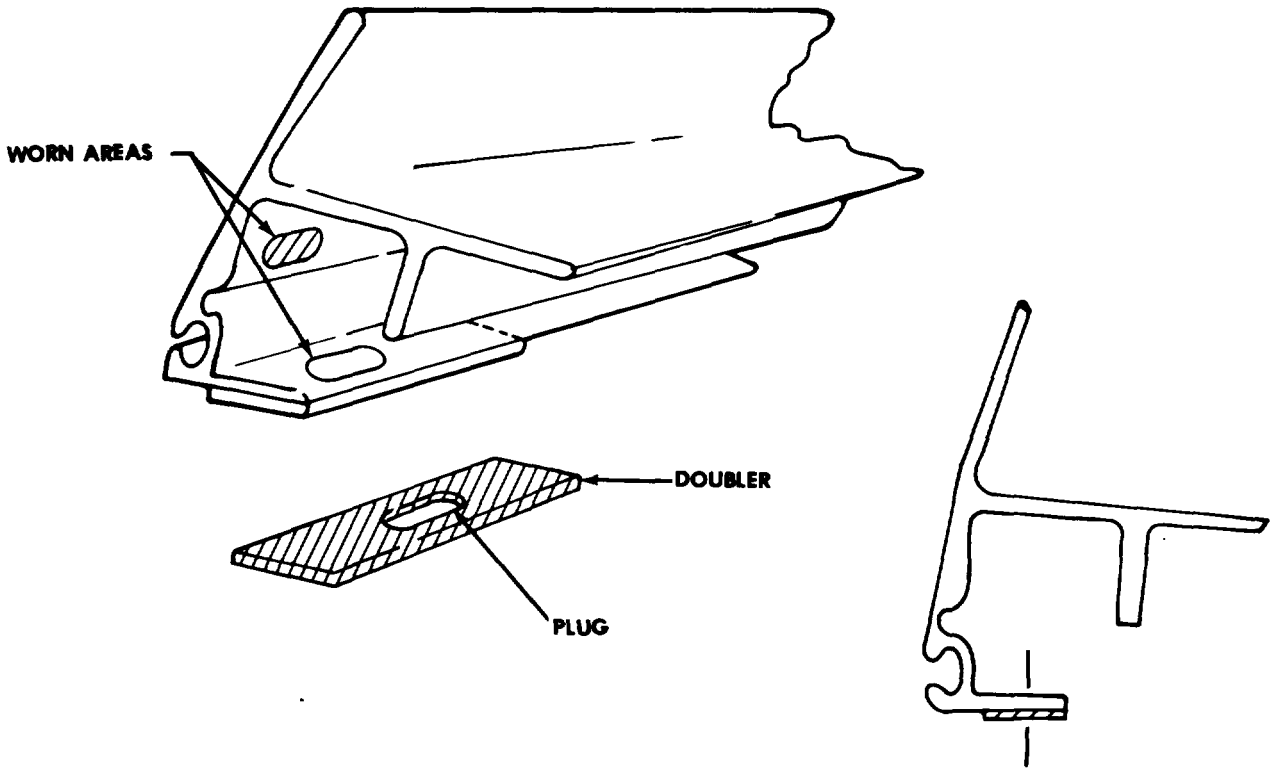
Figure 2-36. Cargo Door Track — Patching (Sheet 1 of 3)



CARGO DOOR LOWER, FORWARD TRACK REPAIR LIMITATION:
BLENDING LIMITED TO 3.0 INCHES BACK FROM FS 166,
OR 25 INCHES IN DEPTH AND 3.0 INCHES IN LENGTH IN
NO MORE THAN THREE LOCATIONS. BENT OR BOWED TRACKS
MUST BE REPLACED. SUPERFICIAL DAMAGE LIMITED TO AN
AREA OF 4 SQUARE INCHES, AND 20 PERCENT OF MATERIAL
THICKNESS.

Figure 2-36. Cargo Door Track - Patching (Sheet 2 of 3)



CARGO DOOR UPPER, FORWARD TRACK REPAIR LIMITATIONS: OUTBOARD, BUBBLED SECTION WEAR EXCEEDING 20 PERCENT OF MATERIAL THICKNESS REQUIRES TRACK REPLACEMENT. WEAR -THROUGH DAMAGE IN LOWER, HORIZONTAL FLANGE SHALL NOT EXCEED THREE REPAIRS OF 1.0 INCH IN LENGTH AND 0.375 INCH IN WIDTH. BENT OR BUCKLED TRACKS REQUIRE REPLACEMENT.

Figure 2-36. Cargo Door Track - Patching (Sheet 3 of 3)

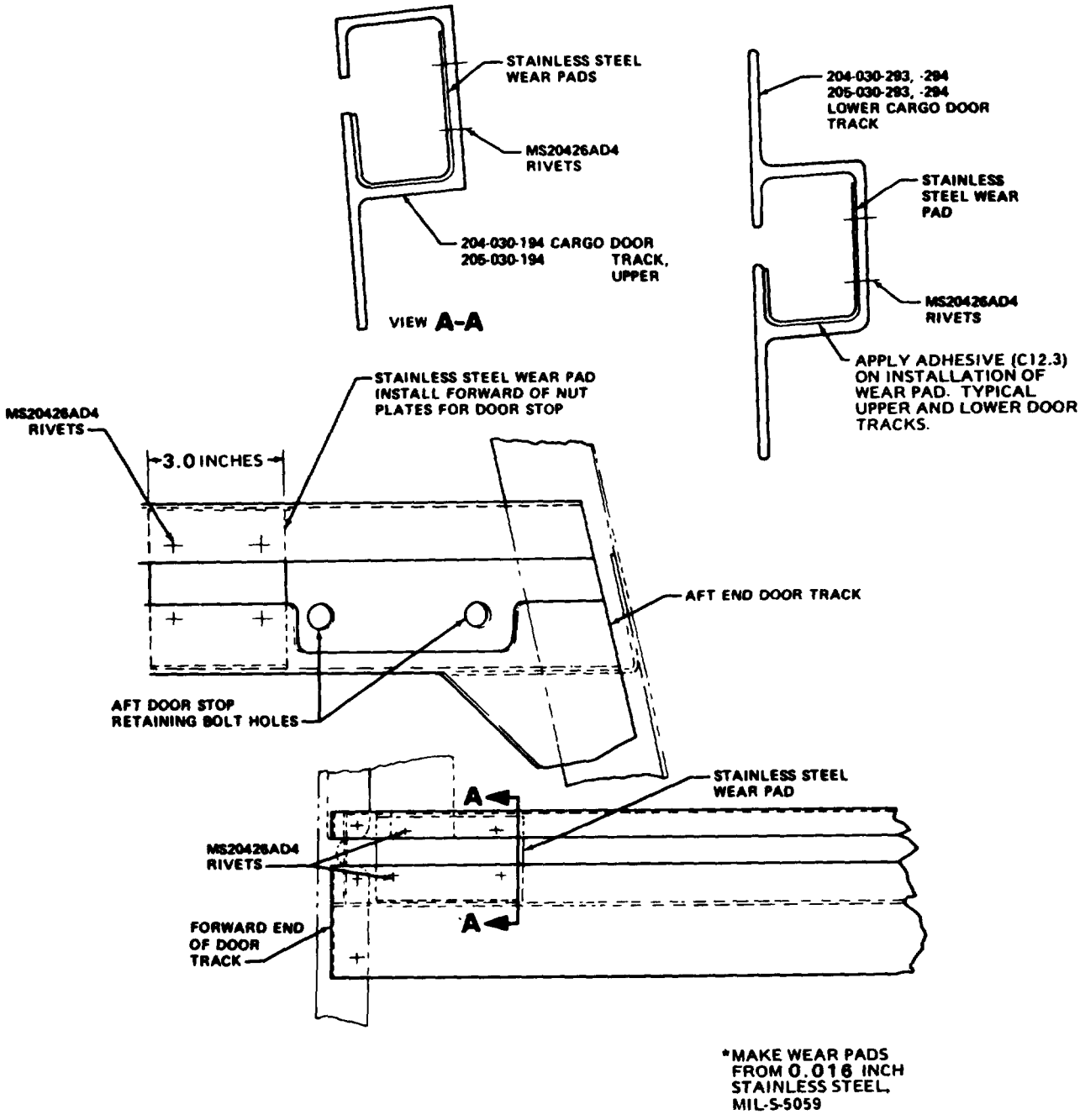


Figure 2-37. Cargo Door Track — Installation of Wear Pads

d. Form wear pad to shape, place in track at aft end cut out. Move into position, lay out and mark for rivets, Drill rivet holes, using No. 30 drill, through wear pad material and doer track. Use care in drilling so that end of drill bit does not damage parts on inboard side of track.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

e. Countersink or dimple wear pad, countersink door track if wear pad is dimpled. Remove wear pad, dean and deburr. Clean door track, apply adhesive (C32) to wear pad location. Slide wear pad into location, install with MS20426AD4 rivets. Clean excess adhesive (C32) from pad and door track with cloth moistened with methyl-ethyl-ketone (C1 77). Clamp or wedge wear pad to lower surface of track for 24 hours to allow adhesive to cure.

f. Repeat above steps for each door track and location of door track.

g. Install cargo door and functionally check to ensure that it operates properly in the track.

h. Clean fuel cell cavity and install fuel cell (paragraph 10-6 or 10-12).

2-131. Repair of Cargo Door Tracks — Installation of Bushing in Hinged Panel Upper Latching Pin Hole (AVIM).

NOTE

This repair is applicable to the latching pin holes for hinged panel in upper cargo door track at station 91.15. If these holes become worn in helicopters prior to Serial Number 68-15490, the holes may be bushed rather than changing the cargo door track.

a. Open hinged panel to the locked open position.

b. Remove two rivets retaining the guide block (figure 2-36). Remove guide blocks.

c. Place guide blocks in vise and drill out existing latching pin hole to 0.250 inch. Counterbore the upper surface at dosed end of guide slot to depth of 0.0625 inch and diameter of 0.375 inch (figure 2-38).

d. Coat a bushing P/N 22-004-12-6-12 with adhesive (C32), and install in guide block, Clean excess adhesive from guide block and allow adhesive to cure for 24 hours.

e. Position guide block in track and install two MS20426AD4 rivets flush on lower side as illustrated.

f. Clean mating surfaces of the track and striker plate with naphtha (C32).

2-132. Repair of Cargo Door Tracks — Installation of Striker Plate at Hinged Panel Lower Latching Hole (AVIM). a. Move cargo door to aft position. Open hinged panel.

b. Fabricate striker plate from 0.040 inch 4130 steel (figure 2-39).

c. Temporarily install striker plate on cargo door track with center of striker plate over locking hole in the track, Locate hole in striker plate.

d. Drill hole in striker plate using a 0.187 inch diameter drill.

e. Locate and drill two (0.128) inch diameter holes (figure 2-39).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

f. Clean mating surfaces of the track and striker plate with naphtha (C178).

g. Coat mating surface of striker plate with adhesive (C32), and install on track with holes aligned.

h. Install two rivets as shown.

i. Wipe excessive adhesive from track and allow to dry for 24 hours.

j. Paint reworked area with epoxy primer (C206).

2-132.1. Passenger Steps.

2-132.2. Description — Passenger steps may be installed to assist in entering and exiting the aircraft through the cargo doors. They are mounted to the hardpoints al fuselage stations 64.50 and 129.50. The steps consist of two flat aluminum plate supports and a flat aluminum tread welded between the supports. Anon-skid surface is applied to the tread for improved footing,

2-132.3. Removal. - Support step assembly prior to removing attachment hardware. Remove cotter pins (5, figure 2-33.1), nuts (4), washers (3) and bolts (2) and remove step assembly from aircraft.

2-132.4. Inspection. -(installed or removed.) a. Inspect step assembly for corrosion. Remove corrosion and touch-up paint (MIL-P-23377 and MIL-C-46168) as needed.

b. Visually inspect weld joints for cracks. No cracks are allowed. If crack in passenger step is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

c. Touch-up non-skid coating (MIL-W-5044) as required.

2-132.5. Installation. -Support step assembly during installation. Install bolts (2), washers (3), one under head, 2 under nut, nuts (4) and cotter pins (5).

2-133. WINDSHIELD.

2-134. Description — Windshields. Windshields may be made of transparent acrylic plastic, or a sandwich type construction of three layers. In the sandwich type of windshield the outer layer is made of tempered glass. The middle layer is made of a pliable laminated glass. The inner layer may be made of glass or plastic.

2-135. Inspection — Windshield. a. Inspect plastic windshield for damage (figure 2-41).

b. Inspect glass windshield for cracks and scratches. Refer to figure 2-41.1 for damage limits.

2-136. Removal — Windshield. a. Loosen ten screws (13, figure 2-40) and remove cover (10) from center windshield post.

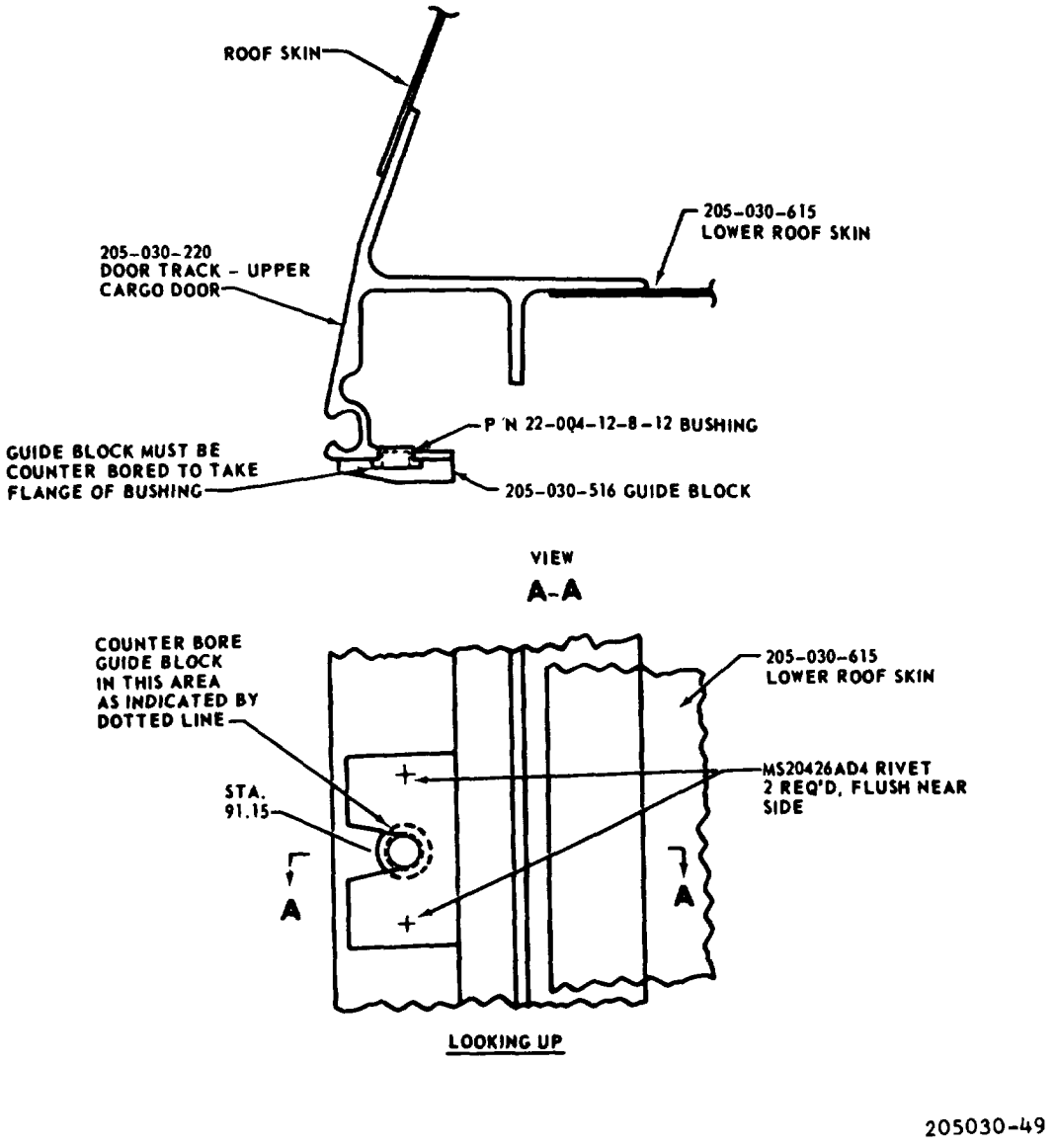


Figure 2-38. Upper Cargo Door Track — Installation of Steel Bushings

b. Pull wire bundle from channel (9) and remove three screws (11) with washers (12) attaching channel (9) to clips (8) and remove channel from center windshield post.

c. Lift windshield wiper arm to the up position and install a suitable pin in hole of arm (paragraph 12-9) to relieve spring pressure. Remove nut and washer attaching wiper arm to serrated end of shaft of wiper motor and remove arm and blade assembly.

d. Mark location of stop (4) to adjacent structure and remove stop from windshield.

e. Mark location fitting (5) on adjacent structure and remove two screws (6), washers and nuts from (instrument panel brace) fitting.

f. Remove free air temperature gage (7) (if removing pilots windshield).

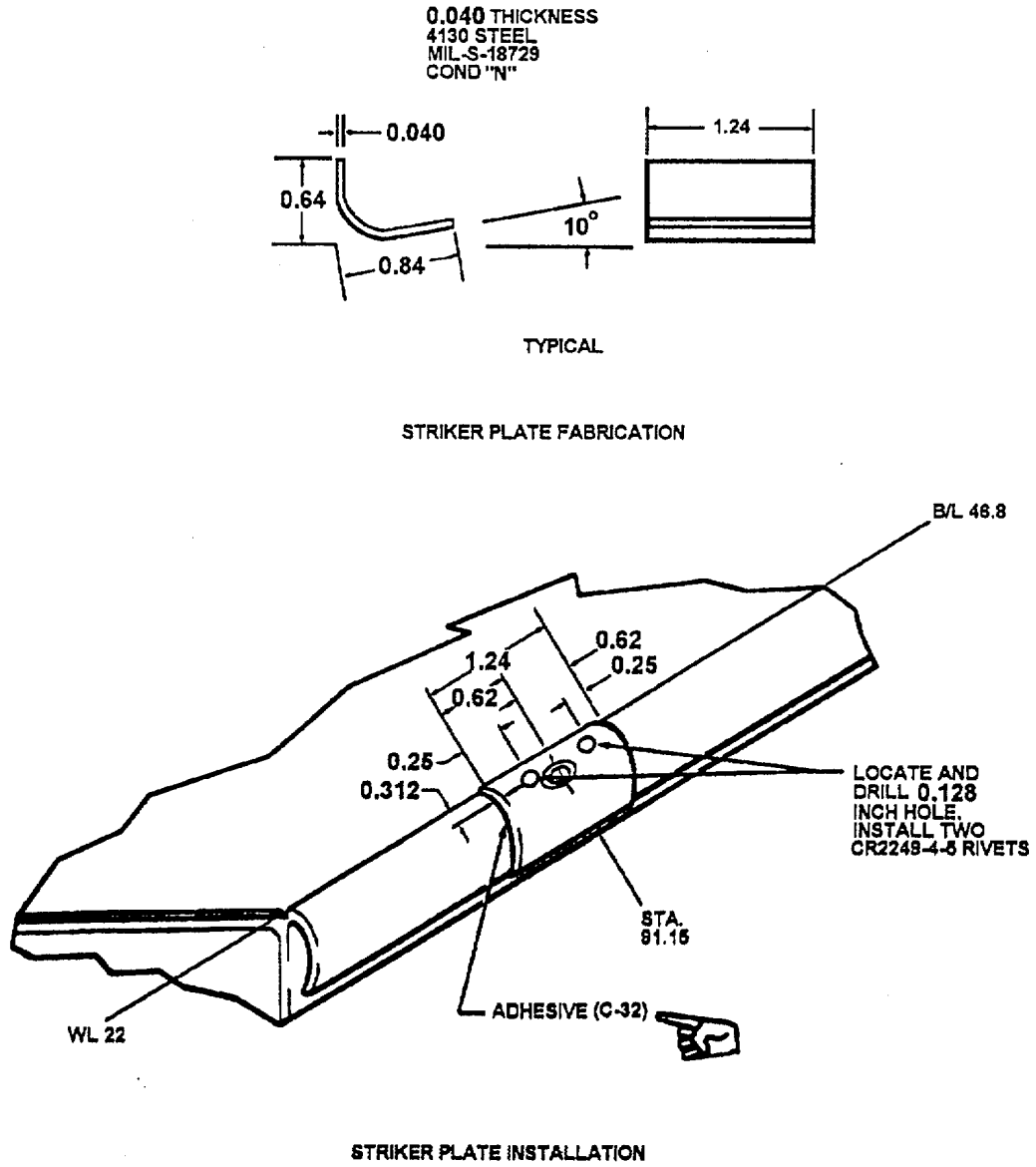


Figure 2-39. Lower Cargo Door Track - Installation of Striker Plate

g. Remove sealant from around cabin air drain hose, located at upper outboard corner of windshield, and pull hose from windshield.

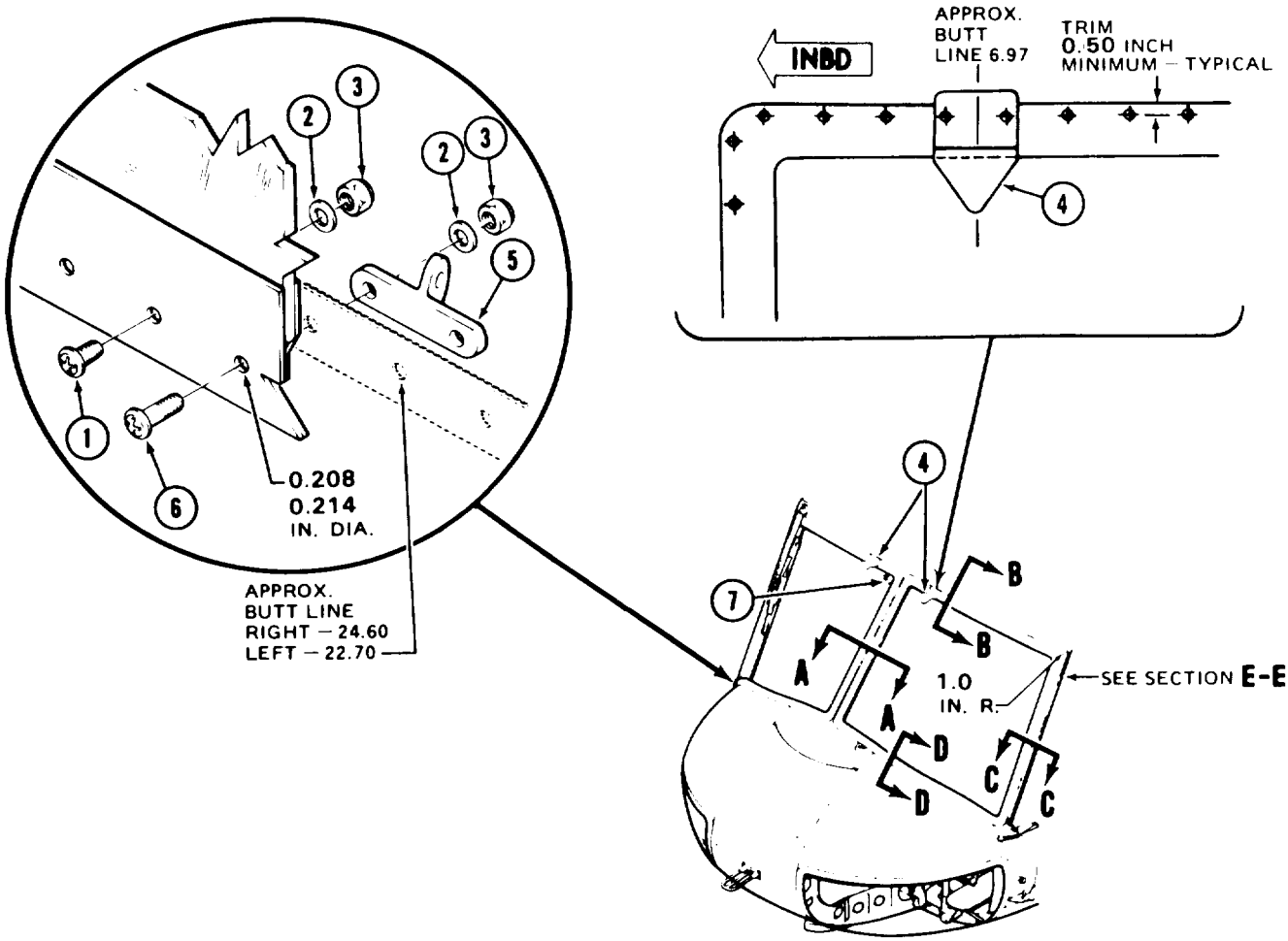
h. If both windshields are being replaced at the same time, observe and mark location of three clips (8) to adjacent structure and remove clips.

i. Remove screws (1), washers (2), and nuts (3) from windshield.

j. Using a plastic scraper, separate and remove windshield from structure.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.



1. Screw
2. Washer
3. Nut
4. Stop
5. Fitting
6. Screw
7. Free air temperature gage
8. Clip
9. Channel
10. Cover
11. Screw
12. Washer
13. Screw

Figure 2-40. Windshield Installation (Sheet 1 of 2)

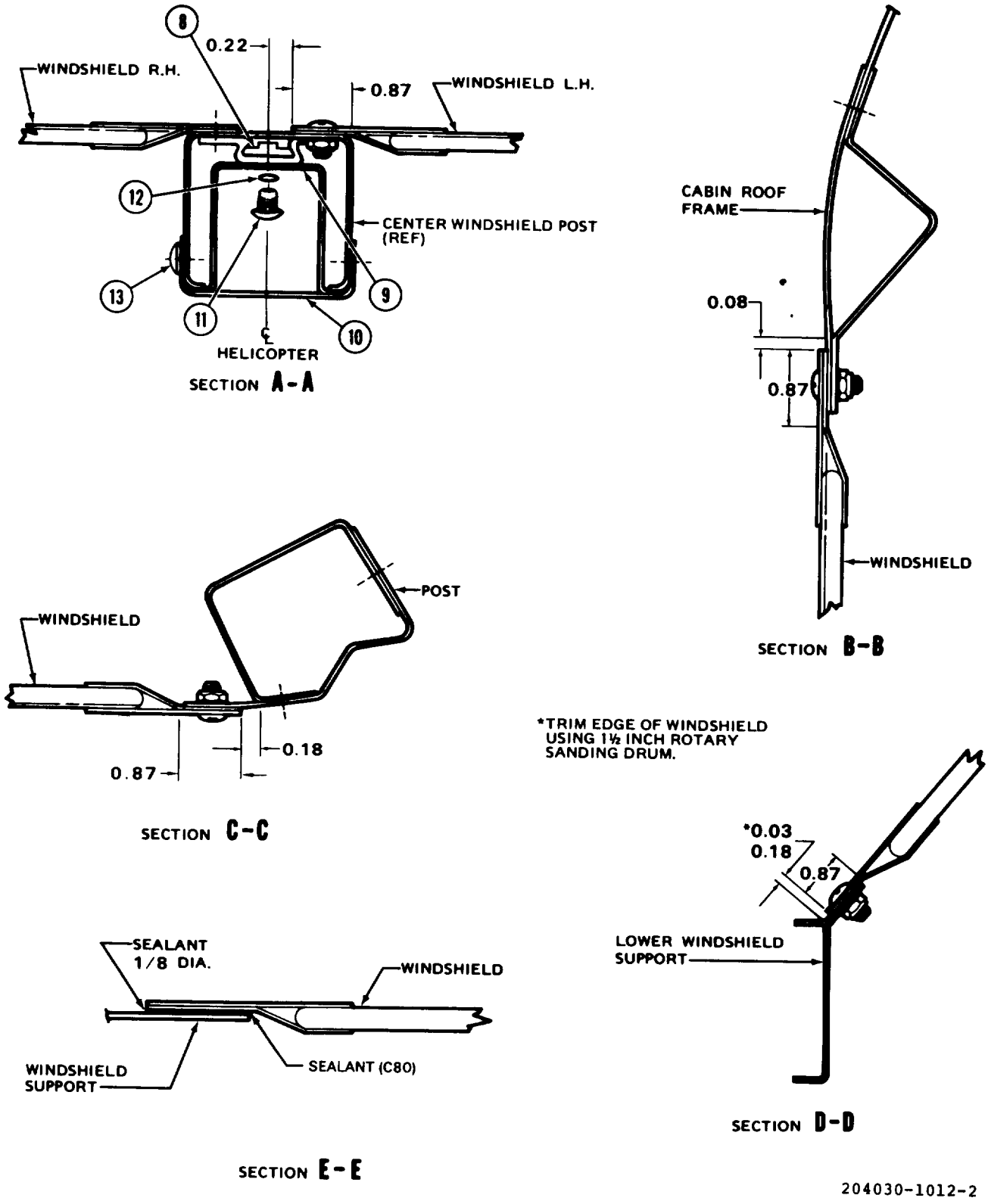


Figure 2-40. Windshield Installation (Sheet 2 of 2)

k. Remove aged sealant from structure with a rag saturated with MEK (C177).

l. Prime outer surface of structure (by spray method) with primer (C206) or primer (C312).

2-137. Cleaning — Windshield.

a. Plastic (Refer to TM 55-1500-344-23) for general instructions.

b. Glass (Refer to Chapter 1).

2-138. Repair or Replacement — Windshield. a. Replace plastic windshield if damage is greater than practical to repair. Repair damage in accordance with TM 55-1500-204-25/1.

b. Replace glass windshield if cracked or if damaged to the extent that vision might be impaired.

2-139. Installation — Windshield.

CAUTION

Do not trim windshield to final size until all mounting holes have been drilled. Glareshield may contact windshield when glass windshield is installed. Adjust glareshield to provide clearance.

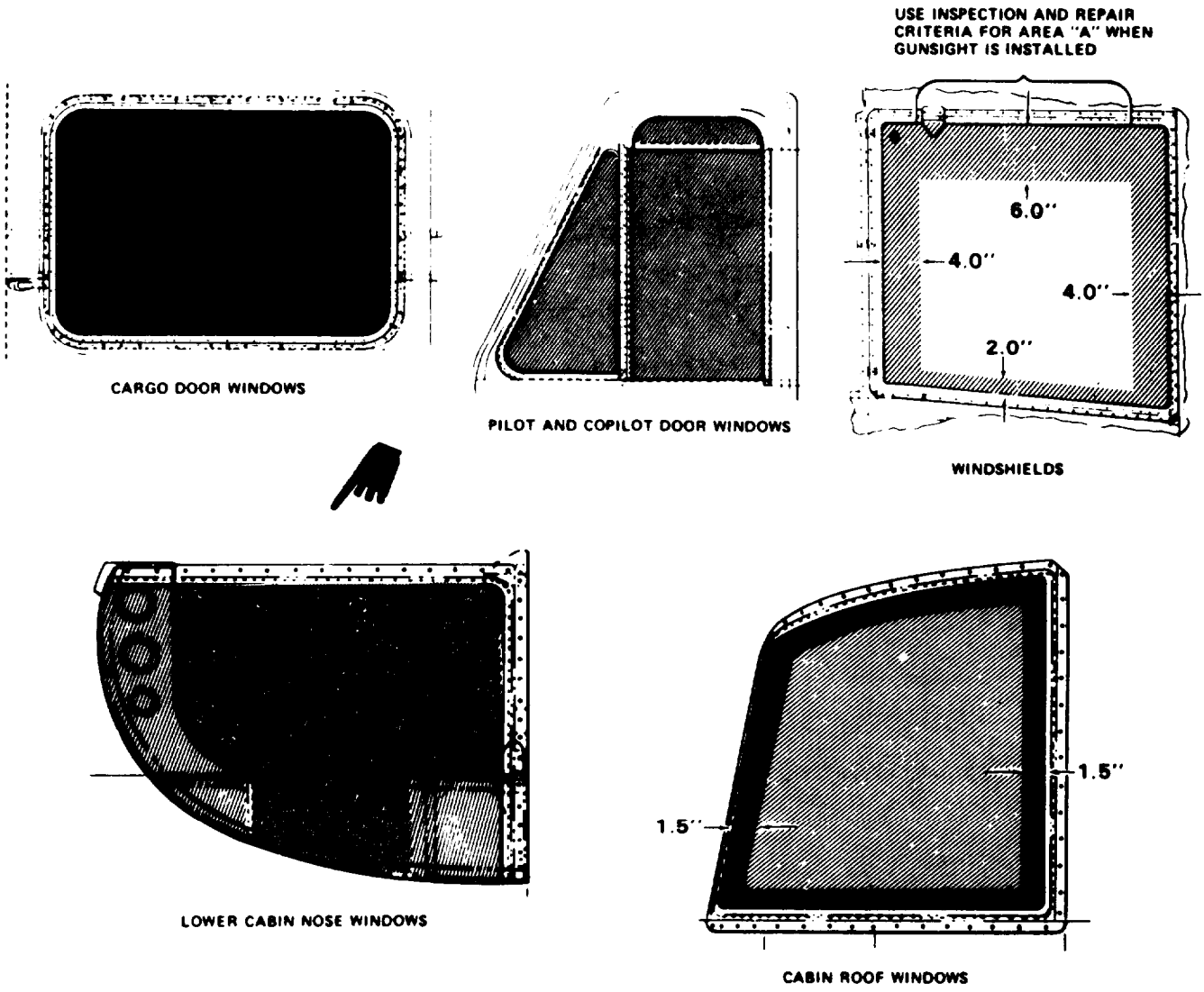
NOTE

Bottom of windshield will not lay flat against structure.

NOTE

til

Changing from acrylic plastic to glass or glass to acrylic plastic windshield requires weight and balance action.

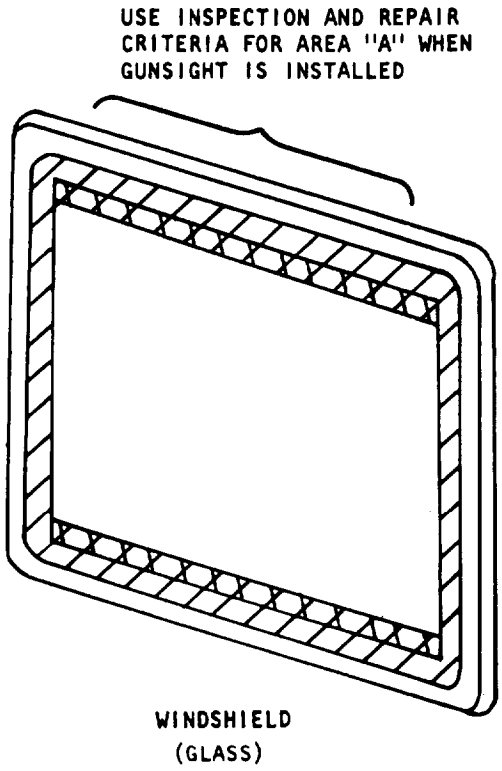


AREA "A" Scratches and pits may be polished out to the extent that vision is not distorted. Distortion of vision is cause for replacement. Cracks holes or other damage may be temporarily repaired, if vision of crew members will not be impaired, by stop drilling, patching or other approved methods (refer to TM 55-1 500-204-25/1), but window must be replaced at the earliest opportunity.

AREA "B" Scratches and pita are permitted in this area provided they are not so numerous or form such a pattern as to be objectionable to the viewer. Cracks, holes or other damage may be temporarily repaired by stop drilling, patching or other approved methods (refer to TM 55- 1500-204-25/1), but window must be replaced at the earliest opportunity.

AREA "C" Scratches and pits are permitted in this area. providing the structural integrity of the window is not impaired. Cracks, holes or other damage maybe repaired by stop drilling. patching or other approved methods provided structural integrity is not impaired {refer to TM 55-1500-204-25/1).

Figure 2-41. Windshields and Windows Critical Areas and Repair Limits.



Critical area: scratches, pits, or chips which impair or distort vision are cause for replacement. Any crack in windshield is cause for replacement.

Non-critical area: 2.0 inches in width around perimeter of glass. Relate when cracks originate from fiberglass edging toward center of windshield into semi-critical area. Minor surface blemishes may be disregarded.

Semi-critical: 3.0 inches at top, 2.0 inches at bottom. Scratches or cracks in either inner or outer panel which do not distort vision are acceptable. Chips or pits not to exceed 3/32 inch are allowable if they do not distort vision.

Figure 2-41.1. Glass Windshields and Windows Critical Areas and Repair Limits

a. Position windshield to cavity of structure. Apply a mark at top and bottom edge (inboard side that overlaps adjacent windshield). Remove and trim excess from windshield to clear adjacent windshield.

CAUTION

Do not drill oversize holes in windshield mounting flange.

b. Position windshield against structure. While maintaining equal clearance{ see Sections B-B and C-C) from structure (minimum 1/8 inch clearance) and using a wooden block as a backup, back drill two 0.1 90 TO 0.196 inch holes approximately 12 inches apart in top center edge of windshield and install two 3/16 metal fasteners.

NOTE

Mounting holes in windshield maybe drilled oversize to 0.213 inch using a number 3 drill bit, after mounting holes in windshield have been locat-ad in accordance with step a above.

c. Using 1 1/2 inch rotary sanding drum, trim lower end of windshield 0.030 TO 0.180 inch clearance from top edge of nose skin as shown in Section D-D.

d. Starting at center (top and lower end) of windshield and working in toward inboard and outboard directions, back drill every third hole and install a 3/16 metal fastener. Back drill remainder of holes in windshield.

e. Remove metal fasteners and windshield from structure.

f. Drill holes to final size, 0.208 TO 0.214 inch. Deburr holes, both sides.

g. Apply a mark 0.50 inch from outer edge of all holes in windshield, draw a line adjoining all marks and trim windshield.

h. Radius, by trimming, lower outboard cor-er (approximately 2.0 inches) of windshield. Maintain 0.50 inch edge distance from outer edge of holes.

i. Trim two inboard corners of windshield to approximately 1-1/2 inch radius. Radius upper outboard corner as required to maintain minimum 0.50 inch hole edge distance.

j. Using a hand file, round all windshield edges approximately 0.015 inch radius.

k. Wipe file dust from windshield. Apply a 0.125 inch bead of watertight sealing compound (C80) on mating surface along inboard and outboard side of holes of windshield and structure.

l. Install two 3/16 metal fasteners in top of windshield, approximately 24 inches apart. Position windshield to structure and secure metal fasteners. Install metal fastener in every other hole.

NOTE

Observe locations of stop (4, figure 2-40) and fitting (5). If clips (8) have bean removed, do not install screws in holes at three locations at this time.

m. Install screws (1). washers (2), and nuts (3) in all open holes in windshield with the exception of mounting points for stop (4) and fitting (5). Remove metal fasteners and install hardware in remainder of holes.

n. Install stop (4).

o. Position fitting (5) at approximately Buttock Line 24.60 and install two screws (6), washers (2), and nuts (3).

p. If three clips (8) have been removed, install clips with screws (1), washer (2), and nuts (3) in same locations from which they were marked, then removed.

q. Position channel (9) to clips (8) and install three screws (11), and three washers (12).

r. Install wire bundle (hanging from overhead console) into channel (9). Position cover (10), while engaging slots over screws (13) and washers, and tighten screws.

s. Back drill hole, located at upper outboard corner and inside of cabin, through windshield for cabin air (water drain) hose. Deburr hole.

t. Install cabin air (water drain) hose to penetrate through window approximately 0.50 inch. Apply sealant (C244) around hose, fair and smooth sealant.

u. Clean excess sealant from around inboard edge of structure and outer edge of windshield.

v. If right windshield (pilot side) is being re-placed, install free air temperature gage (7).

w. Mask and paint fiberglass area of wind-shield, refer to TM 55-1500-345-23.

x. Remove protective film from inner and outer surface of windshield. Clean and polish inner and outer surface of windshield. (Refer to TM 55-1500-204-25/1.)

y. Install windshield arm and blade assembly {paragraph 12-9) to shaft of wiper motor at same position from which it was removed. Install bolt, washer and nut. Remove pin from arm.

2-140. UPPER DOOR WINDOW – CREW DOOR,

2-141. Description – Upper Door Window. A small, fixed, transparent acrylic plastic window (7, figure 2-42, detail B) is located at top of both pilots and copilots crew door. The window is secured to crew door with screws, washers, and nuts.

2-142. Removal – Upper Door Window, a. Remove nuts (5, figure 2-42, detail B), washers (6) from window (7).

b. Separate window (7) from sealing compound and remove window from door (3).

c. Remove old sealant from mounting flange of door (3) with a flat bladed non-metallic tool.

WARNING

Cleaning materiels ore flammable and toxic. Avoid skin contact and breathing of solvent vapors,

CAUTION

When cleaning mounting flange and window, use only aliphatic naphtha, type 2 (C178).

d. Wipe and clean mounting flange and edge of window (7) with naphtha (C178).

2-143. Cleaning – Upper Door Window (TM 55-1500-204-25/1).

2-144. Inspection — Upper Door Window (figure 2-41).

2-145. Repair or Replacement – Upper Door Window. Replace window if damage is greater than practical to repair. Repair window damage in accordance with TM 55-1500-204-25/1.

2-146. Installation - Upper Door Window.

NOTE

Do not trim replacement window to final size until all mounting holes have boon drilled.

a. Position replacement window (7, figure 2-42, over opening. Trim surplus edge to permit window to mate against mounting flange.

b. Position window against mounting flange. Using a No. 23 drill, back drill two 0.146 TO 0.166 inch holes on each edge of window.

c. Secure window to mounting flange with suitable metal fasteners, Drill remainder of holes,

d. Remove window. Mark a line 0.500 inch from outer edge of holes and trim window.

e. Using a suitable file, radius edge of window. Deburr rivet holes on both sides of window.

f. Remove all dust and foreign matter, from mating area of window and mounting flange of door.

g. Apply a 1/8 inch bead of sealing compound (C80) along each side of holes of mating surface of window and mounting flange of door.

h. Position windows (1) to mating flange and install screws (8), washers (6), and nuts (5).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact end breathing of solvent vapors,

CAUTION

When cleaning window, use only aliphatic naphtha, type 2 (C178).

i. Remove excess sealing compound from around window using naphtha (C178). Remove protective film from window. Clean and polish window (TM 55-1500-204-25/1).

2-147. FORWARD DOOR WINDOW – CREW DOOR.

2-148. Description – Forward Door Window. A triangle shape transparent acrylic plastic window (1, figure 2-42, detail A) is located at the forward side of pilots and copilots crew door. The window is secured to crew door with rivets and rivet washers.

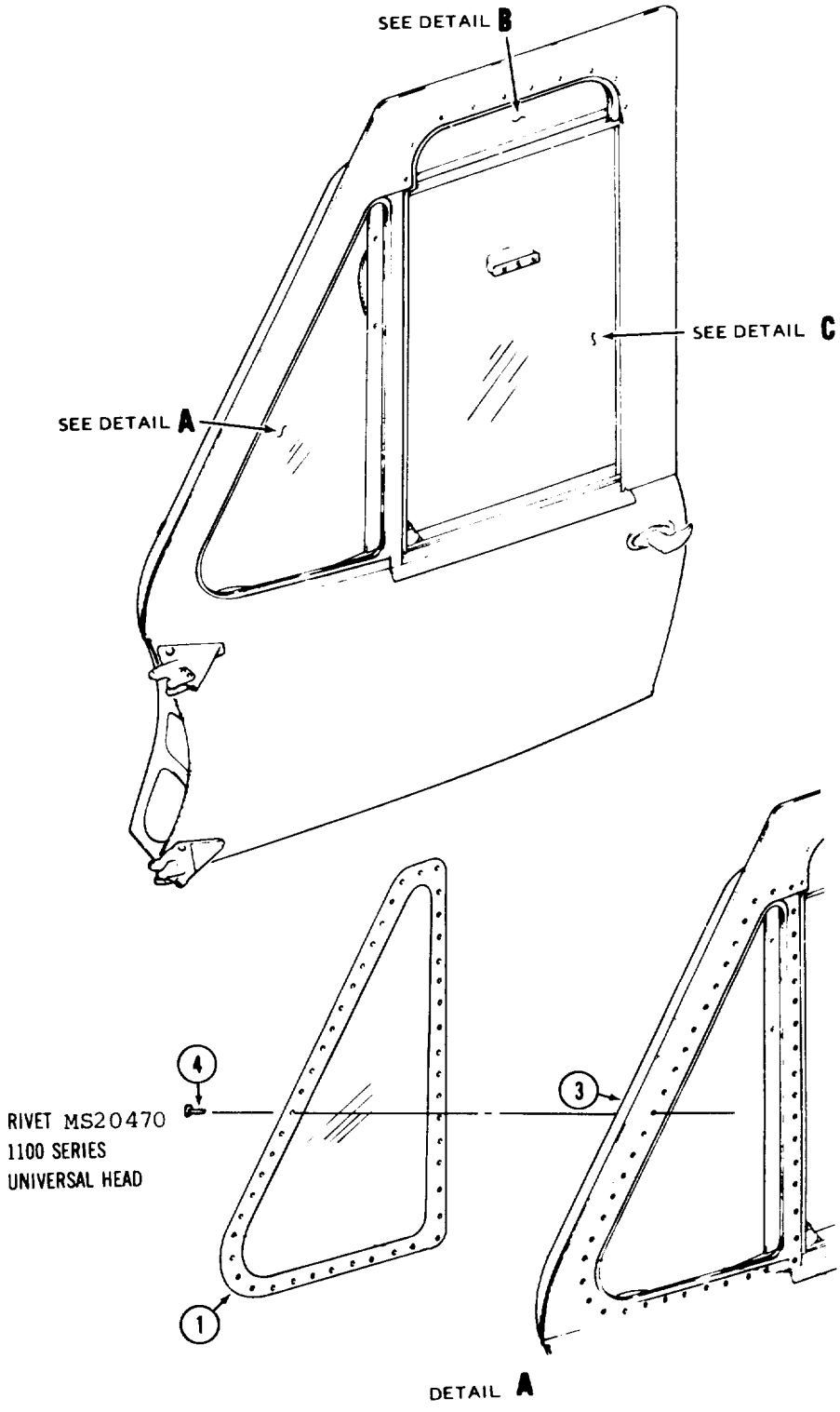
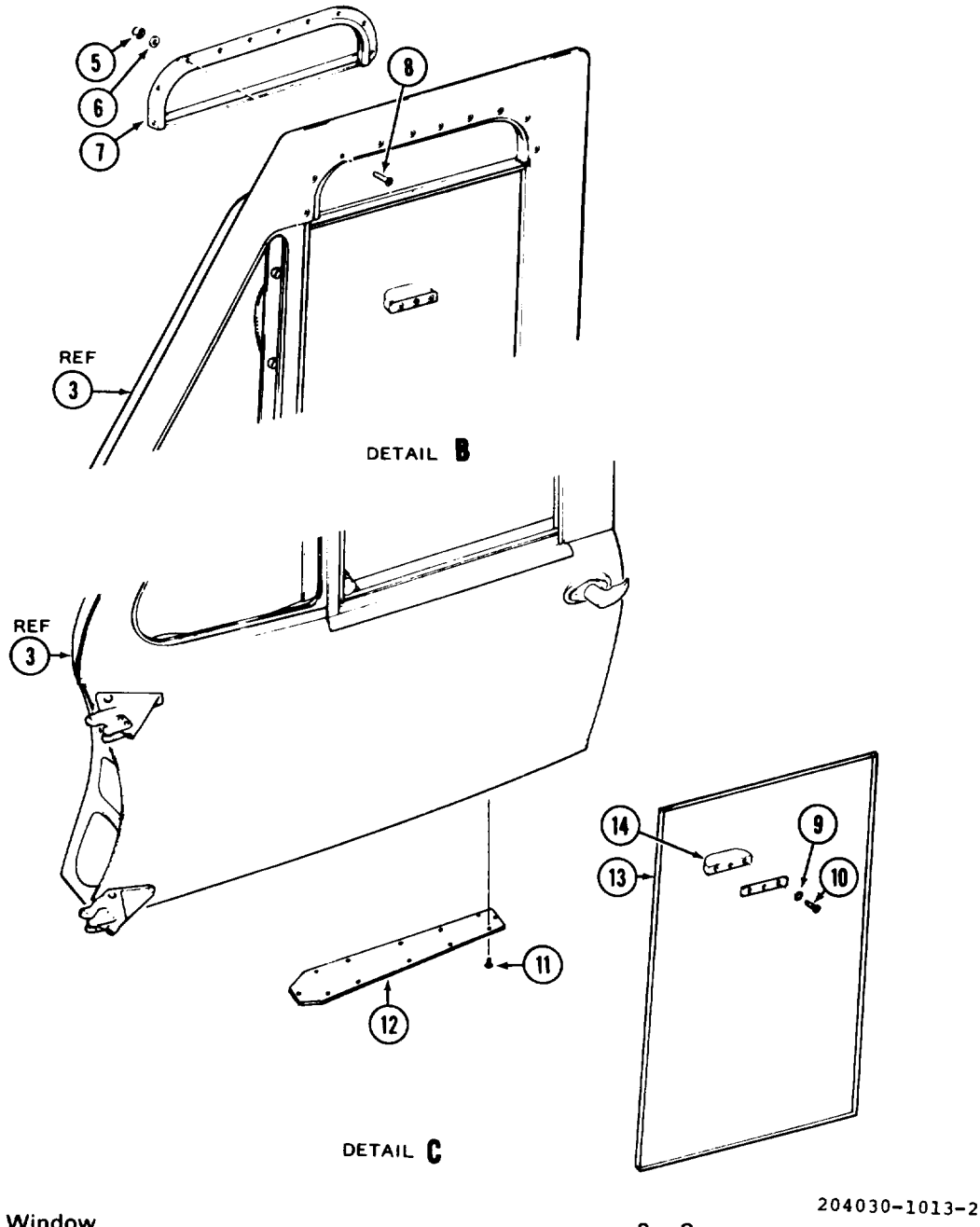


Figure 2-42. Crew Door Windows - Remove/Install (Sheet 1 of 2)



1. Window
2. Deleted
3. Door
4. Rivet
5. Nut
6. Washer
7. Window
8. Screw
9. Washer
10. Screw
11. Screw
12. Door access
13. Window
14. Handle

Figure 2-42. Crew Door Windows – Remove/Install (Sheet 2 of 2)

2-149. Removal — Forward Door Window. a. Using a No. 41 drill, drill rivet shanks from rivets.

b. Drill rivets (4) from windows (1),

c. Separate window (1) from sealing compound and remove window from door (3).

d. Remove old sealant from mounting flange of door (3) with a flat bladed nonmetallic tool.

2.150. Cleaning — Forward Door Window (TM 55-1500-204-25/1).

2-151. Inspection — Forward Door Window (figure 2-41).

2-152. Repair or Replacement — Forward Door Window. Replace window if damage is greater than practical to repair. Repair window damage in accordance with TM 55-1500-204-25/1.

2-153. Installation — Forward Door Window.

NOTE

Do not trim replacement window to final size until all mounting holes have been drilled.

a. Position replacement window (1, figure 2-42, detail A) over opening. Trim surplus edge to permit window to mate against mounting flange.

NOTE

Radius of window must not foul mounting flange Check for equal clearance.

b. Position window (1) against mounting flange. Back drill four holes and secure window to door with metal fasteners or screws, washers, and nuts and lightly tighten nuts. Drill remainder of holes.

c. Remove window. Mark a line approximately 1/8 inch from outer edge of holes to clear radius of mounting flange of door. Trim window.

d. Using a suitable file, radius edge of window. Deburr rivet holes on both sides of window.

e. Remove all dust and foreign matter from mating area of window and mounting flange of door.

f. Apply a 1/8 inch bead of sealing compound (C244) along each side of holes of mating surfaces of window and mounting flange of door.

g. Position window (1) to door (3) and install a metal fastener in every other hole.

h. Install MS 20470 rivet with manufactured head inboard in open holes, Remove metal fasteners and install remainder of rivets.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

CAUTION

When cleaning window, use only aliphatic naphtha, type 2 (C178).

i. Remove excess sealing compound from around window using naphtha (C178). Remove protective film from window. Clean and polish window (TM 55-1500-204-25/1).

2-154. ADJUSTABLE WINDOW — CREW DOOR.

2-155. Description — Adjustable Window. The lower large transparent plastic window in the crew door is the adjust able window.

2-156. Removal — Adjustable Window. a. Remove screws (11, figure 2-42. detail C) and remove door (12).

b. Remove screws (10), washers (9), and handle (14).

c. Guide window downward through slot in bottom **of door and remove window.**

2-157. Cleaning — Adjustable Window. Clean window in accordance with TM 55-1500-204-25/1

2-158. **Inspection – Adjustable Window. Inspect in accordance with figure 2-41.**

2-159. Repair or Replacement – Adjustable Window. Replace window if damage is sufficient to impair vision or greater than practical to repair Repair window damage in accordance with TM 55-1500-204-25/1.

2-160. Installation — Adjustable Window a. Guide window (13, figure 2-42, detail C) upward through slot in bottom of door and into window channels

NOTE

When installing new window, refer to figure 2-28.1 for pilot/copilot window security device.

NOTE

Check progress through opening in aft edge of door.

b. Place window in partially closed position and install handle (14) with washers (9) and screws (10).

c. Install door (12) with screws (11)

2-161. CABIN ROOF WINDOWS.

2-162. Description — Cabin Roof Windows. Two transparent plastic windows are Installed above the pilot and copilot in the cabin roof windows.

2-163. Removal — Cabin Roof Windows. a. Remove nuts, washers, and screws attaching window to cabin roof

b. Separate window from sealant and remove window.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

CAUTION

Do not clean windows with methyl-ethyl-ketone.

c. Remove aged sealant from structure using a rag moistened with methyl-ethyl-ketone (C177).

2-164. Cleaning — Cabin Roof Windows. Clean in accordance with TM 55-1500-204-25/1

2-165. Inspection — Cabin Roof Windows. Inspect in accordance with figure 2-41.

2-166. **Repair or Replacement — Cabin Roof Windows, Replace window if damage is sufficient to Impair vision, or greater than practical to repair Repair window damage in accordance with TM 55-1500-204-25/1**

2-167. Installation — Cabin Roof Windows. a. Trim, fit and drill window in accordance with instructions and dimensions in paragraph 2-146.

b. Apply a 1/8 inch bead of sealing compound (C242) to mating flanges of windows and structure.

c. Postion window to structure and install screws, washers, and nuts,

WARNING

Cleaning Materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

CAUTION

When cleaning window, use only aliphatic naphtha, type 2 (C178).

d. Remove excess sealing compound using naphtha (C 178).

e. Remove protective film from window. Clean window in accordance with TM 55-1500-204-25/1.

2-168. LOWER FORWARD CABIN WINDOWS.

2-169. Description — Lower Forward Cabin Windows. Two transparent plastic windows are located forward and below each set of the tail rotor control pedals.

2-170. Removal — Lower Forward Cabin Windows. a. Remove rear view mirror if removing right window (paragraph 2-177).

b. Remove nuts, washers, and screws attaching window to cabin structure.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

CAUTION

Do not clean windows with methyl-ethyl-ketone.

c. Remove aged sealant from structure using a rag moistened with methyl-ethyl-ketone (Cl 77).

2-171. Cleaning — Lower Forward Cabin Windows. Clean in accordance with TM 55-1 500-204-25/1.

2-172. inspection — Lower Forward Cabin Windows. Inspect **in accordance with figure** 2-41,

2-173. Repair or Replacement — Lower Forward Cabin Windows. Replace window if damage is sufficient to impair vision, or greater than practical to repair. Repair window damage in accordance with TM 55-1500-204-25/1 .

2-174. Installation — Lower Forward Cabin Window. a. Trim, fit, and drill window in accordance with instructions and dimensions in paragraph 2-146.

b. Apply a 1/8 inch bead of sealing compound (C242) to mating flanges of window and structure.

c. Position window to structure and install screws, washers, and nuts.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

CAUTION

When cleaning windows, use only aliphatic naphtha, type 2 (C178).

d. Remove excess sealing compound using naphtha (C178).

e. **Remove** protective film from window. Clean window in accordance with TM 55-1500-204-25/1,

f. If removed, install and adjust rear view mirror (paragraph 2-178 and 2-179).

2-175. REARVIEW MIRROR.

2-176. **Description — Rearview Mirror. The helicopter is equipped with an adjustable rearview mirror located outside the forward cabin below the pilot lower window.** This mirror, when properly adjusted, enables the pilot to visually check the operation **of the external cargo suspension** hook. When the helicopter is employed on missions which do not require use of the external cargo suspension, the rearview mirror may be covered or removed and stowed.

2-177. Removal — Rearview Mirror. a. Remove bolts, **washers, nuts and/or quick-release pins, which attach braces and supports to structure. Remove mirror assembly from helicopter.**

b. To remove mirror from brace assembly, remove mirror rover, spring pins from adjustment handles.

2-178. Installation — Rearview Mirror. a. Install braces and supports to structure, using previously removed bolts, washers, nuts and/or quick-release pins.

b. Position rearview mirror and align mounting holes.

c. Screw adjustment handles through mounting holes. Adjust mirror to desired angle, tighten adjustment handles. Insert spring pins in threaded ends of handles.

d. Slide protective cover over mirror and fasten holding snap.

2-179. Adjustment — Rearview Mirror. a. Remove spring pin and loosen adjustment handles.

b. Manually adjust mirror to desired angle.

c. Tighten adjustment handles, Insert spring pins.

2-180. SOUNDPROOFING BLANKETS.

2-181. Description — Soundproofing Blankets. Cabin interior is covered with soundproofing material to reduce noise level for crew and passengers during operation, and provide protection to main beam panels. Blankets are attached to structure by hook-and-pile and snap-type fasteners. They may be removed for maintenance access, but must be securely installed for flight.

CAUTION

To prevent damage to aircraft bulkheads during flight, all sound absorbing blankets must be securely installed with the bulkhead tiedown fittings, straps, and rings extending outside of the sound absorbing blankets.

2-182. Removal — Soundproofing Blankets. Release snap fasteners and hook-and-pile attachments holding blankets to structure, Remove ‘blankets.

2-183. Inspection — Soundproofing Blankets. Visually inspect blankets for cuts and tears. Inspect for missing and damaged buttons and sockets.

2-184. Repair or Replacement — Soundproofing Blankets. a. Repair cuts or tears.

(1) Cut a patch from cloth (C69) large enough to overlap all sides of the tear or cut.

(2) Apply a thin, even coating of adhesive (C57) to back of patch. Allow to dry until tacky.

(3) Center patch over tear or cut with adhesive side against blanket.

(4) Apply firm, even pressure to patch in such a manner that it will adhere securely to blanket without wrinkles or irregularities.

b. Replace missing or damaged buttons and sockets.

(1) Cut a patch from cloth (C69) large enough to overlap all sides of the damaged area around button or socket.

(2) Center patch over damaged area and sew securely in place with thread (C286).

(3) Install new button or socket, using press and dies.

2-185. Installation – Soundproofing Blankets, Position blankets in helicopter and attach to structure with snap fasteners and hook-and-pile attachments,

2-186. BLACKOUT CURTAINS.

2-187. Description — Blackout Curtains. A blackout curtain may be installed behind pilot and copilot seats, between forward and aft cabin sections. Other blackout curtains may be installed over both cargo door windows and window in removable door post

2-188. Removal — Blackout Curtains. Release fasteners and screws attaching curtains to structure. Remove curtains.

2-189, Inspection — Blackout Curtains. Inspect curtain for cuts, tears, missing attachment buttons and sockets. Inspect slide fasteners for operation and damage,

2-190. Repair or Replacement — Blackout Curtains. a. Repair cuts and tears in blackout curtains,

(1) Cut a patch of twill (C294) large enough to overlap all sides of the cut or tear.

(2) Center patch over cut or tear. Sew in place with thread (C287).

NOTE

All sewing shall be in accordance with Federal Specification DDD-S-751.

b. Replace damaged or missing buttons and sockets,

c. Repair damaged slide fasteners,

(1) Rip out stitching attaching slide fastener to curtain material, Remove damaged slide fastener.

NOTE

Visually inspect flap of blackout material attached to back of slide fastener.

(2) Repair area to which new slide fastener and flap will be attached,

(3) Position new slide fastener and flap and **sew in place with thread (C287).**

2-191, **Installation — Blackout Curtains. Position curtains. Attach with screws and fasteners.**

2-192. PARATROOP STATIC LINE CABLE.

2-193. Description -Paratroop Static Line Cable. A paratroop static line cable may be installed on the center of the aft cabin bulkhead. This installation consists of a cable (6, figure 2-43), a compression tube (1), attach plates (3), fitting (4), and attaching hardware.

2-194. Removal -Paratroop Static Line Cable.

a. Remove nuts (18, figure 2-43), washers (13), and bolts (12) securing attach plates (14) to fittings (8).

b. Remove bolts (6) and washers (7) attaching fitting (8) to bulkhead. Remove cable installation from bulkhead.

c. Remove cotter pins (16), washers (15), and pins (5) to remove cable (17) from fittings (8).

d. Remove nuts (11), lockwasher (10), and washers (9) to remove fitting (8) from compression tube (1). Remove washers (4), lockwashers (3) and nuts (2).

2-195. Inspection -Paratroop Static Line Cable.

a. Inspect cable (17, figure 2-43) for wear and broken or frayed wires.

b. Inspect fitting (8) and compression tube (1) for damage or cracks. If crack is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

2-196. Repair or Replacement - Paratroop Static Line Cable.

a. Replace cables that are worn or that have broken or frayed wires.

b. Replace fittings or compression tube that is cracked or damaged.

2-197. Installation -Paratroop Static Line Cable.

a. Install nut (2, figure 2-43), lockwasher (3), and washer (4) on each end of compression tube (1).

b. Position fittings (8) on compression tube (1). Align holes in tube (1), fittings (4) and cable (17). Install pins (5), washers (15), and cotter pins (16).

c. Install washers (9), lockwashers (10) and nuts (11). Leave nuts (11) loose.

d. Position fittings (8) to bulkhead. Install bolts (6) with washers (7).

e. Install bolts (12), with washers (13) and nuts (18).

f. Tighten nuts (11) and (2).

2-198. JACK FITTINGS.

2-199. Description -Jack Fittings. The two forward jack pads (figure 1-9) are located just forward of front crosstube at each side. The two aft jack pads are located behind aft crosstube. The jackfittings provide a mounting point for the mooring fittings.

2-200. Removal -Jack Fittings.

a. Remove bolts and washers.

b. Remove jack fitting.

2-201. Inspection -Jack Fittings. Inspect jack fitting for wear, cracks, or elongated mounting holes. If crack in jack fitting is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

2-202. Repair or Replacement -Jack Fittings. Replace jack fitting if worn, cracked, or mounting holes are elongated.

2-203. Installation -Jack Fittings.

a. Position jack fitting on fuselage, align bolt holes.

b. Install bolts and washers.

c. Torque bolts 50 TO 70 inch-pounds.

2-204. MOORING FITTINGS.

2-205. Description -Mooring Fittings (paragraph 2-199).

2-206. Removal -Mooring Fittings. (Figure 1-8.)

a. Remove bolt and washer.

b. Remove mooring fitting.

2-207. Inspection -Mooring Fittings.

a. Inspect mooring fitting for wear.

b. Inspect bushing in jack fitting for wear or cracks. If crack in bushing is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

c. Inspect mooring fitting for cracks. If crack in mooring fitting is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

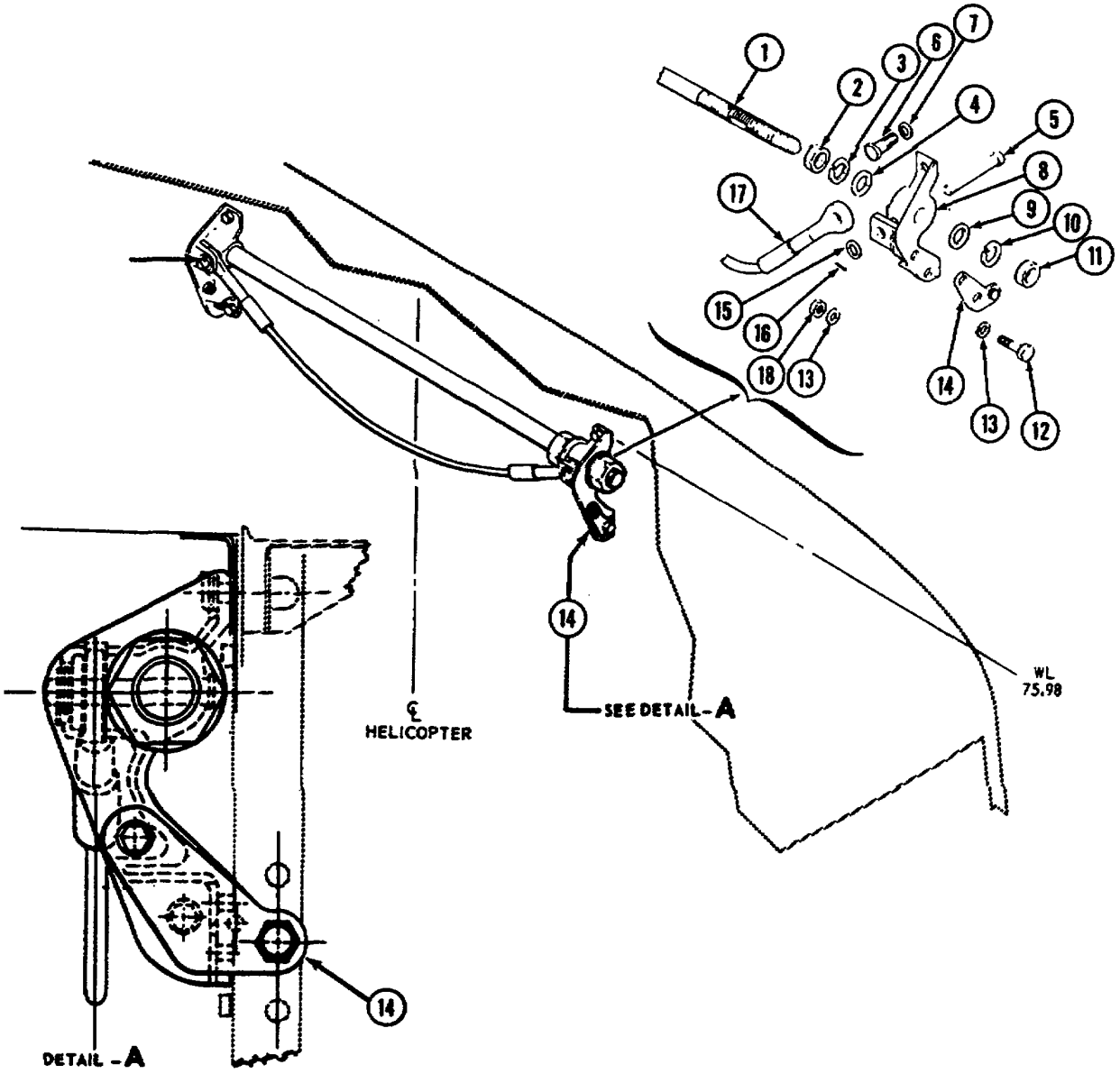
d. Check mooring fitting for security.

2-208. Repair or Replacement -Mooring Fittings.

a. Replace shackle if worn.

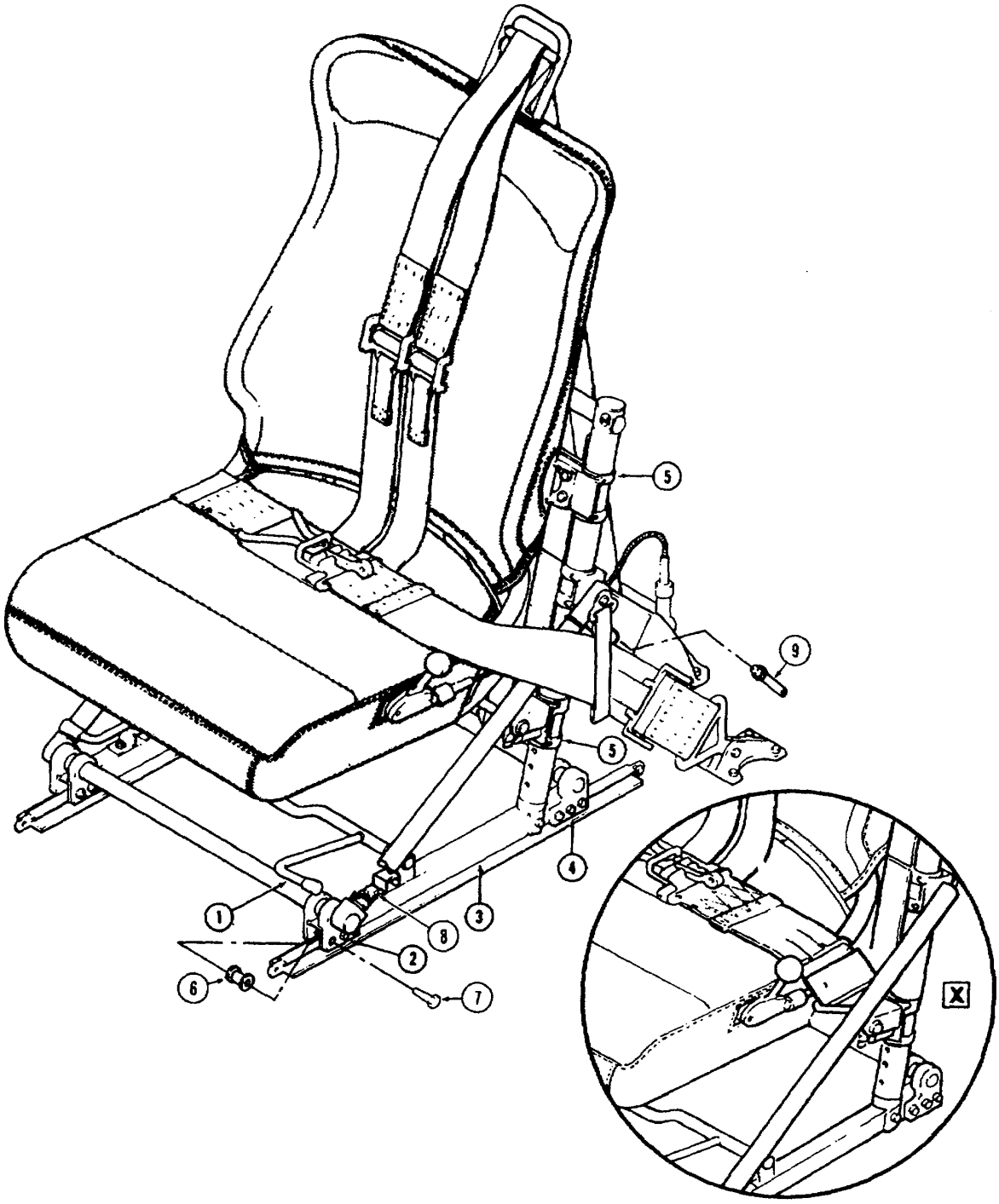
b. Replace bushing in jack fitting if worn or cracked.

c. Replace shackle if cracked.



1. Compression tube
2. Nut
3. Lockwasher
4. Washer
5. Pin
6. Bolt
7. Washer
8. Fitting
9. Washer
10. Lockwasher
11. Nut
12. Bolt
13. Washer
14. Attach plate
15. Washer
16. Cotter pin
17. Cable
18. Nut

Figure 2-43. Paratroop Static Line Cable



1. Actuator handle
2. Forward fitting
3. Carriage assembly
4. Aft fitting
5. Fitting
6. Carriage roller
7. Bolt
8. Bolt
9. Straight headed pin

Figure 2-44. Crew Seat -Typical.

2-209. Installation - Mooring Fittings.

a. Position mooring fitting on jack fitting.

b. Install bolt and washers.

2-210. MAP AND DATA CASE.

2-211. Description -Map and Data Case. A case with a hinged, lock-down cover is installed on aft end of lower pedestal between crew seats.

2-212. Inspection - Map and Data Case. Inspect hinges, screws, and mounting brackets for security.

2-213. Removal - Map and Data Case. Remove four screws attaching case to mounting brackets.

2-214. Repair or Replacement - Map and Data Case. Replace hinges or case if broken.

2-215. Installation -Map and Data Case. Position case on brackets and install four screws.

2-216. STANDARD CREW SEAT.

NOTE

Other than location and mounting configuration, the mission operator seat for the EH-1X (paragraph 2-252.10) is identical to the crew seat.

2-217. Description -Standard Crew Seat. Seats are adjustable, nonreclining type, mounted on tracks fixed to cabin floor (figure 2-44).

2-218. Removal -Standard Crew Seat.

a. Remove stopbolts or quick-release pin and stop assembly on outboard track only at aft ends of seat tracks.

b. Remove hardware securing stops and remove stops from aft end of track, if applicable.

c. Lift handle, located on left side of seat, to release position pin. Slide seat aft off tracks.

2-219. Disassembly -Standard Crew Seat (Figure 2-44).

a. Remove seat bottom and seat back cover assemblies (paragraph 2-227).

b. Remove shoulder harness, inertia reel, inertia reel manual control, and seat belts from seat assembly (paragraphs 2-234 and 2-243).

c. Remove hardware attaching seat to carriage assembly (3), and separate seat from carriage.

d. Remove hardware attaching actuator adjustment handle assembly to carriage assembly (3).

e. Remove hardware attaching actuator handle (1). Remove actuator handle.

2-220. Inspection -Standard Crew Seat (Figure 2-44).

a. Forward (2) and aft (4) may be inspected by fluorescent penetrant method (TM 1-1500-204-23 Series). If crack is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

b. Visually inspect vertical adjustment handle assembly for distortion and wear.

c. Visually inspect actuator handle (1) for damage.

d. Check carriage assembly (3) for damage and operation.

e. Fittings (5) may be inspected by fluorescent penetrant method (TM 1-1500-204-23 Series). If crack in the fittings is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

f. Inspect seat bottom and seat back cover assemblies for damage and serviceability.

g. Inspect tubes for cracks, distortion, and serviceability. If crack in the tubes is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

h. Inspect tracks. Seats are adjusted by means of an eccentric bolt. Wear deemed beyond limits would be if eccentric bolt has turned to the highest point in cam rotation and seat still exhibits a vertical play in excess of 0.025 inch (measured between roller and channel).

2-221. Repair or Replacement - Standard Crew Seat (Figure 2-44).

a. Replace seat attachment fittings (2 and 4) if unserviceable.

b. Replace actuator handle (1) if unserviceable.

c. Replace entire unit of carriage assembly (3) if damaged or operation is not satisfactory.

d. Replace fittings (5) that fail to meet inspection requirements.

e. Replace vertical adjustment handle assembly if worn or damaged.

f. Replace seat bottom or seat back if damaged or unserviceable.

2-222. Assembly -Standard Crew Seat.

a. Reassemble seat and carriage.

b. Install shoulder harness, inertia reel, inertia reel manual control and seat belts on seat assembly (paragraphs 2-236 and 2-246).

c. Install seat bottom and seat back cover assemblies (paragraph 2-229).

2-223. Installation - Standard Crew Seat.

a. Lubricate pilots and copilots seat rollers with lubricant (C164) as required.

b. Engage rollers on aft end of tracks. Lift handle on left side of seat. Slide seat forward on tracks to normal position.

c. Install stopbolts or quick-release pin and stop assembly on outboard track only at aft ends of tracks.

d. Install stop on aft end of track with previously removed hardware, if applicable.

2-224. Adjustment - Standard Crew Seat. Vertical adjustment is provided by a lever on right side of each seat. Fore and aft adjustment lever is located on left side of seat. Tightening or loosening of the seat (bottom) net is accomplished by adjustment of turnbuckles. The back net tension can be controlled by use of the nylon cord lacing.

2-225. CREW SEAT COVERS.

NOTE

Mission operator seat covers for the EH-1X are identical to the crew seat covers.

2-226. Description - Crew Seat Covers. Crew seat metal frames are covered with nylon mesh material. Metal eyes are provided in seat back cover for lacing with nylon cord (C84). Metal strips are attached to tabs of lower seat cover with eyelets for attachment of turnbuckles.

2-227. Removal - Crew Seat Covers.

NOTE

Bottom seat covers made of nylon cloth, Raschel knit, shall have a service life of 24 months. Seat covers that are not marked with installation date shall be assumed to have the same date as the day of acceptance of the helicopter. Replacement seat covers shall be stenciled "INSTALLED (day-month-year)" with contrasting stencil ink conforming to (C140). The stenciled date is to be located as shown in figure 2-45. Armored seat assemblies do not have to be removed from the aircraft to replace seat covers.

a. Remove seat back cover as follows:

(1) Remove eight bolts securing back of seat to frame.

(2) Lift and remove seat frame.

(3) Lift flap on side of seat back cover for access to nylon cord.

(4) Untie nylon cord and loosen as necessary to remove cover.

b. Remove lower seat cover as follows:

(1) Cut lockwires and loosen turnbuckles underneath seat.

(2) Disconnect tumbuckles from metal reinforcing strips in seat cover tab.

2-228. Inspection/Repair - Crew Seat Covers. Refer to TM 1-1500-204-23-1.

2-229. Installation - Crew Seat Covers.

NOTE

Tool (T72.1) may be used to install seat covers.

a. Install seat back covers as follows:

CAUTION

Trim all reinforcing strips 1/16 inch shorter than the nylon material they are contained in. Round off all sharp corners with a file.

(1) Position cover on seat back.

(2) Use nylon cord laced through reinforcing eyes to tighten cover to desired tension.

b. Install lower seat cover as follows:

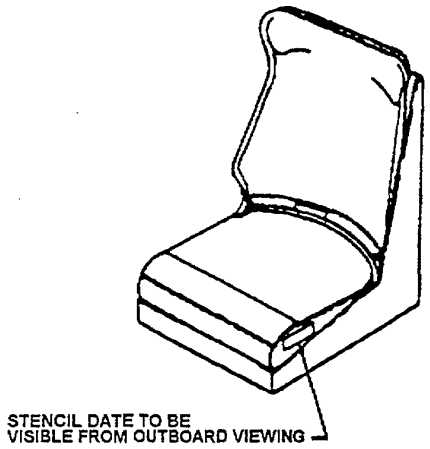


Figure 2-45. Crew Seat Cover/Stencil

(1) Position cover on lower seat.

(2) Connect turnbuckles to metal reinforcing strips in seat cover tab.

(3) Adjust seat cover to desire tension by tightening turnbuckle. The correct tension is achieved when the metal stiffener at the adjustment attachment just begins to buckle. Lockwire (C155) turnbuckles together for security.

(4) Position seat frame on seat assembly.

(5) Install and tighten eight bolts to secure seat frame.

2-230. Adjustment - Crew Seat Covers. If turnbuckle has reached its extreme position and further tightening is desires, the seat cover may be tightened further as follows:

a. Cut lockwire securing turnbuckle.

b. Loosen and disconnect turnbuckles from metal reinforcing strip in seat cover tab.

c. Turn metal reinforcing strip one-half turn.

NOTE

Roll tab material evenly.

d. Connect turnbuckles to metal reinforcing strips through slots provided in material.

e. Adjust seat covers to desired tension by tightening turnbuckles. The correct tension is achieved when the metal stiffener at the adjustment attachment just begins to buckle.

f. Lockwire (C1 55) turnbuckles together for security.

2-231. SHOULDER HARNESS AND INERTIA REEL - CREW STANDARD SEAT.

NOTE

Mission operator seat shoulder harness and inertia reel for the EH-IX are identical to that used on the crew seat.

2-232. Description - Crew Standard Seat, Shoulder Harness and Inertia Reel. An inertia reel shoulder harness, with a manually operated control handle is incorporated on each crew seat. The inertia reel is a mechanical restraining device that is designed to hold crewmember in a normal seated position during any maneuver which would tend to pitch the crewmember forward. Each reel is connected to a shoulder harness with a web strap. An automatic locking mechanism, a webbing roller, and a manual control are incorporated in each unit (figure 2-46). On EH-1 H aircraft, the mission operator seats have shoulder harness inertia reels bolted to the rear of the seat back (figure 2-48.1).

2-233. Inspection - Crew Standard Seat, Shoulder Harness and Inertia Reel.

a. Inspect shoulder harness for wear (TM 1-1500-204-23-1). Inspect shoulder harness for security of attachment to reel strap (3). Inspect inertia reel for security of mounting and attachment to floor structure.

b. Place manual control handle to AUTO position. Disconnect shoulder harness from reel strap (3), attach spring scale to end of reel strap (3) and, while watching ! scale, slowly pull length of strap (3) out of inertia reel. The tension indicated shall be not less than one pound.

c. Cycle control handle from AUTO to MANUAL several times as the reel strap (3) is being reeled in and out. The reel shall positively lock and hold each time the handle is moved to MANUAL.

d. Place control handle in the unlocked position. Sharply pull shoulder harness, exerting a 2 to 3 "G" force to check auto locking mechanism. Check that shoulder harness has locked and retracts into inertia reel. Cycle control handle to release auto locking mechanism.

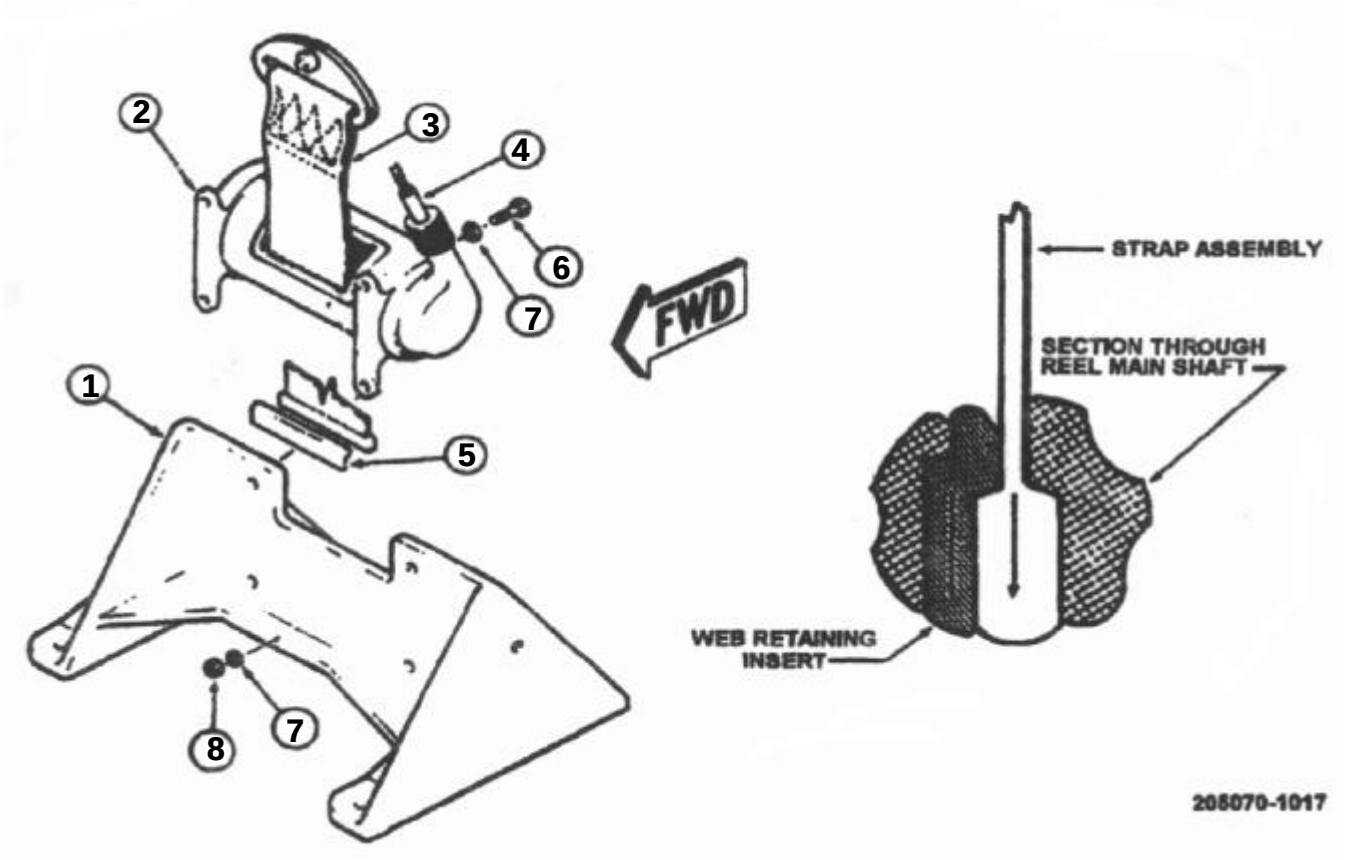
2-234. Removal - Crew Inertia Reel.

a. Remove bolt, washer, and nut securing shoulder harness from inertia reel strap. Remove shoulder harness from seat.

b. Remove two screws, washers, spacers, and nuts securing control assembly from left side of crew seat.

b.1. To remove control cable (4), remove lockwire, disconnect from control lever and inertia reel, and remove cable.

c. Remove bolts (6, figure 2-46), washers (7) and nuts (8) securing reel assembly (2) from support bracket (1). Remove control assembly and reel assembly from seat.



1. Support bracket	**3. Strap**	**5. Web retaining insert**	**7. Washer**
2. Reel assembly	**4. Control cable**	**6. Bolt**	**8. Nut**

Figure 2–46. Crew Inertia Reel – Standard Seat

2–234.1 Removal – Crew Inertia Reel (MA–16 Inertia Reel)

a. Remove bolt, washer, and nut securing harness from inertia reel strap. Remove shoulder harness from seat.

b. Set inertia reel control handle to manual lock (front) and remove safety wire from knurl nut on inertia reel. Disconnect knurled nut from inertia reel and remove control cable (4, figure 2–46).

c. Remove bolts (6), washers (7), and nuts (8) securing inertia reel assembly (2) to support bracket (1) and remove inertia reel.

2–235. Repair or Replacement – Crew Inertia Reel.

a. Replace if failed inspection (paragraph 2–233).

b. Replace strap (3) if worn or frayed (paragraph 2–237 or 2–237.1).

NOTE

When installing crew inertia reel, ensure control cable is installed to the outside of telescoping tube (Ref. Fig. 2–47, Item 7) or damage to control cable, seat frame, and armor plating may occur.

2–236. Installation – Crew Inertia Reel.

a. Apply vinyl tape (C281) to fraying surface of reel and fitting. Position inertia reel assembly (2, figure 2–46) on support bracket (1) using bolts (6), washers (7), and nuts (8).

b. Attach control assembly to left side of seat using two screws, washers, spacers and nuts.

c. To install control cable (4), connect fitting at control lever and inertia reel, tighten finger tight, and lockwire (C155).

d. Attach strap (3) to shoulder harness with bolt, nut, and washer.

e. Secure control cable (4) to control assembly and lockwire (C155) knurled nut.

2–236.1 Orienting The Control Head Assembly – MA–16 Inertia Reel.

a. Place reel on a flat surface standing on end with the control head assembly facing up.

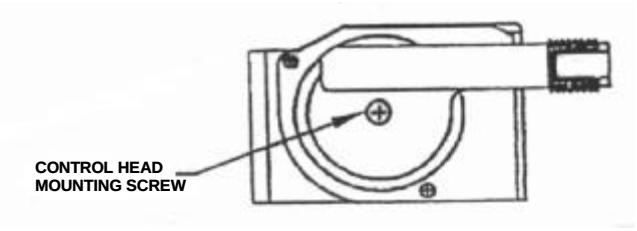


Figure 2–46.1A Inertia Reel As Shipped – End View

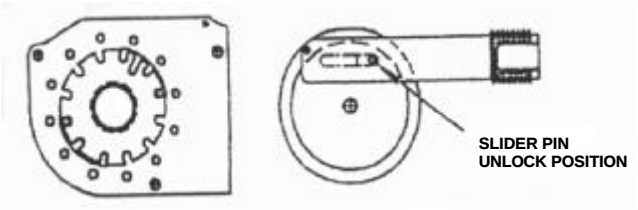


Figure 2–46.1B With Control Head Removed

b. Figure 2–46.1A shows the reel in the "as shipped" condition. Figure 2–46.1B illustrates the proper component orientation for this configuration. Figure 2–46.2 illustrates and identifies the components involved in reorienting the control head assembly.

c. Remove the screw in the center of the control head assembly and lift the assembly off of the reel.

CAUTION

The reel must be unlocked as indicated by the bright pin being in the position shown in figure 2–46.2 before reassembly.

The slider pin must be in the position shown in figure 2–46.2 before reassembly (pushed all the way toward the threaded end of the tube).

CAUTION

Over tightening the control head screw can cause binding.

d. If inertia reel is mounted to the floor figure 2–46.3 shows the correct position of the control head assembly. If inertia reel is mounted to the back of the seat figure 2–46.4 shows the correct position of the control head assembly (as shipped). If reorienting lift off the adapter ring and replace it in the position shown in the appropriate figure. Replace the control head assembly in the new orientation ensuring the locator pin is properly engaged in the end cover. Replace the screw.

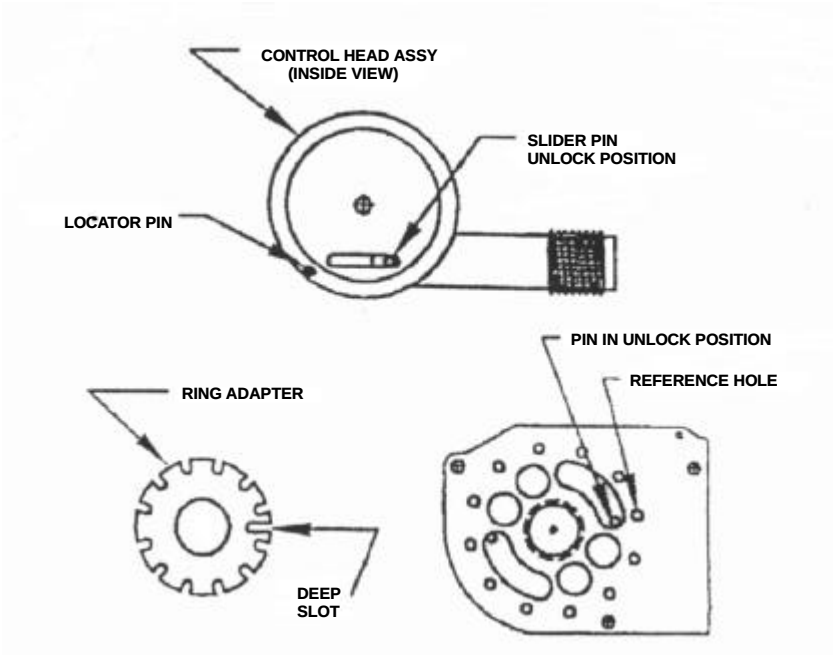


Figure 2–46.2 As Shipped Configuration

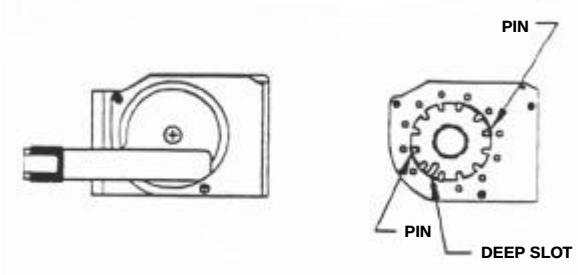


Figure 2–46.3

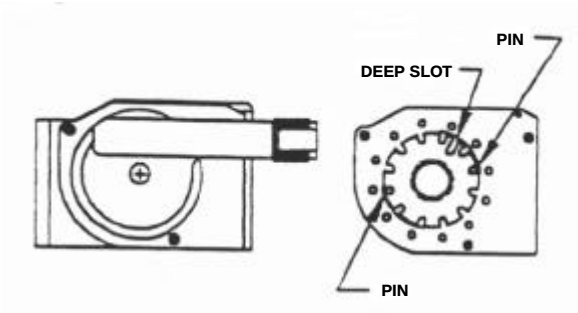


Figure 2–46.4

e. Using a small screwdriver or allen wrench, push the slider all the way into the tube and pull back out to original position. If it moves, the reorientation has been properly accomplished.

f. If the slider will not move, note the **CAUTION** above and repeat steps d. and e.

2–236.2. Installation Crew Inertia Reel (MA–16).

CAUTION

New reels are supplied with spring fully wound and tie rapped for strap installation. If the spring is allowed to unwind rapidly, spring damage will result. The damage may not be apparent and the spring may appear to function normally. If rapid unwinding occurs, replace the entire reel assembly.

a. Apply vinyl tape (C281) to mounting surface of MA–16 inertia and support bracket. Position MA–16 inertia reel assembly (2, figure 2–46) on support bracket (1) with the control head facing up. Secure assembly to the bracket using bolts (6), washers (7), and nuts (8).

CAUTION

The existing cable and control assembly must have a minimum stroke of 5/8 of an inch. The cable and control assembly must be replaced if the above condition is not met.

b. Connect control cable (4) and knurled nut to inertia reel; tighten finger tight, and lockwire knurled nut.

c. Attach inertia reel strap (3) to shoulder harness with bolt, hut, and washer.

d. Perform OPERATIONAL CHECK (Para. 2–233, c and d).

2–237. Removal – Crew Inertia Reel Strap (Figure 2–46).

a. Fully extend strap (3) and retain from further rotation by holding with a hex wrench in hex hole in reel assembly (2).

b. Move both strap (3) and insert (5) in direction of arrows.

c. Remove insert (5) and pull strap (3) back through opening.

CAUTION

Hex wrench must be left in hex hole, reel shall be secured until new strap is installed. If reel is inadvertently released while strap is removed, replace the entire reel assembly.

2–237.1. Removal Crew Inertia Reel Strap (Figure 2–46.5) (MA–16 Inertia Reel).

CAUTION

Do not clamp the reel in the main label area. The MA–16 sensor is located below the label.

CAUTION

To prevent damage to inertia reel due to uncontrolled release of spring tension, hex wrench must be left in hex hole and not allowed to become disengaged from reel shaft. If the spring is allowed to unwind rapidly, spring damage may result. The damage may not be apparent, and the spring may appear to function normally. If rapid unwinding occurs replace the entire reel assembly.

CAUTION

The spring may only be manually wound in the counterclockwise direction. Directional arrows on the spring cover and tamper proof seal indicate the direction to manually wind the spring.

NOTE

Only the "Z" bracket supplied with the reel may be used. "Z" brackets for other than Koch MA–16 reels will not work.

a. Remove bolt, washer, and nut securing shoulder harness from reel strap.

b. Fully extend strap.

c. Remove and save back dot adhesive cover.

d. Place 7/32 inch hex wrench in hex hole on end of reel housing, and hold shaft from turning.

e. Push belt retaining insert and belt down and out of reel shaft.

f. Remove belt "Z" bracket retaining insert and pull belt from reel shaft.

2–238. Inspection – Crew Inertia Reel Strap. Inspect belts for fraying, wear, and loose stitching (TM 1–1500–204–23 series).

CAUTION

If strap is dirty, do not attempt to clean. Liquids (solvents or water) will cause strap to swell rendering inertia reel inoperative.

2–239. Repair or Replacement – Crew Inertia Reel Strap. Replace strap if frayed, worn or unserviceable.

2–240. Installation – Crew Inertia Reel Strap. (Figure 2–46).

a. Insert end of new strap through upper slot in reel housing and through slot in main shaft until end of strap (3) protrudes through lower slot in reel housing.

NOTE

Spring must be 1/2 to 1 1/2 turns back from tight.

b. Install strap retaining insert (5), then pull upward on strap (3) with at least six pounds force. Maintain force until reel is released by removing hex wrench, allowing strap (3) to rewind onto main shaft.

2–240.1 Installation – Crew Inertia Reel Strap – MA–16. (Figure 2–46.5).

NOTE

Only the "Z" bracket supplied with the reel may be used. "Z" brackets for other than Koch MA–16 reels will not work.

CAUTION

The spring may only be manually wound in the counterclockwise direction. Directional arrows on the spring cover and tamper proof seal indicate the direction to manually wind the spring.

a. Set the reel control to UNLOCK.

b. Locate the end of the reel opposite from the cable attachment. Remove (and save) the black adhesive decal to expose the access port.

CAUTION

Do not clamp the reel in the main label area. The MA–16 sensor is located below the label.

c. Face reel so that view matches figure 2–46.5B. Insert a 7/32 allen wrench to engage the end of the webbing shaft.

CAUTION

New reels are supplied with spring fully wound and tie rapped for strap installation. If the spring is allowed to unwind rapidly, spring damage will result. The damage may not be apparent and the spring may appear to function normally. If rapid unwinding occurs, replace the entire reel assembly.

d. Brace wrench against spring torque and cut nylon tie wrap to release shaft.

e. Adjust the wrench slightly in either direction as necessary until the narrow mouth of the slot in the webbing shaft faces out through the opening in the housing, per figure 2–46.5B. Hold the shaft in this position.

f. Feed the molded plastic end of the webbing into the window so that it passes through the shaft from narrow side of the slot to wide side of the slot.

g. With the wrench, allow the shaft to retract 180 degrees while feeding the molded plastic end of the webbing through the narrow mouth of the slot in the shaft until it is just clear of the housing and extended parallel to the plane of the bottom of the reel as shown in figure 2–46.5C.

h. Hold the "Z" bracket against the side of the molded plastic end fitting away from the main length of the restraint lead in strap (with the long leg of the bracket against the molded end and the short leg of the bracket against the strap as shown in figure 2–46.5C); and feed both together into the shaft (see figure 2–46.5A, section view).

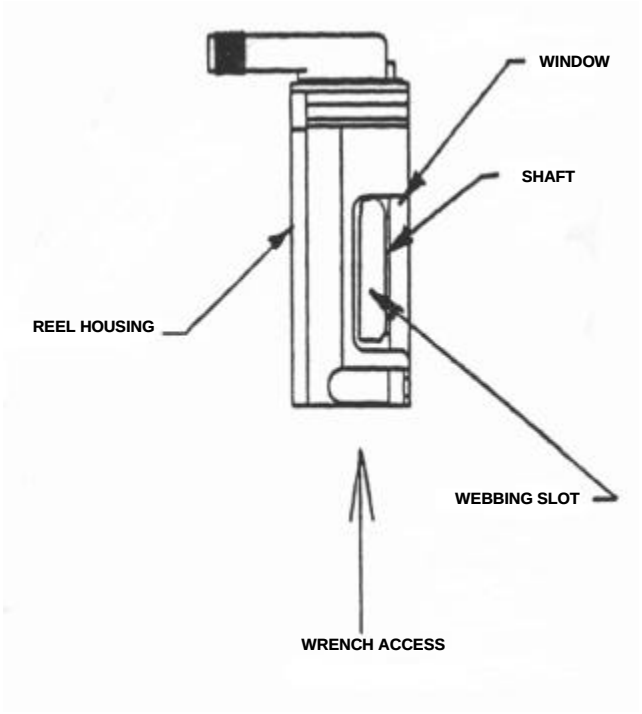


Figure 2–46.5B

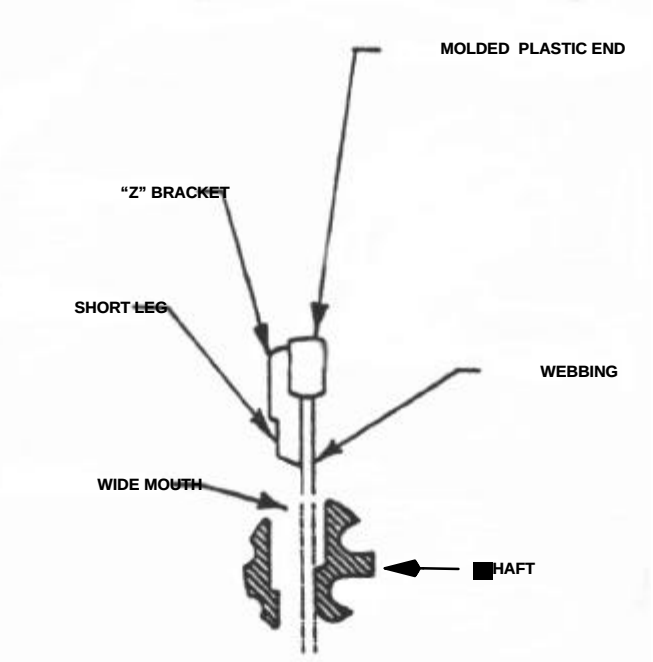


Figure 2–46.5A

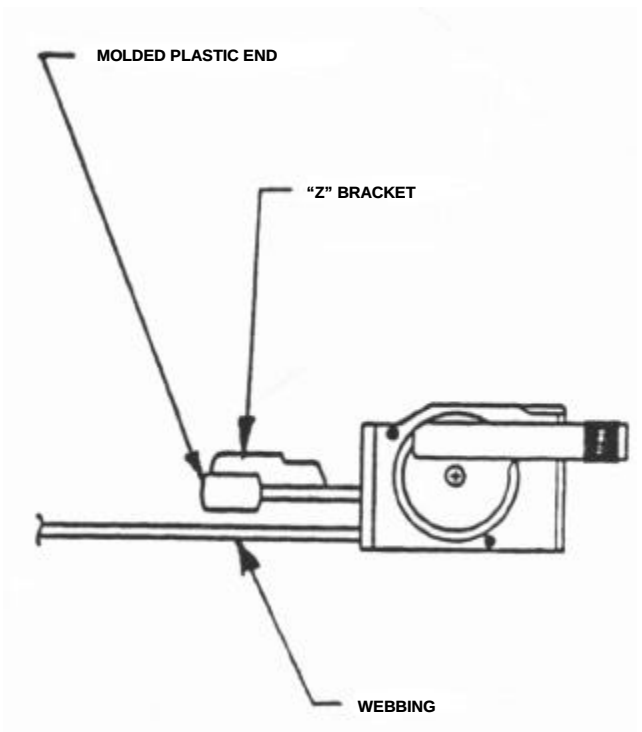


Figure 2–46.5C

NOTE

If the "Z" bracket is installed improperly, an asymmetric wrap will result and full webbing retraction will be impeded. If the molded plastic end fitting on the webbing will not fit easily into the slot in the shaft, check the width of the fitting. If it is greater than 1.75 (1 3/4) inches, it may be necessary to radius or chamfer the ends of the fitting as shown on figure 2–46.6. Use a hand file or emery cloth. Power tools are not recommended.

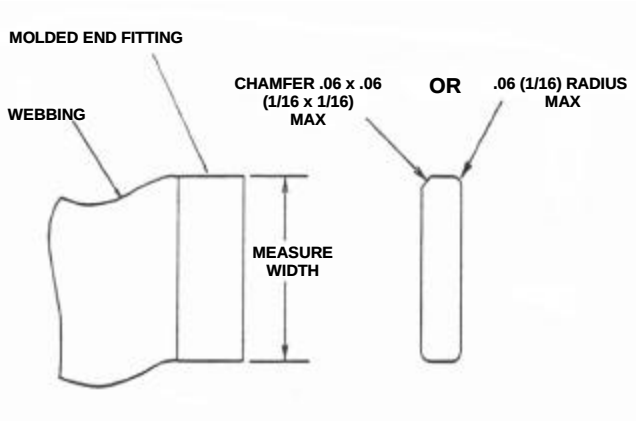


Figure 2–46.6

i. Pull 'down' tight on the webbing to chock the molded end completely into the shaft, so that it does not protrude beyond the diameter of the shaft. Hold the webbing firmly and remove the wrench.

j. Slowly and carefully allow the webbing to retract fully into the reel. If the webbing fails to retract fully or wraps asymmetric, pull the webbing out and check that the molded end is fully seated per step i.

k. Replace the adhesive decal.

l. Install bolt, washer, and nut securing shoulder harness to inertia reel strap.

NOTE

If it should prove necessary to deliberately unwind the spring, do so slowly and carefully. Before reinstalling the webbing, fully wind the spring and then carefully unwind two and a half to three (2 1/2 – 3) turns until the shaft is aligned per figure 2–46.5B.

2–241. Crew Seat Belts.

NOTE

With the exception of seat belt attachment (figure 2–44), mission operator seat belts for the EH–1X are identical to the crew seat belts.

2–242. Description – Crew Seat Belts. Lap–type seat belts are installed on crew seats. Seat belts are attached to fittings on cabin floor.

2–243. Removal – Crew Seat Belts. Remove bolts, washers, and nuts holding seat belt to fittings.

2–244. Inspection – Crew Seat Belts. Inspect belts for fraying, wear, and loose stitching (TM 1–1500–204–23 series).

2–245. Repair or Replacement – Crew Seat Belts. Replace worn or unserviceable seat belts.

WARNING

Assemble each crew seat belt with release handle pointing left.

2–246. Installation – Crew Seat Belts. Position belts on fittings and install nuts, washers, and bolts.

2–247. ARMORED CREW SEAT.

2–248. Description – Armored Crew Seat. The seat, constructed from a composite ceramic–metal material, is designed to protect crew against small arms ball and armor piercing ammunition. A segmented construction is used to permit the replacement of any damaged components. Armored seats are equipped with a quick release; activating the quick release will recline seats to aid in removal of injured personnel (figure 2–47).

2–249. Removal – Armored Crew Seat.

a. Remove bolt, nut, and washers securing seat belt to floor fittings.

b. Remove bolts securing stops (9, figure 2–47) from each side of tracks (4).

c. Lift the fore and aft seat adjustment handle and slide the seat aft until seat clears tracks.

d. Remove headguard (if installed) as illustrated on figure 2–48.

2–249.1 Removal – Crew Inertia Reel (MA–16 Inertia Reel).

a. Remove bolt, washer, and nut securing harness from inertia reel strap. Remove shoulder harness from seat.

b. Set inertia reel control handle to manual lock (front) and remove safety wire from knurl nut on inertia reel. Disconnect knurled nut from inertia reel and remove control cable.

c. Remove bolts, washers and nuts securing inertia reel assembly from support bracket and remove inertia reel.

2–250. Inspection – Armored Crew Seat.

a. Visually inspect armor panels for bonding separation, cracks, or any unserviceable condition. If a void is suspected, refer to TM 1–1520–256–23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH–1 helicopter series.

b. Inspect quick release lever (13, figure 2–47) (two locations) for condition and lockwire installation.

c. Inspect seat hardware, belts, shoulder harness for condition and security.

2–251. Repair or Replacement – Armored Crew Seat.

a. Replace unserviceable parts.

b. Lockwire quick release handle using 0.020 inch copper wire (C305). Lubricate quick release mechanism with lubricant (C136).

c. Lubricate seat rollers with lubricant (C136).

d. Secure rubber channels (14, figure 2-47) with adhesive (C57).

e. On the under surface of the crew seat frame bottom, P/N AL-1040-55-00 in the center install a 1/4 inch thick rubber pad (C3230, 8 in. X 8 in, with cement (C57) between inner and outer flaps of seal cover to prevent damage to cover by bolt heads. The rubber is NSN 9320-00-241-9758.

f. On the upper surface of the armor seat plate bottom, NSN 1680-00975-0199, P/N 178046-1/-3, attach in center at forward edge a 12 in. X 12 in. 1/4 thick rubber pad using cement EC1357, NSN 8040-00-165-8614, item (C57) in Table 1-1.

NOTE

Use only P/N 17810-11 bolts inside back panel to prevent cracking tiles.

g. A stencil shall be applied on the front of the back panel of the armored seat P/N 178061-3 to state the size of bolts (P/N 17810-11) to be used when repairing armored. The wording of stencil is to be as follows:

NOTE

Use only P/N 17810-11 bolts inside back panel to prevent cracking tiles.

h. Remove area on lower extremity of the angle-lower armor seat bracket P/N 178054-11/-12, one inch wide and 5/16 inch deep with one inch radius. Center of removal area will be 5/8 inch from weld center as shown in Figure 2-46.7. P/N 178054-11/-12 are shown in Figure 37, item 28, in TM 55-1520-23P-1.

2–251.1. Installation Crew Inertia Reel (MA–16).

a. Position MA–16 inertia reel assembly on support bracket with the control head assembly on the right and facing down. Secure assembly to the bracket using bolts, washers, and nuts.

CAUTION

The existing cable and control assembly must have a minimum stroke of 5/8 of an inch. The cable and control assembly must be replaced if the above condition is not met.

b. Connect control cable and knurled nut to inertia reel; tighten finger tight, and lockwire knurled nut.

c. Attach inertia reel strap to shoulder harness with bolt, nut, and washer.

d. Perform OPERATIONAL CHECK (Para 2–233, c and d).

2-252. Installation - Armored Crew Seat (Figure 2–47).

a. Position seat roller on aft end of tracks. Lift handle on left side of seat and slide seat forward on tracks.

b. Install stop (9) on aft end of tracks using spacer (10), washer (12), and bolt (11).

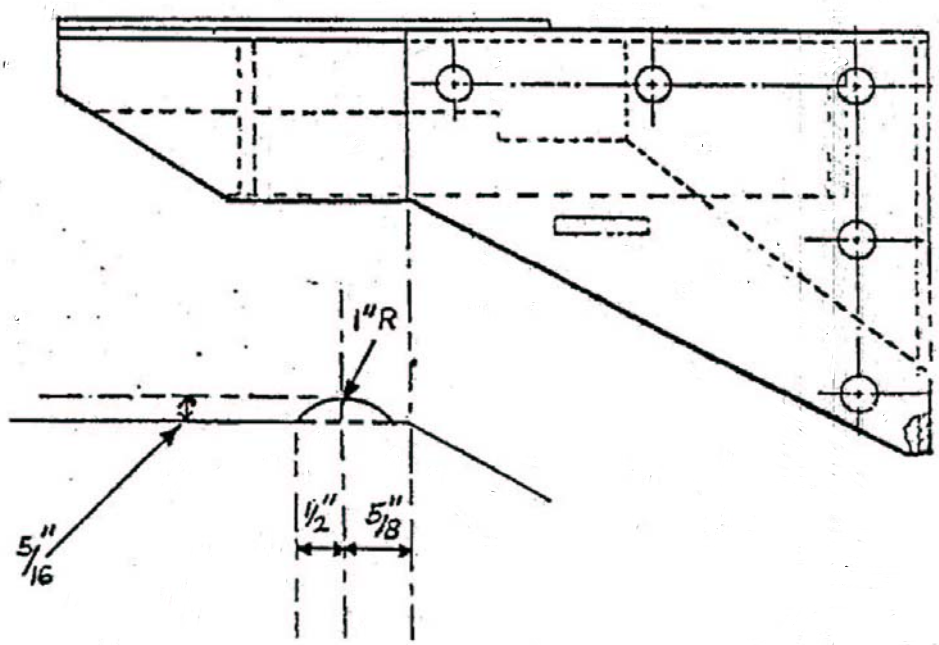
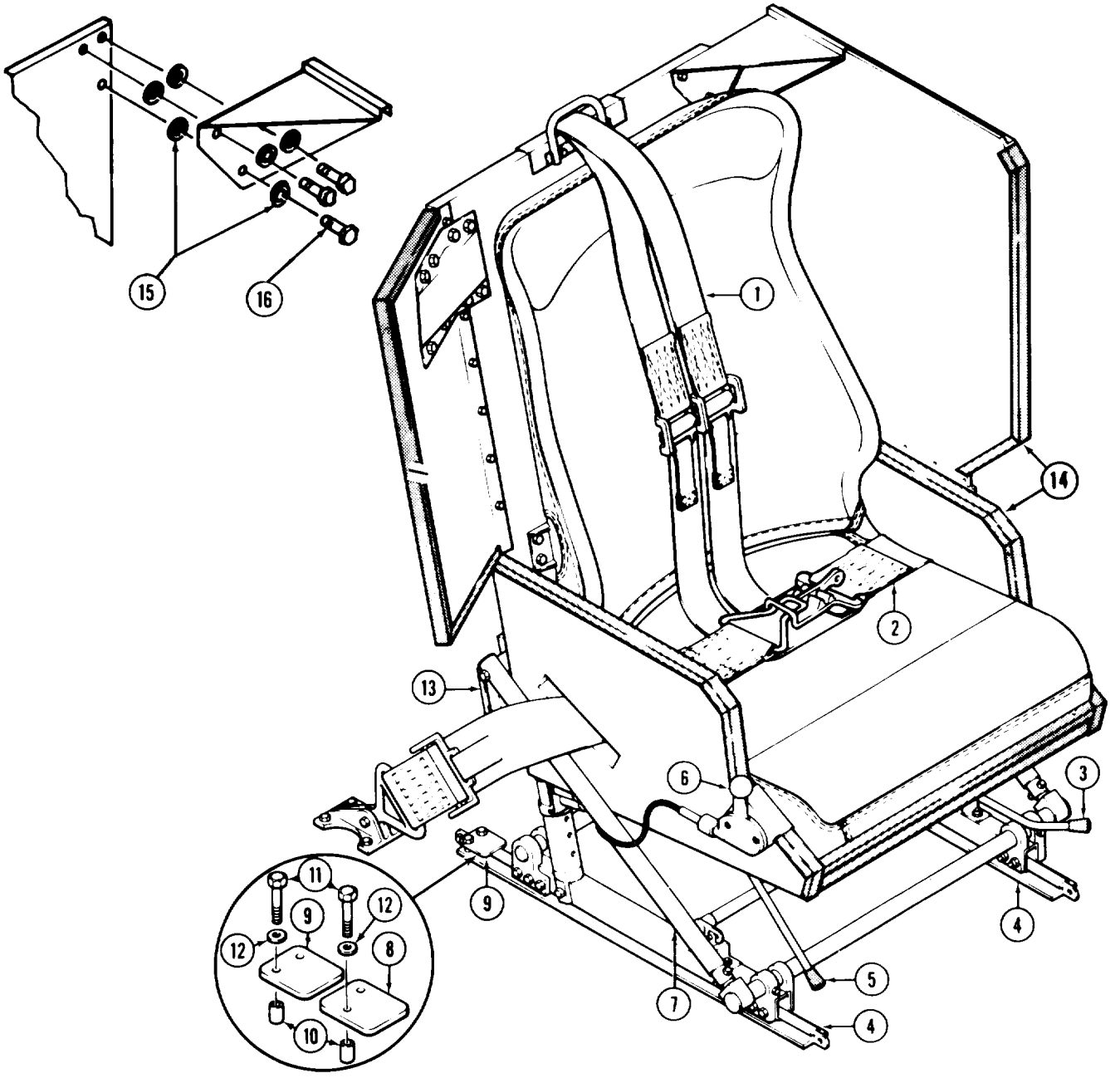
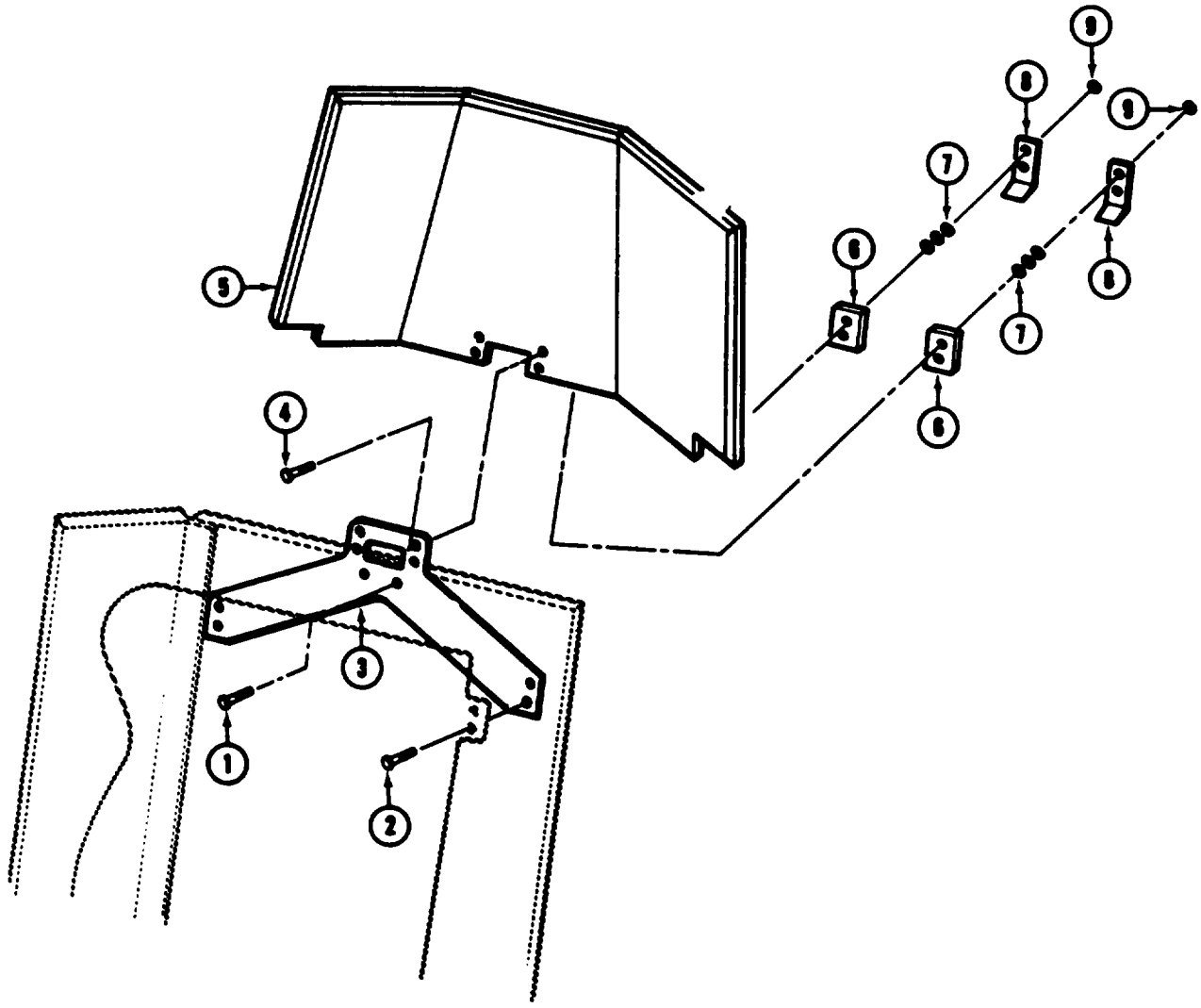


Figure 2-46.7 Angle-Lower Armor Seat Bracket



1. Shoulder harness
2. Seat belt
3. Seat adjustment handle
4. Tracks
5. Seat adjustment handle
6. Shoulder harness release handle
7. Telescoping tube
8. Fitting
9. Seat stop
10. Spacer
11. Bolt
12. Washer
13. Quick release lever
14. Channel
15. Washer
16. Bolt

Figure 2-47. Armored Crew Seat



1. Screw
2. Screw
3. Support bracket
4. Bolt
6. Armor panel
6. Spacer plate
7. Washer
8. support clamp
S. Nut

Figure 2-48. Armored Crew Seat Headguard

c. Attach seat belts to floor fittings using bolts, washers, and new self locking nuts.

d. Functionally check all seat controls.

CAUTION

Ensure that the armored seat reclining mechanism is locked in position. The two red-painted handles at the lower aft of the seat must be positioned so that the telescoping tube (7) is locked. The handles must be restrained with copper shear-type lockwire (C305).

e. Adjust eccentric bolt as necessary to obtain sufficient clearance and smooth operation of carriage roller.

2-252.1. EB MISSION OPERATOR SEATS.

2-252.2. Description - Mission Operator Seats. The mission operator's seats are adjustable, non-reclining, swivel based with webbing on back. Each seat is equipped with lap safety belt and inertia-reel harness (figure 2-48.1).

NOTE

The mission operator seat assemblies are P/N 4251-5. These seats are equipped with a recline control; however, the EH-1H installation seats cannot be reclined due to interference with the inertia reel assembly.

2-252.3. Removal - Mission Operator Seats (figure 2-48.2).

a. Release tension on the elevation springs before removing retainer mounting bolts by elevating seat as far as possible.

b. Remove the four bolts (14) and washers (15) that secure the four seat mounting pads to the reinforced deck plates.

c. Remove seat assembly.

d. Remove headrest assembly (1) from seat.

2-252.4. Disassembly - Mission Operator Seats (figure 2-48.2).

a. Remove two screws (18) with nuts (12), washers (13) and remove shoulder harness locking assembly (17) and cable.

b. Remove three bolts (34) and remove retract reel bracket (35) with reel attached.

c. Remove split ring on shoulder harness guide at top of back assembly (19).

d. Remove shoulder harness and retract reel assembly from seat.

e. Undo four snaps at front and three snaps at rear of seat bottom assembly (16). Remove seat cushion.

f. Remove cotter pin (22), washer (23), and flat head pin (24) at two locations on lower seat assembly. Plastic shroud (25) can now be moved exposing recline stop brackets.

g. Remove pin (30), washers (27) and cotter pin (28) from recline stop brackets at two locations on lower rear of seat bottom assembly (16).

h. Remove bolt (4), spacers (5 and 6), washer (7) and nut (8) from back assembly (19) at the two pivot locations where it hinges with the seat bottom assembly (16).

i. Remove large recline spring (9).

NOTE

Short end of recline spring attaches to seat base, long end to back assembly.

j. Press recline lever (29) and remove back assembly from seat bottom assembly.

k. Cut cord restraints (3, figure 2-48.3) at lower end of back assembly (4).

l. Remove two screws (2) securing lower edge guide (1) to frame.

m. Remove two screws (21, figure 2-48.2) securing upper edge cover (20) on upper end of back assembly (19).

n. Remove four screws (33) securing upper edge guide (31) to frame.

o. Working toward upper end of back assembly (1, figure 2-48.4), slide cover (2) along side cover guides (5) until free of back assembly.

2-252.5. Inspection - Mission Operator Seats.

a. The four mounting pads may be inspected by fluorescent penetrant method MIL-1-6866 (Code F). If crack is suspected, refer to TM 1-1520-256-23 AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

b. Visually inspect the vertical adjustment handle assembly for distortion and wear.

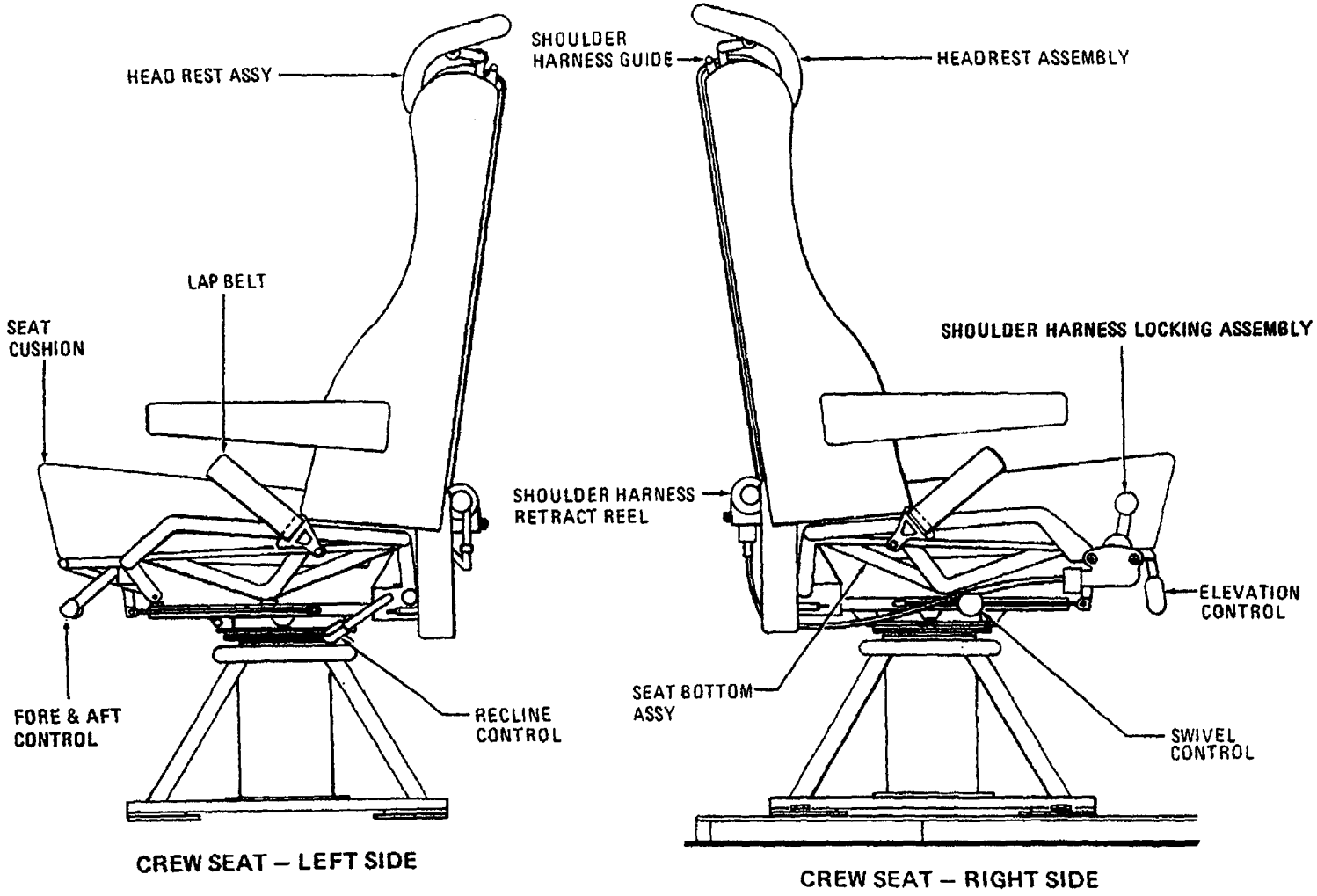


Figure 2-48.1. Mission Operator Seat Assembly

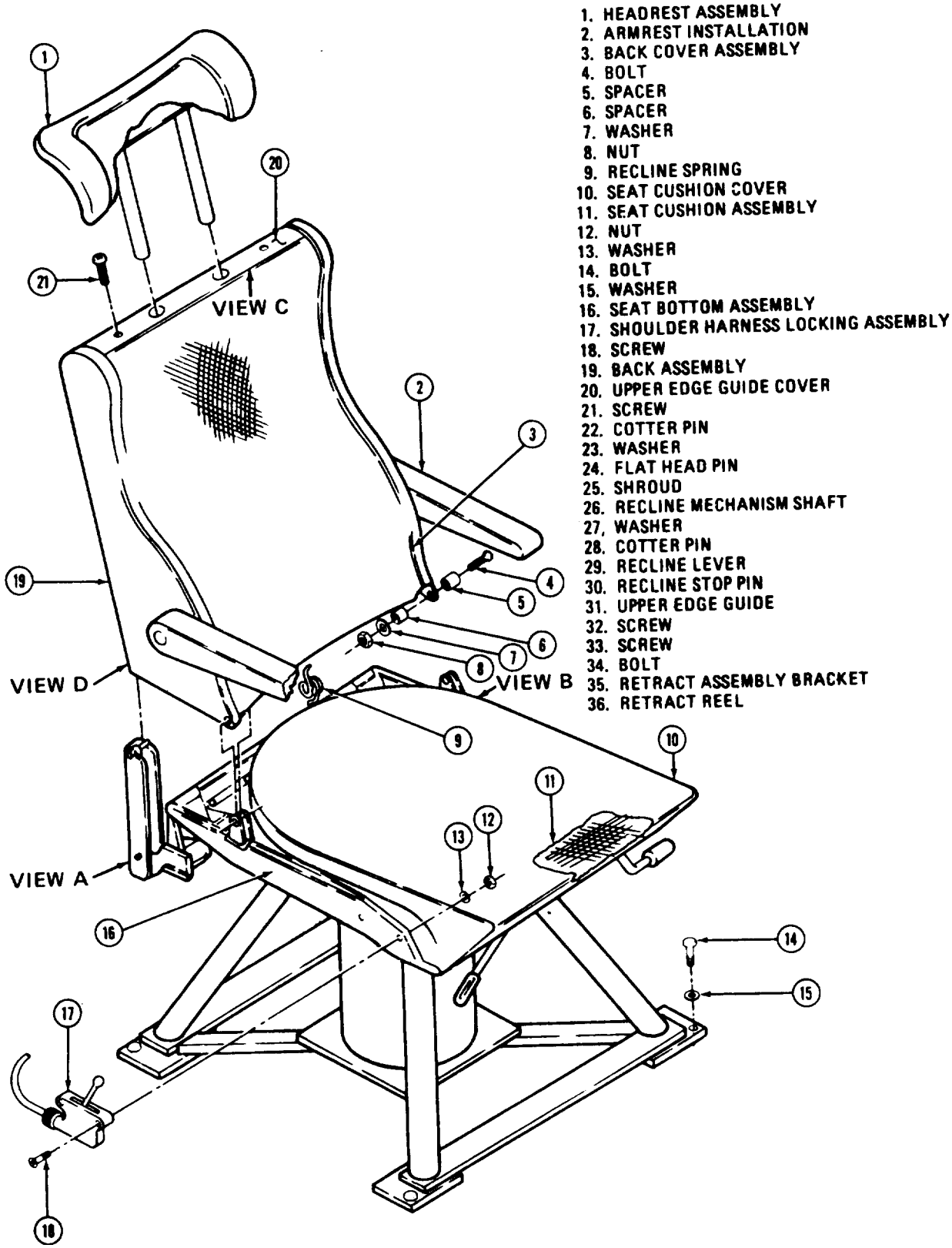


Figure 2-48.2. Mission Operator Seat Assembly Breakdown (Sheet 1 of 2)

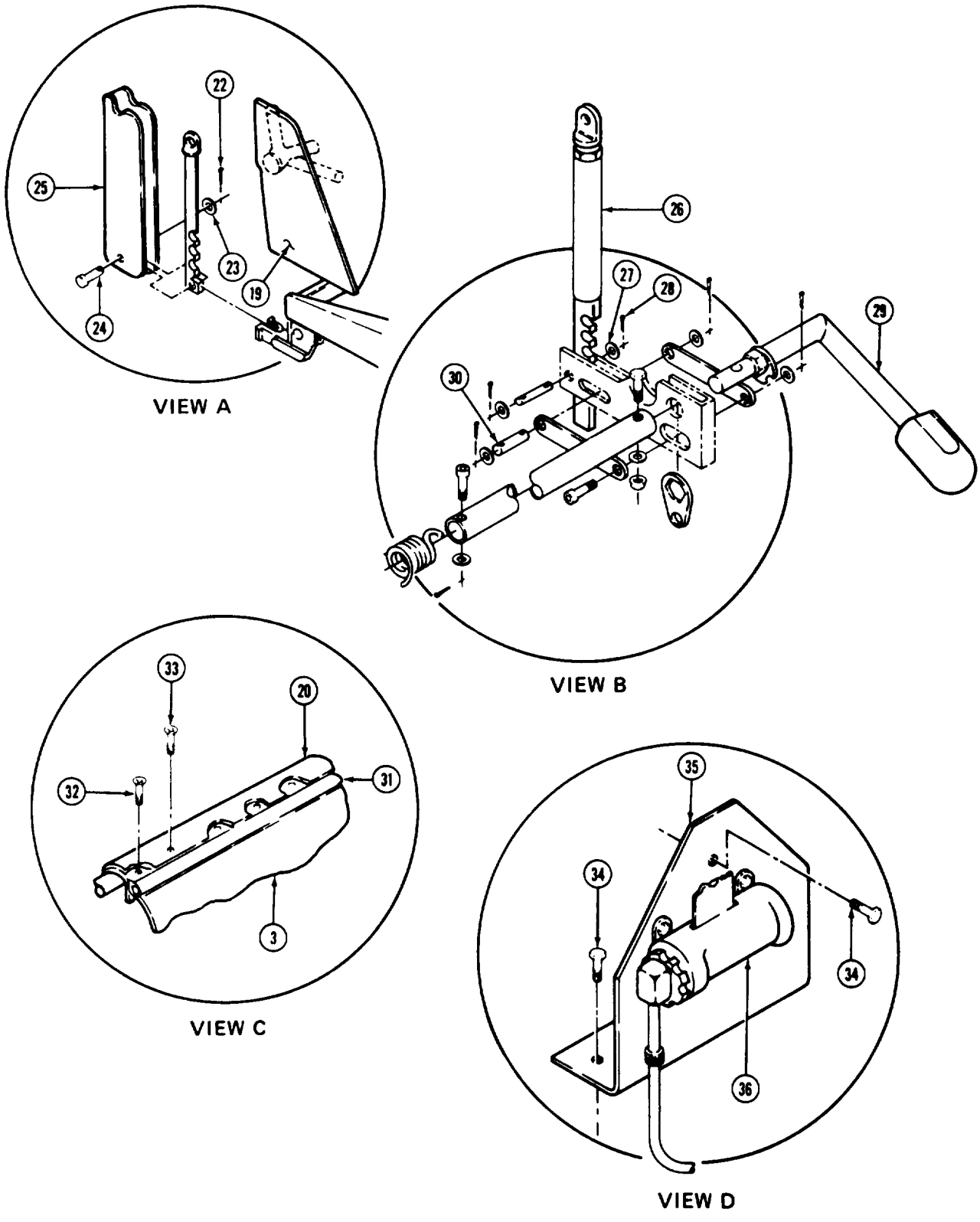
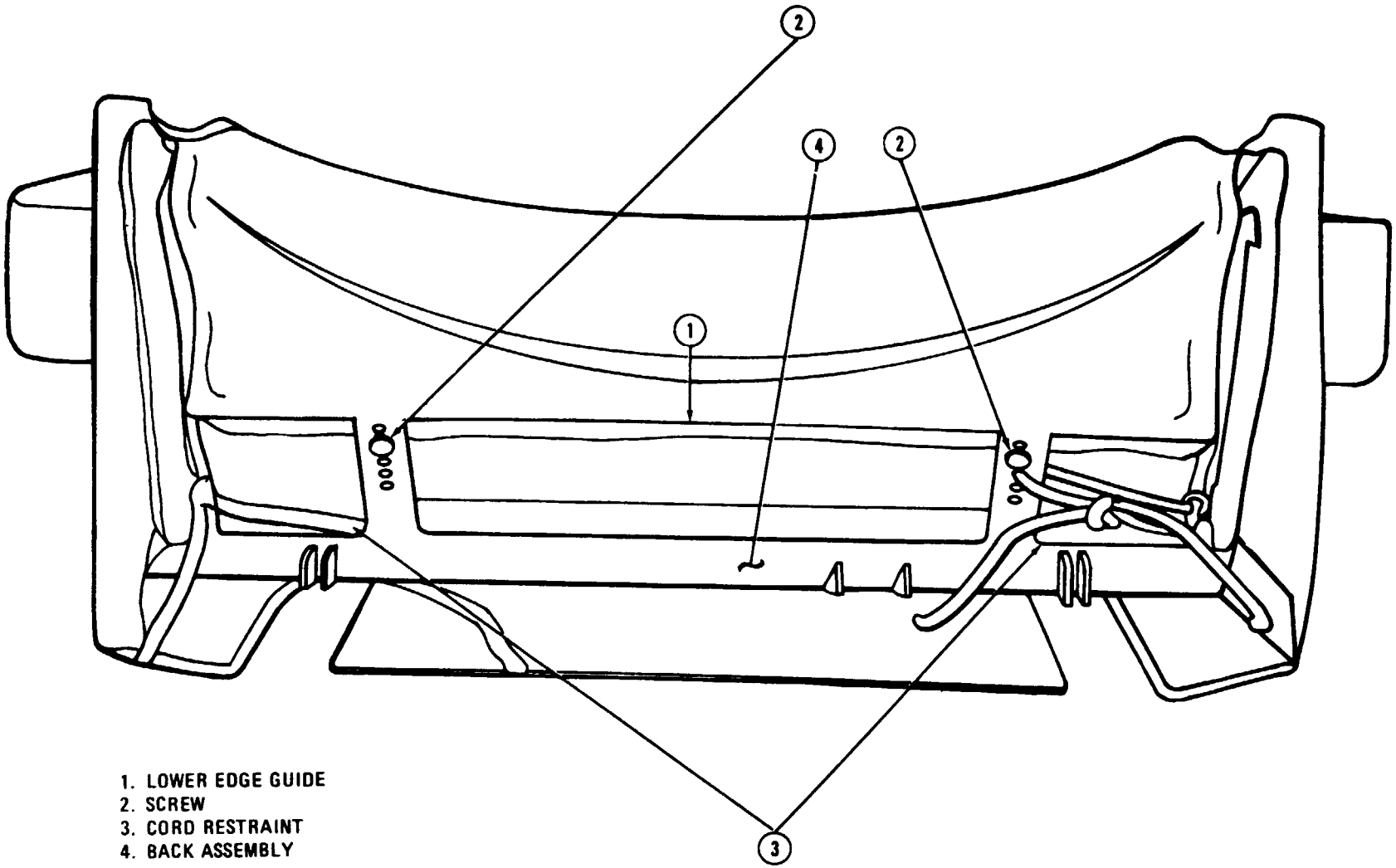


Figure 2-48.2. Mission Operator Seat Assembly Breakdown (Sheet 2 of 2)



1. LOWER EDGE GUIDE
2. SCREW
3. CORD RESTRAINT
4. BACK ASSEMBLY

Figure 2-48.3. Back Assembly (Bottom)

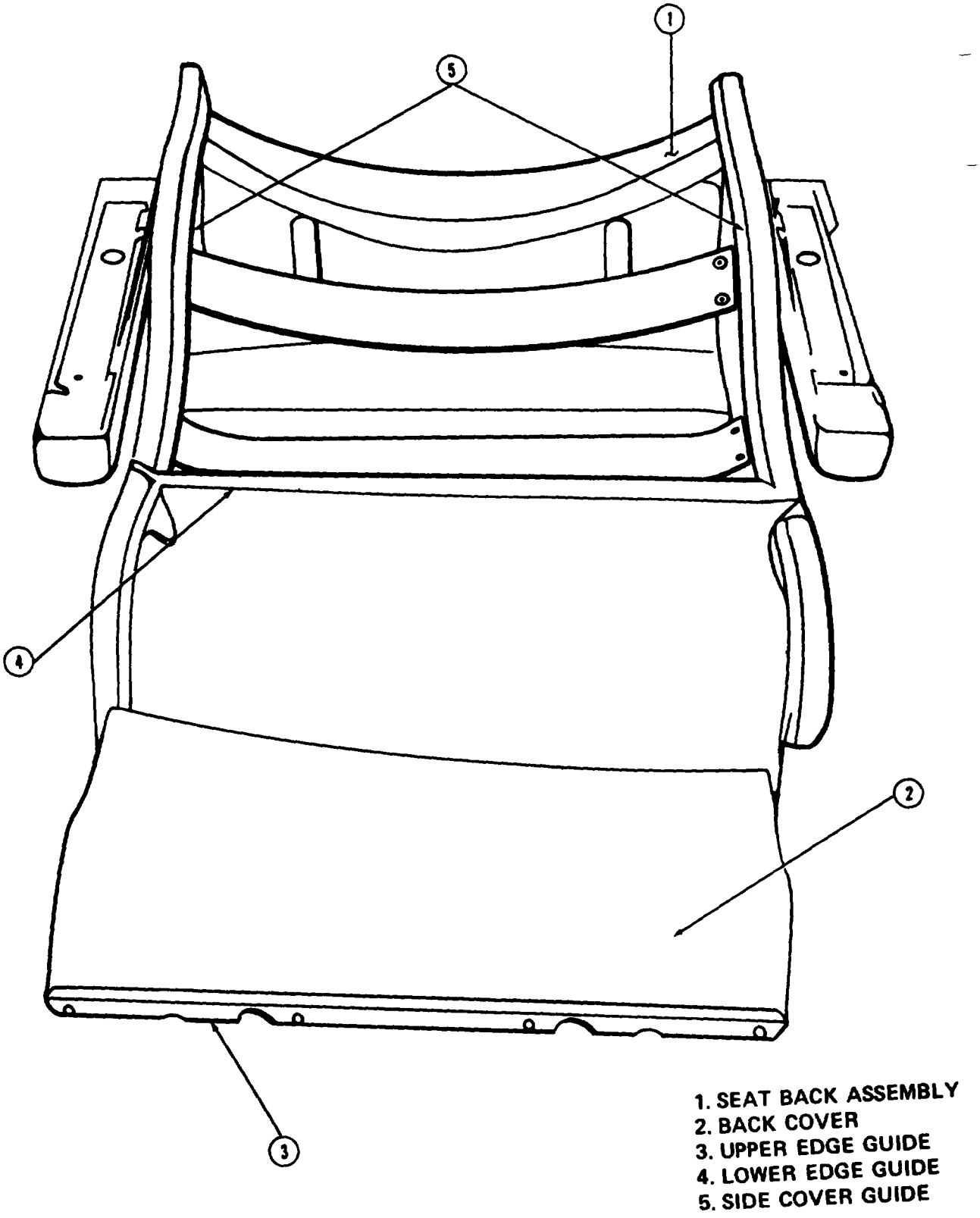


Figure 2-48.4. Removal of Back Cover Assembly

c. Visually inspect the fore and aft adjustment handle assembly for distortion and wear.

d. Visually inspect the swivel control handle assembly for distortion and wear.

e. Visually inspect seat back and bottom assemblies for signs of wear, cracks and corrosion.

f. Inspect headrest assembly for excessive wear of socket and tube assembly, torn netting, loose rivets and loose or missing hardware.

g. Inspect seat bottom and back cover assemblies for damage and serviceability.

h. Inspect all springs for loss of tension.

l. Inspect armrests for torn covers, position lock and release mechanism for worn parts and loose or worn shaft, washers or springs in pivot assembly.

NOTE

Mission operator seat covers are time replacement items. Seat covers shall be replaced every 24 months.

2-252.6. Repair or Replacement - Mission Operator Seats.

CAUTION

The elevation springs are extremely powerful. Do not activate the elevation controt with seat unoccupied and a lowered position.

NOTE

Do not dissassemble farther than necessary to remove a damaged or defective part and never disassemble farther than shown In the exploded view,

a. Replace seat base assembly if worn or damaged and seat will not elevate or swivel properly.

b. Replace seat bottom assembly if worn or damaged and seat does not move fore and aft properly.

c. Replace seat bottom or back assembly if damaged or unserviceable.

d. Replace seat bottom cover or back cover if net material is stretched or torn.

e. If headrest netting requires replacement, drill out rivets securing retainers in place on frame. Position replacement netting assembly in place in retainers and secure to frame with rivets (figure 2-48.7).

f. Repair minor damage to anodized surfaces by touching up with primer coating (C215).

g. Repair painted surfaces by sanding down to bare metal and applying one coat of zinc chromate primer (C219). Allow primer to dry thoroughly and apply a finish coat of enamel (C146).

h. Repair minor damage to dry film lubricated parts by coating part with dry film lubricant (C160). Place part in a drying oven seat at 375°F for 1 hour. If wear area of parts exceeds 60% of total surface area, replace part.

i. Replace armrest pad and cover if worn or torn.

j. Replace armrest assembly if pivot assembly or locking mechanism are damaged.

NOTE

To affect minor repairs to seat beck assembly, remove bolts, screws, and nuts that are concealed under covering fabric by making a cross slit in the covering to gain access. This will allow removal of necessary parts without removing entire cover assembly. To remove coverings cemented in place, loosen cement with methyl-ethyl-ketone (C177).

2-252.7. Assembly - Mission Operator Seats.

a. Lubricate side cover guides on back assembly. Use silicone compound (C250).

b. Slide new back cover (2, figure 2-48.4) into side cover guides (5) on back assembly (1) and gradually (alternately one side then the other) pull the new cover over the back assembly until the cover extends beyond each end of the side cover guides.

NOTE

Seam of new back cover faces into beck assembly.

c. Lubricate, using silicone compound (C250) upper and lower edges of new back cover. Slide upper and lower edge guides over back cover edges until cover is centered in the guide.

d. Secure upper edge guide (31, figure 2-48.2) to frame using four screws (32). Pull new back cover as taut as possible toward end of back assembly. Secure lower edge guide (1, figure 2-48.3) to frame using two screws (2). Secure upper edge

cover (20, figure 2-48.2) to back assembly using two screws (33). Secure cord restraints (3, figure 2-48.3) to frame.

e. Orientate back assembly (19, figure 2-48.2) and bottom assembly (16) with pivot holes aligned. Press recline lever (29) to facilitate alignment.

f. Install recline spring (9).

g. Install recline stop pin (30), washers (27), and cotter pins (28) at two locations.

h. Install two bolts (4) with washers (7), spacera (5 and 6), and nuts (6) at pivot locations.

i. Align shroud (25) and install flat head pin (24), washer (23), and cotter pin (22) at two locations.

j. Install retract reel bracket assembly (35), using three bolts (34).

k. Install shoulder harness locking assembly (17) using two screws (19), washers (13), and nuts (12).

l. Cover seat cushion in conventional manner and snap seat cushion into place in seat assembly.

2-252.8. Reassembly Checks - Mission Operator Seats. a. Position assembled seat in an upright position on a hard surface.

CAUTION

The elevation springs are extremely powerful. Do not activate the elevation control with seat unoccupied and in a lowered position.

b. With a maintenance technician sitting in the seat, perform checks of the elevation, swivel and fore and aft controls.

(1) Activate the elevation control while raising and lowering seat its full travel. No binding should occur while seat is in motion. The locking mechanism should engage and disengage smoothly.

(2) Activate the swivel control while turning seat in both directions. Seat should swivel freely and lock positively in any selected position.

(3) Activate fore and aft control while sliding seat back and forth Seat should slide freely and lock in any desired position.

2-252.9. Installation - Mission Operator Seats. a. Position seat assembly mounting pads on floor.

b. Install bolts (14, figure 2-48.2) and washers (15) to secure pads to deck plates.

NOTE

The mission operator seats and consoles are bolted to reinforced mounting plates which are secured to the cabin deck. For mounting plate maintenance procedures, refer to TM 11-5895-776-14-1.

c. Install headrest assembly (1).

2-252.10. MISSION OPERATOR SEAT

2-252.11. Description — Mission operator seat. The mission operator seat is identical to the crew seat (paragraph 2-216) but is installed on a specially modified cago deck mounting plate (figure 2-48.10). The mounting plate is installed with additional mounting screws and requires that the deck support structure be modified.

2-252.12 Removal — Mission Operator Seat.

NOTE

If the mission consoles or operator console are removed from the aircraft, remove the seat in accord. ante with paragraph 2-218.

a. Remove screws (2 and 3, figure 2-48. 10) securing mounting plate (1) to deck.

b. Remove the seat and mounting plate as an assembly through the right side passageway.

c. Remove seat from mounting plate (paragraph 2-218).

2-252.13. Disassembly — Mission Opera. tor Seat and Mounting Plate.

a. Disassemble the seat in accordance with paragraph 2-219.

b. Remove bolts (3, figure 2-48.11), washers (4), and mounting angles (5) from mounting plate (2).

c. Remove bolts (6), washers (4), nuts (8), and tracks (7) from mounting angles (5).

2-252.14. Inspection — Mission Operator Seat and Mounting Plate.

a. Inspect the seat in accordance with paragraph 2-220.

b. Inspect the mounting plate in accordance with the general instructions given in paragraph 2-27.1.

2-252.15 **Repair — Mission Operator Seat and Mounting Plate.**

a. Repair the mission operator seat in accordance with paragraph 2-221.

b. Repair the mounting plate in accordance with the general instructions given in paragraph 2-27.1.

2-252.16 Assembly — Mission Operator Seat and Mounting Plate.

a. Install tracks (7, figure 2-48.11) on mounting angles (5) and secure with bolts (6), washers (4), and nuts (8).

b. Install mounting angles (5) on mounting plate (2) and secure with washers (4) and bolts (3).

c. Assemble seat in accordance with paragraph 2-222.

NOTE

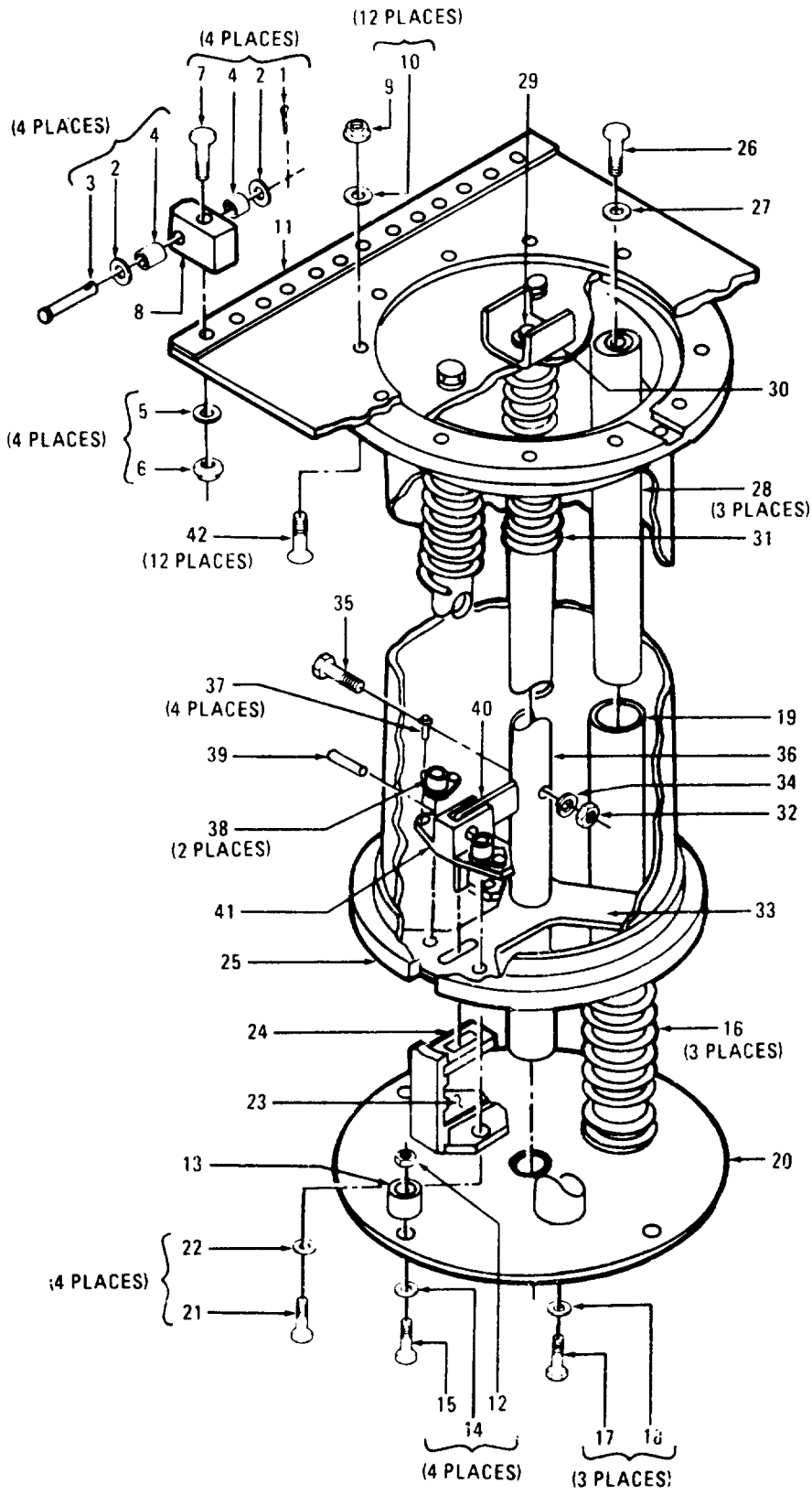
If the mission consoles or operator console are removed from the aircraft, the mounting plate and seat may be installed in the aircraft separately.

d. Install the seat on the mounting plate (paragraph 2-223).

2-252.17. Installation — Mission Operator Seat.

a. Working through the right side passageway, position the seat and mounting plate assembly on the deck.

b. Secure the mounting plate (1, figure 2-48.10) to the deck using screws (2 and 3).



1. COTTER PIN
2. WASHER
3. CLEVIS PIN
4. ROLLER
5. NUT
6. WASHER
7. STUD
8. GUIDE
9. NUT
10. WASHER
11. WEAR STRIP
12. NUT
13. SPACER
14. WASHER
15. BOLT
16. SPRING
17. BOLT
18. WASHER
19. LOWER GUIDE ASSEMBLY
20. RETAINER
21. BOLT
22. WASHER
23. RETAINER
24. LOCK BAR
25. BEARING
26. BOLT
27. WASHER
28. UPPER GUIDE ASSEMBLY
29. NUT
30. YOKE
31. SPRING
32. NUT
33. RETAINER
34. WASHER
35. BOLT
36. TUBE
37. RIVET
38. NUTPLATE
39. PIN
40. LEVER
41. BRACKET
42. SCREW

Figure 2-48.5. Pedestal Assembly, Mission Operator Seat

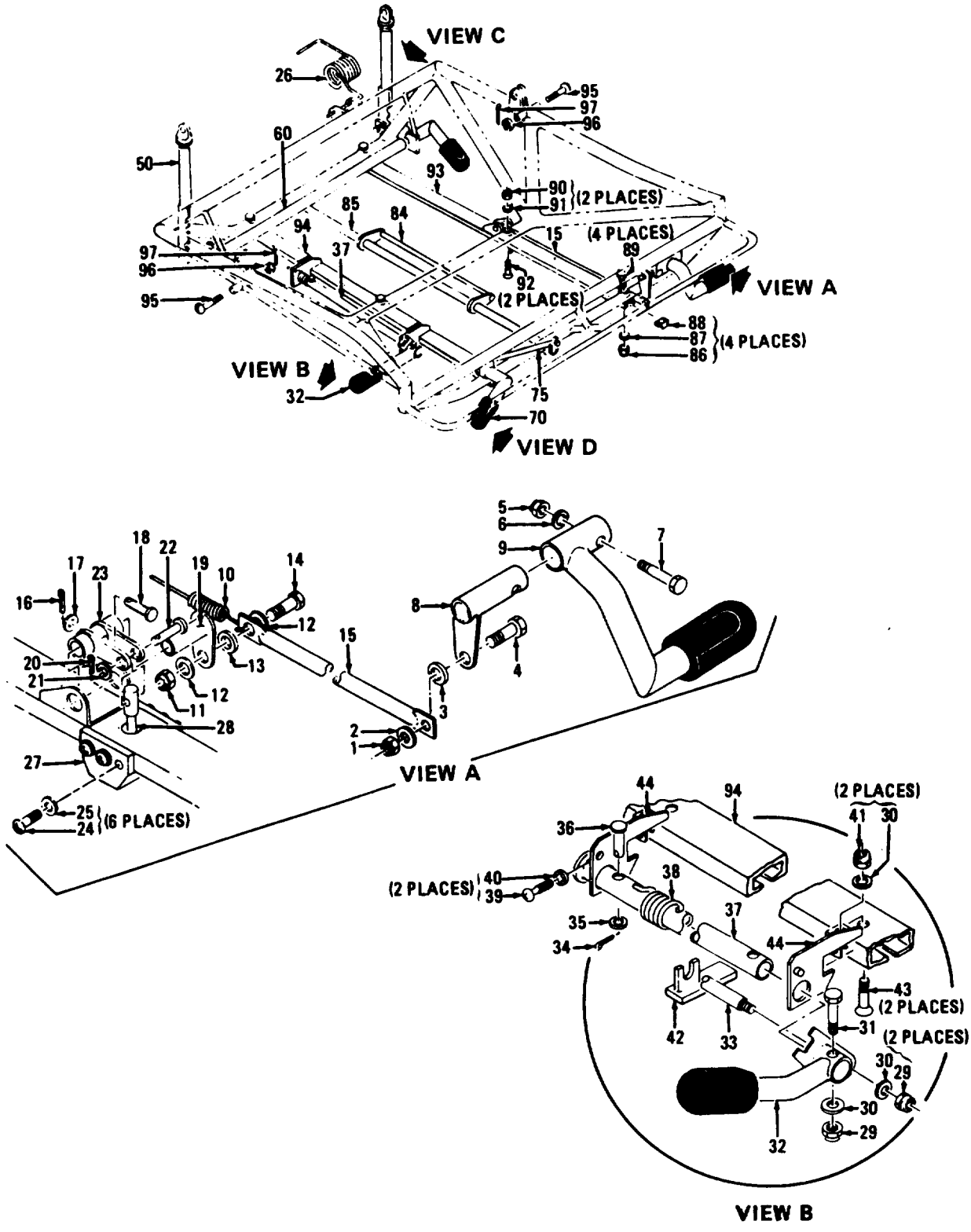
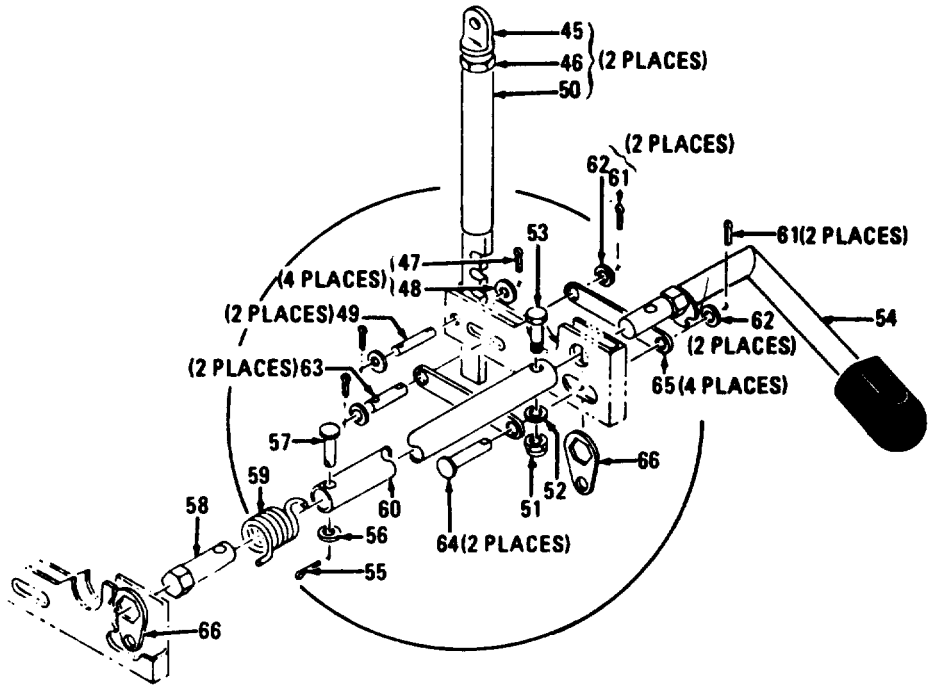


Figure 2-48.6. Controls Installation, Mission Operator Seat (Sheet 1 of 3)



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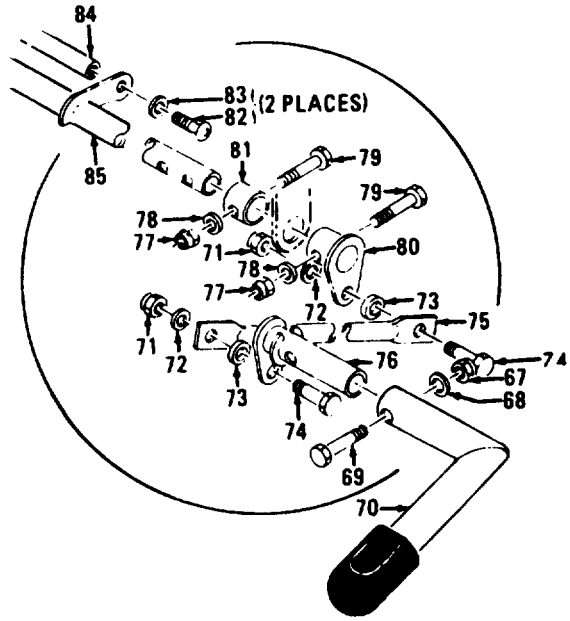

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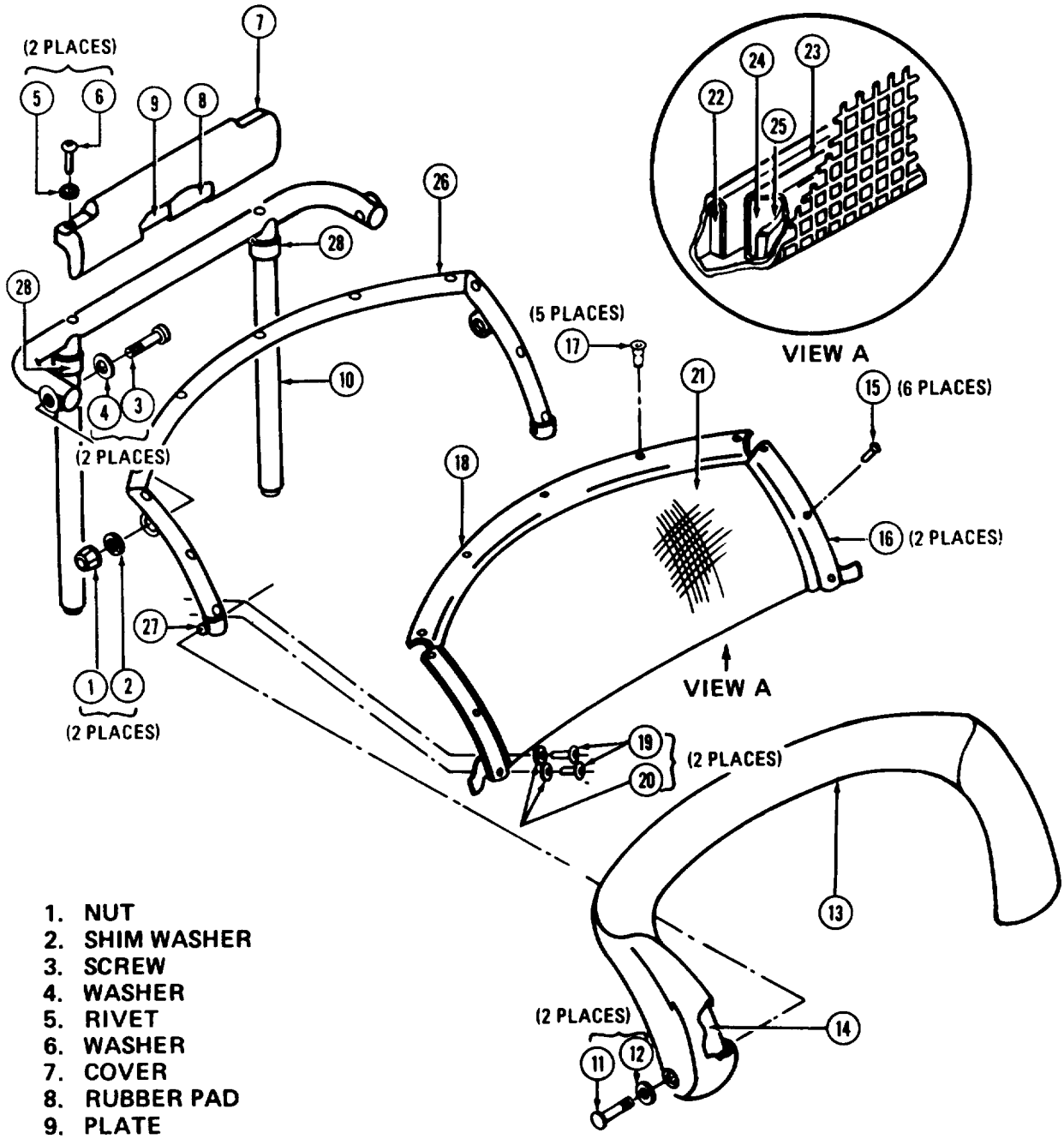
Figure 2-48.6. Controls installation, Mission Operator Seat (Sheet 2 of 3)

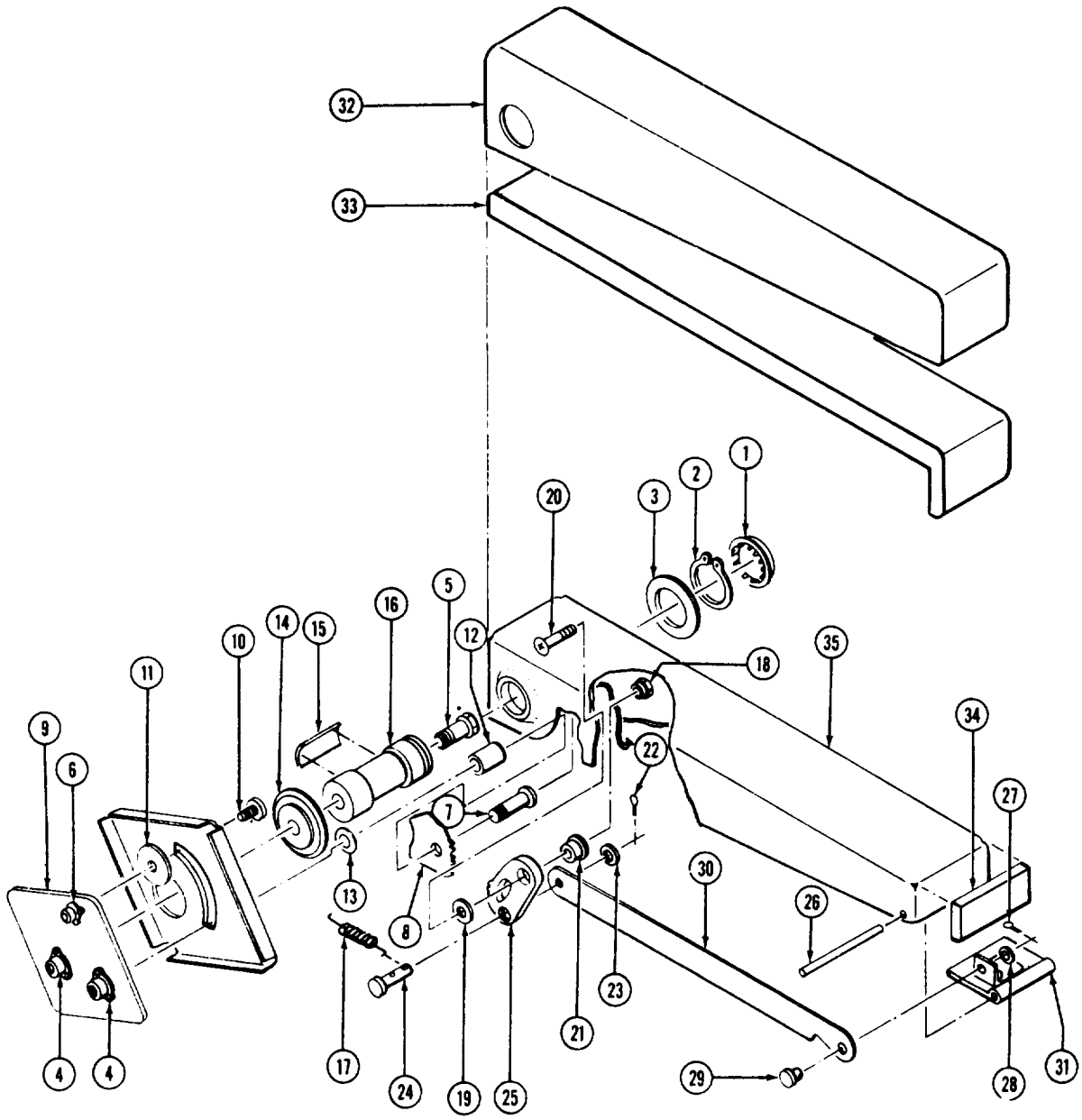
1. NUT
2. WASHER
3. SPACER
4. BOLT
5. NUT
6. WASHER
7. BOLT
8. BELLCRANK
9. FWD/AFT HANDLE ASSEMBLY
10. SPRING
11. NUT
12. WASHER
13. SPACER
14. BOLT
15. LINK
16, COTTER PIN
17. WASHER
18. CLEVIS PIN
19. TORQUE TUBE ASSEMBLY
20. COTTER PIN
21. WASHER
22. CLEVIS PIN
23. INDEX CRANK ASSEMBLY
24. SCREW
25. WASHER
26. SPRING
27. INDEX PIN RETAINER
28. INDEX PIN
29. NUT
30. WASHER
31. BOLT
32. SWIVEL HANDLE ASSEMBLY
33. SWIVEL CONTROL
34. COTTER PIN
35. WASHER
36. CLEVIS PIN
37. TOROUE TUBE ASSEMBLY
38. RECLINE CONTROL SPRING
39. SCREW
40. WASHER
41. NUT
42. SWIVEL DOG
43, SCREW
U. BRACKET
45. RECLINE ADJUSTMENT CLEWS
46. CHECK NUT
47. COTTER PIN
48. WASHER
49. PIN
50. RECLINE MECHANISM
51. NUT
52. WASHER
53. BOLT
54. RECLINE HANDLE ASSEMBLY
55. COTTER PIN
56. WASHER
57. CLEVIS PIN
58. TORQUE TUBE LUG
59. RECLINE CONTROL SPRING
60. TORQUE TUBE
61. COTTER PIN
62. WASHER
63. RECLINE LOCK PIN
64. CLEVIS PIN
65. LINK
66. RECLINE CONTROL CRANK
67. NUT
66. WASHER
69. BOLT
70, ELEVATION CONTROL HANDLE ASSEMBLY
71. NUT
72. WASHER
73, SPACER
14. BOLT
75. LINK
76. CRANK ASSEMBLY
77, NUT
78. WASHER
79. BOLT
80. CRANK ASSEMBLY
81. SLEEVE
82. SCREW
83. WASHER
M. ELEVATION ACTUATING TUBE
85. TORQUE TUBE
86. NUT
87. WASHER
88. TRACK RIDER
89. BOLT
90. NUT
91, WASHER
92, SCREW
93. TRACK
94, TRACK
95. BOLT
96. NUT
97. COTTER PIN

Figure 2-48.6. Controls Installation, Mission Operator Seat (Sheet 3 of 3)



1. NUT
2. SHIM WASHER
3. SCREW
4. WASHER
5. RIVET
6. WASHER
7. COVER
8. RUBBER PAD
9. PLATE
10. SOCKET AND TUBE ASSEMBLY
11. SCREW
12. WASHER
13. PROTECTIVE PAD ASSEMBLY
14. SHROUD
15. SCREW
16. SIDE NET RETAINER
17. RIVET
18. TOP NET RETAINER
19. RIVET
20. WASHER
21. NET
22. FILLER STRAP
23. COVER
24. WEB STRAP
25. RUBBER PAD
26. FRAME ASSEMBLY
27. RIVNUT
28. COLLAR

Figure 2-48.7. Headrest Assembly, Mission Operator Seat



1. PLUG BUTTON
2. RETAINING RING
3. WASHER
4. NUTPLATE
5. BOLT
6. NUTPLATE
7. SCREW
8. GEAR
9. PLATE ASSEMBLY
10. BOLT
11. WASHER
12. SPACER
13. WASHER
14. STEP WASHER
15. LEAF SPRING
16. SHAFT
ARMREST ASSEMBLY
17. SPRING
18. NUT
19. WASHER
20. SCREW
21. STEP BUSHING
22. COTTER PIN
23. WASHER
24. PIN
25. GEAR
26. PIN
27. COTTER PIN
28. WASHER
29. PIN
30. LINK
31. LEVER ASSEMBLY
32. COVER ASSEMBLY
33. PAD ASSEMBLY
34. FILLER
35. ARMREST WELDMENT

Figure 2-48.8. Armrest Assembly, Mission Operator Seat

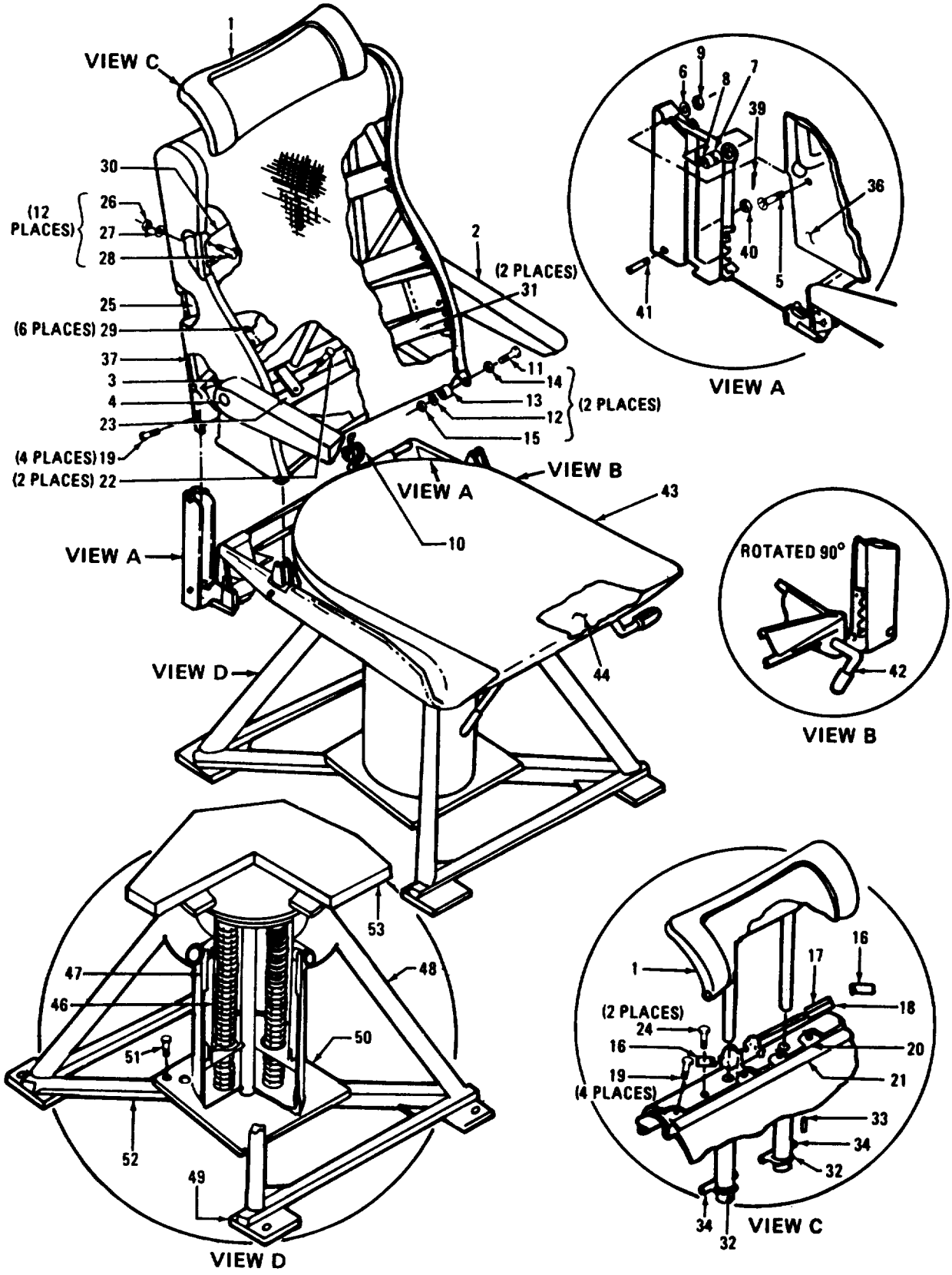


Figure 2-48.9. Mission Operator Seat, EH-1H (Sheet 1 of 2)

1. HEADREST ASSEMBLY
2. ARMREST INSTALLATION, LH (FOR BREAKDOWN)
3. ARMREST INSTALLATION, RH
4. BUTTON, PLUG
5. BOLT
6. WASHER
7. SPACER
8. SPACER
9. NUT
10. SPRING
11. BOLT
12. WASHER
13. SPACER
14. SPACER
15. NUT

SEAT BACK ASSEMBLY

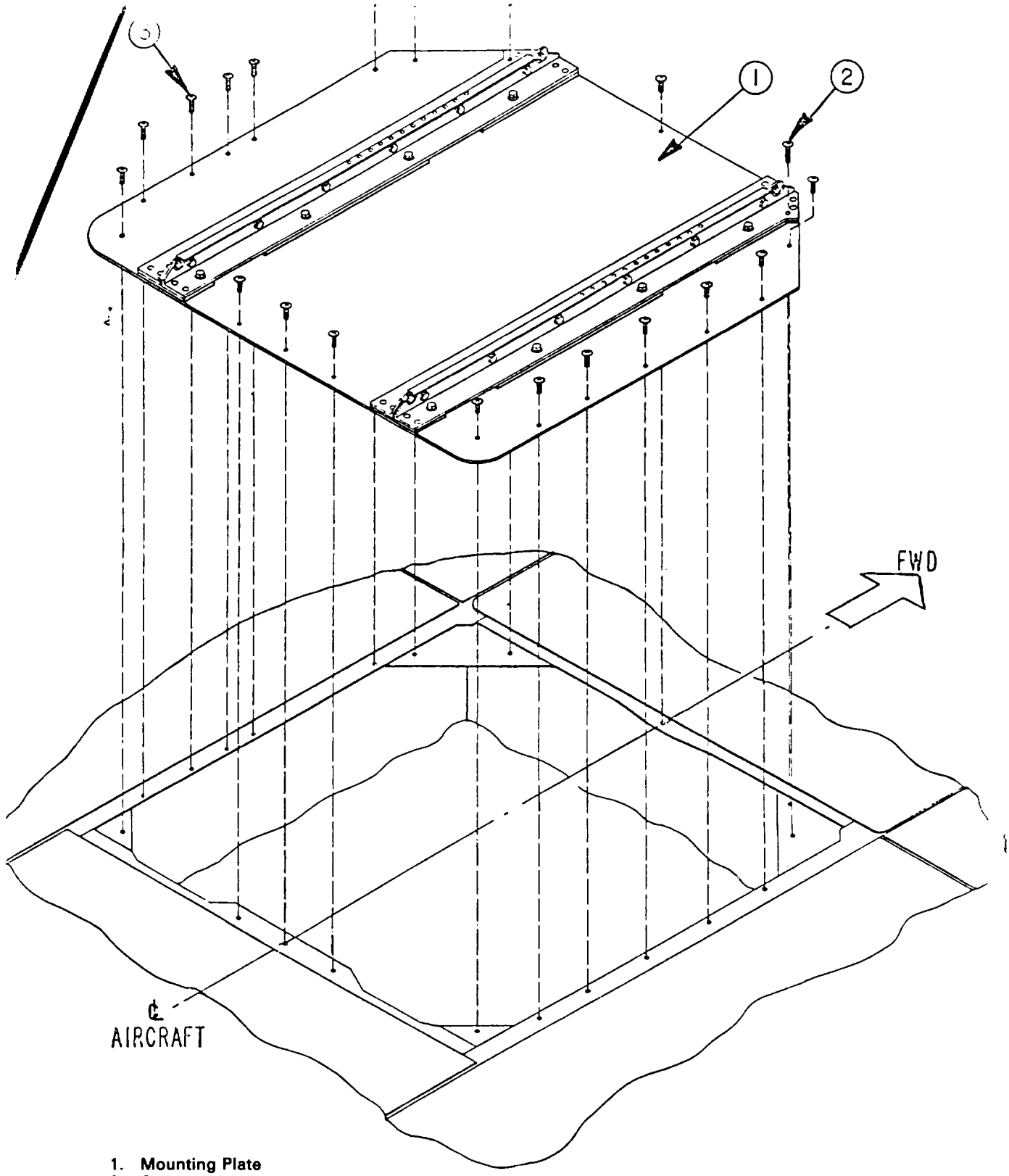
16. RETAINING RING
17. ROLLER PIN
18. ROLLER
19. SCREW
20. UPPER EDGE GUIDE
21. NET RETAINER
22. SCREW
23. NET RETAINER
24. SCREW
25. BACK COVER
26. NUT
27. WASHER
26. SCREW
28. FILLER
30. BACK STRAP
31. BACK STRAP
32. SPRING
33. COTTER PIN
34. PIN
35. SCREW
36. BACK PANEL ASSY
37. BACK FRAME ASSEMBLY
36. SHROUD
38. COTTER PIN
40. WASHER
41. FLAT HEAD PIN
42. CONTROLS INSTALLATION
43. BOTTOM COVER
44. SEAT BOTTOM CUSHION
45. BOTTOM ASSEMBLY
46. INNER TUBE ASSEMBLY
47. OUTER TUBE ASSEMBLY
46. BASE
49. PLATE ASSEMBLY
50. FLANGE
51. SCREW
52. CHANNEL
53. SEAT BOTTOM

Figure 2-48.9. Mission Operator Seat, EH-1H (Sheet 2 of 2)

2-253. TROOP SEATS.

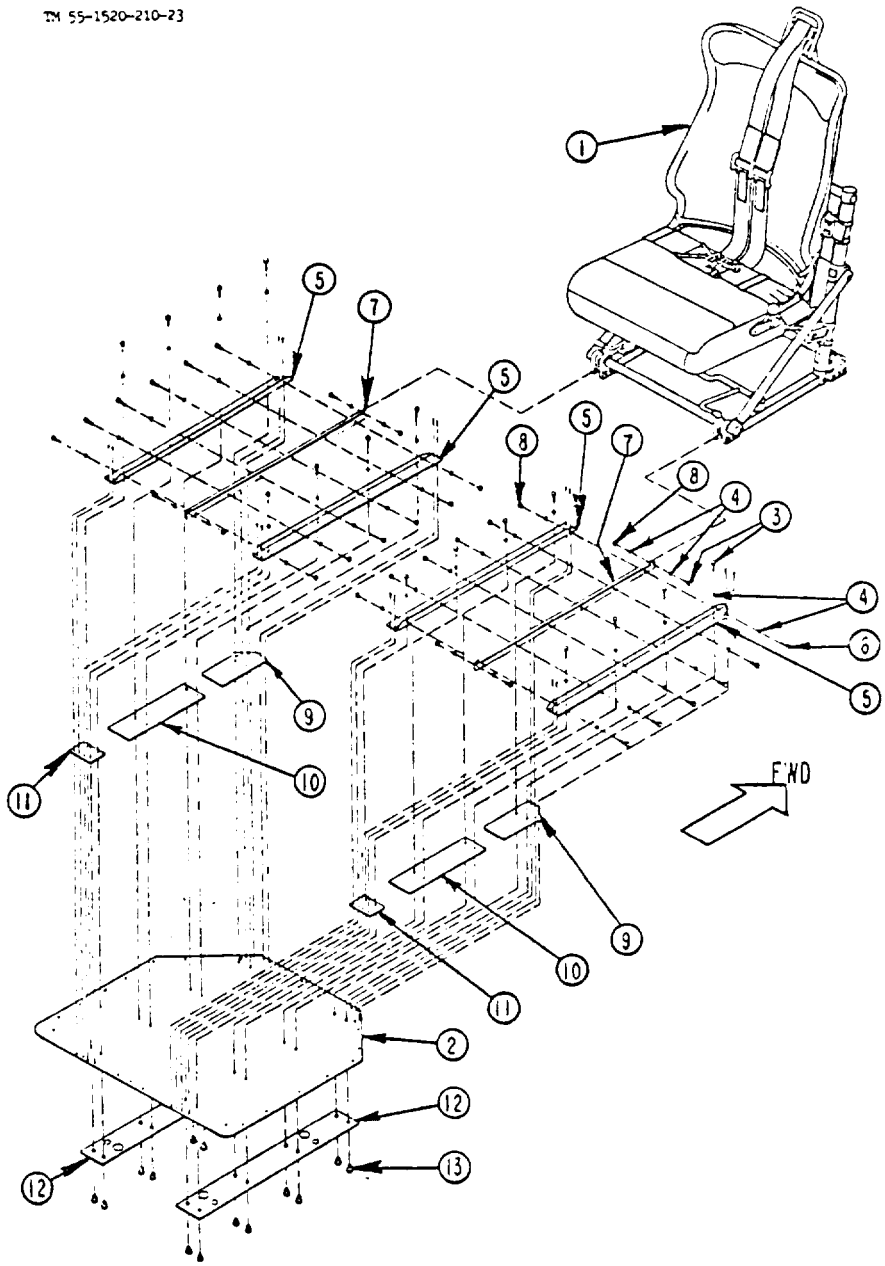
2-254. Description - Troop Seats. a. Arrangements have been made in aft section of the forward fuselage section for seating eleven passengers (figure 2-49). Either of the two following arrangements may be used for passenger seating.

(1) Three seats facing forward, and accommodating five passengers may be placed across cabin immediately forward of the transmission



1. Mounting Plate
2. Screw
3. Screw

Figure 2-48.10 [X] SEAT TRACK ASSEMBLY

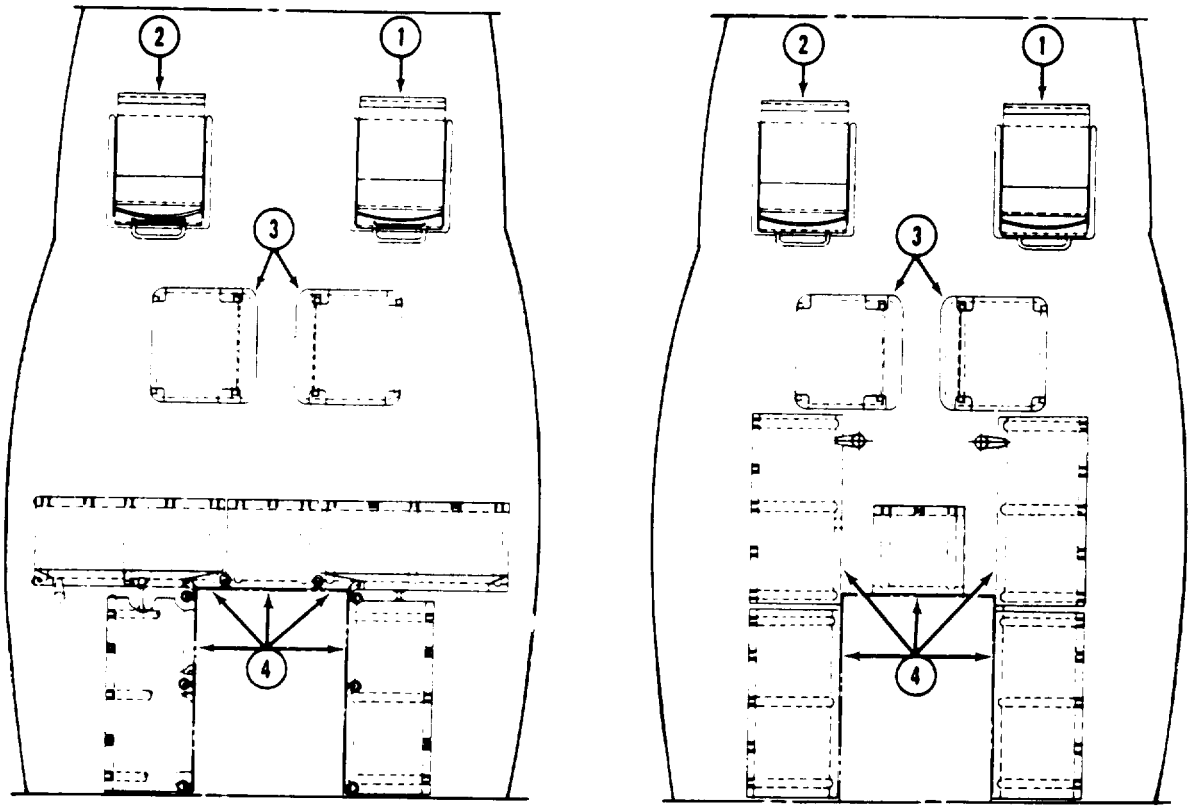


1. Mission Operator's Seat
2. Mounting Plate
3. Bolt
4. Washer, Plain
5. Track Mounting Angle
6. Bolt
7. Track
8. Nut
9. Spacer
10. Spacer
11. Spacer
12. Doubler
13. Structural Fastener

Figure 2-48.11 [X]Mission Operator Seat Assembly

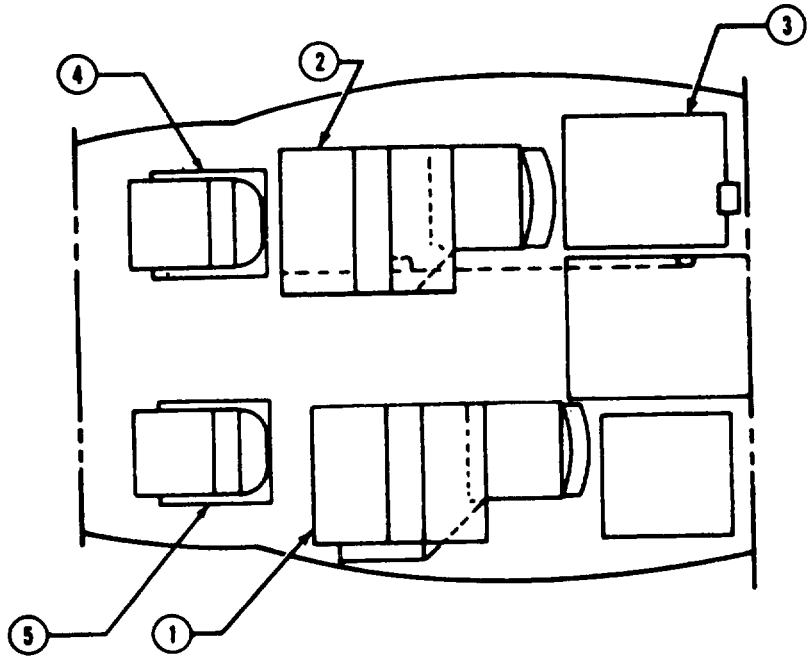
support structure. A one-passenger seat, without back rest, is located between two two-man seats (4, figure 2-49) which have backs. Two additional two-man seats (4), without backs, are located parallel to the helicopter centerline aft of the five passenger seats. Passengers in these seats face outboard. Two single-passenger folding seats (3), with backs are located just aft of the *crew* seats.

(2) Four two-man seats, facing outboard, may be placed, two on each side of the helicopter center line, approximately in line with the side faces of the transmission support structure. The two forward seats (4) are equipped with backs. A one-passenger seat, without back rest, is located immediately forward of the transmission support structure on the helicopter centerline and faces forward. Two single-



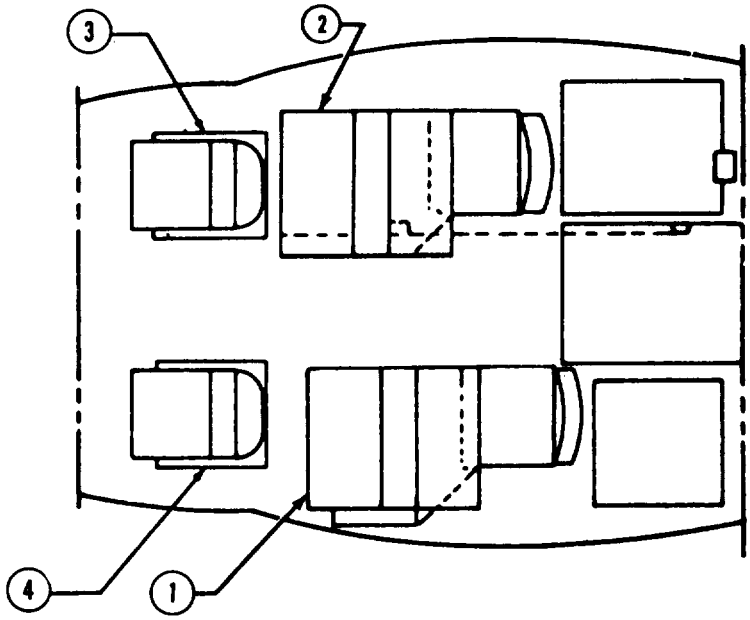
1. Pilot seat
2. Copilot seat
3. Passenger seats (folding)
4. Passenger seats

Figure 2-49. Seating Arrangement



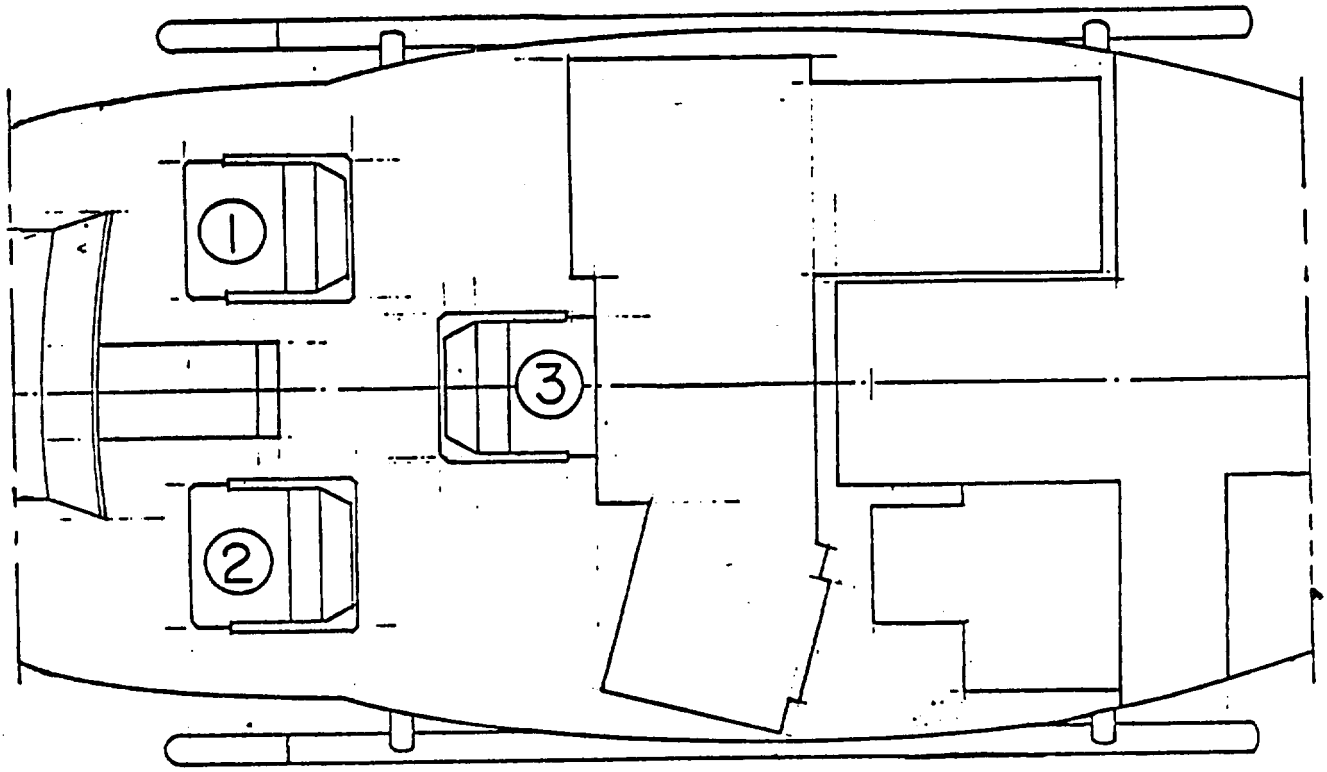
1. MISSION OPERATOR CONSOLE 1
2. MISSION OPERATOR CONSOLE 2
3. MISSION OPERATOR CONSOLE 3
4. PILOT'S SEAT
5. COPILOT'S SEAT

Figure 2-49.1. E Seating Arrangement



1. Mission operator console no. 1
2. Mission operator console no. 2
3. Pilot seat
4. Copilot seat

Figure 2-49.2 EE Seating Arrangement



1. Pilot Seat
2. Co-pilot Seat
3. Mission Operator Seat

Figure 2-49.3. [X] Seating Arrangement

passenger folding seats (3), with backs are located aft of the crew seats.

NOTE

The two single-passenger folding seats (item 3, figure 2-49) may be installed facing aft or toward either side, but not forward. A single-passenger folding seat may be installed center of the craw seats and facing forward oniy when performing flight training with two students, pilot evacuation, or a maintenance test fright. It may alao be installed facing aft or toward either side during normal operation.

2-255. Inspection – Troop Seats. a. Visually inspect fabric (TM 55-1500-204-25/1).

b. Visually inspect east support tubes for damage.

c. Check seat leg attachment fittings for positive engagement in floor studs, legs for dents and damage.

d. Inspect seat support fittings for secure engagement of seat support tubes.

2-256. Removal — Troop Seats. .Remove one-man seat without back as follows:

(1) Slide collar of each leg attachment fitting upward from the floor to reieaae fittings from floor studs.

(2) Disengage aft tube assembly from spring-loaded lock fittings and remove seat assembly from the helicopter.

b. Remove one-man seat with back as follows:

(1) Slide collar of each leg attachment fitting upward from the floor to release fittings from floor studs.

(2) Pull the quick-reieaae pin attaching seat back support tubes to each side of the seat bottom, and fold seat back forward onto seat bottom.

(3) Pull the quick-release pin attaching diagonal leg brace to forward leg and fold each leg inboard against seat bottom.

(4) Remove seat assembly from helicopter.

c. Remove two-man seat without back as follows:

(1) Slide collar of each leg attachment fitting upward from the floor to release fittings from floor studs.

(2) Disengage aft tube assembly from fittings and fold seat legs against seat bottom.

(3) Removal seat assembly from the helicopter.

d. Remove two-man seat with back as follows:

(1) Pull upper and lower quick-release pins attaching seat beck to stanchion assembly fittings.

(2) Remove nuts, washers, and bolts attaching seat back to fittings and fold seat beck forward on seat bottom.

(3) Slide collar of each leg attachment fitting upward from the floor to release fittings from floor studs and fold seat assembly legs against bottom of seat.

(4) Remove seat from helicopter.

(5) Slide collars of upper and lower attachment fittings on stanchion assemblies toward center of assembly to release stanchions from roof and floor studs, and remove stanchion assemblies from the helicopter.

e. Remove three-man troop seats with back as follows:

(1) Slide collar on each leg attachment fitting upward from the floor to release fittings from floor studs.

(2) Remove seat from helicopter.

2-257. Disassembly – Troop Seats. a. Slide upper aft seat tube assembly from loops in back of seat.

b. Remove nuts, bolts, and washer securing seat legs to forward seat tube assembly. Remove legs.

c. Remove nuts, bolts, and washers securing crosstubes extending from forward tube assembly to lower aft tube assembly.

d. Slide seat cover off tubes.

e. Remove bolts, nuts, and washers securing fittings to lags. Remove fittings.

2-258. Repair or Replacement — Troop Seats. Tears, cuts, and holes smaller than 3/8 inch in length or diameter in the fine-mesh duck cloth of the troop seat covers, are permissible without repair. Tears, cuts or holes greater than 1 inch in length or diameter are not allowed. Tears, cuts, or holes less than 1 inch in length or diameter may be repaired by a darning procedure which picks up at least 1/4 inch of good material adjacent to our surrounding the cut, tears, or hole. While mending the thread tension should be maintained so as to produce a mend which disturbs as little as possible the natural lines of the seat netting adjacent to the mends. Nylon thread (C287) or equivalent to be used for repairs. Internal support tubes (3/4 inch diameter) of troop seat support legs (PN A6968) may be replaced for cracks by fabrication of new tube. Manufactured tubes will be identified as PN BS-1. Internal support tube may be removed by unscrewing two allen head bolts located on either side.

2-59. Reassembly — Troop Seats. a. Replace seat cover on tubes.

b. Secure cross tubes from forward to lower aft tube assembly with bolts, nuts, and washers.

c. Replace fittings on legs and secure with bolts, nuts, and washers.

d. Attach legs to forward seat tube assembly with bolts, washers, and nuts.

e. Replace upper aft seat tube assembly in loops of seat back.

2-260. Installation — Troop Seats. a. Install one-man seat without back as follows:

(1) Position seat assembly in helicopter. Engage aft tube assembly in spring-loaded lock fittings.

(2) Position seat assembly support legs on floor studs. Secure legs to lor by sliding attachment fitting collars downward as far as possible.

b. Install one-man seat with back as follows:

(1) Unfold diagonal leg brace and attach to forward leg with quick-release pin.

(2) Raise seat back to vertical position. Attach seat back support tubes to each side of seat bottom by installing quick-release pins.

(3) Position seat assembly support legs on floor studs. Secure legs to floor by sliding attachment collars downward as far as possible.

c. Install two-man seat without back as follows:

(1) Position seat assembly in helicopter. Engage aft tube assembly in fittings.

(2) Unfold seat assembly support legs and position on floor studs. Slide leg attachment fitting collars downward as far as possible to secure legs to floor.

d. Install two-man seat with back as follows:

(1) Position stanchion assemblies in helicopter between roof and floor studs. Slide attachment fitting collars as far as possible toward studs to secure stanchion assemblies to roof and floor.

(2) Unfold seat assembly support legs. Position on floor studs. Slide leg attachment fittings collars downward as far as possible to secure legs to floor.

(3) Raise seat back to vertical position. Install bolts, washers, and nuts attaching seat back to finings.

(4) Position seat back in stanchion assembly fittings. Install upper and lower quick-release pins.

(5) Position seat assembly support legs on floor studs. Secure legs to floor by sliding attachment fitting collars downward as far as possible.

2-261. TROOP SEAT BELTS.

2-262. Description — Troop Seat Belts. Individual lap-type seat belts are provided for all troop seats. The same belts, with web extensions, are provided for litter patients when helicopter is used for rescue missions.

2-263. Removal — Troop Seat Belts. a. To remove seat safety belts from seats, unsnap both ends of the belt from rings.

b. To remove safety belts and extensions from litters, disconnect belt from extensions.

2-264. Inspection - Troop Seat Belts. (TM 55-1500-204-25/1).

2-265. Repair or Replacement - Troop Seat Belts. (TM 55-1500-204-25/1).

2-266. Installation — Troop Seat Belts. a. Position belt across seat bottom and attach both ends to seat rings.

WARNING

Assemble each belt with release handle pointing left.

b. To install safety belts and extension on litters, connect one end of belt to extension. Pass belt and extension combination around litter and connect other ends.

NOTE

Two safety belt and extension combinations are required for each litter.

2-267. ENGINE MOUNTS.

2-268. Description - Engine Mounts. Engine is suspended at three points by supports made of steel tubing. These supports are attached to fittings on service deck. Forward support tube has rod end bearing for mounting to forward trunnion. Bipod support, on righthand side, and tripod support on left-hand side, both have pillow blocks with hinged bearing caps. These caps retain bearings of two trunnion fittings installed on mounting pads at each side of engine diffuser housing (figure 2-50).

2-269. Removal -Engine Mounts. Prior to lifting the engine, remove the particle separator. Disconnect the droop cam control rod (27, figure 2-50), the fuel control throttle arm, and the aft engine fire wall Dzus fasteners. Open the forward engine belmouth V band clamp. This will allow engine to shift during mount removal.

CAUTION

Lift engine with care to avoid undue strain on fuel or oil lines, electrical wiring, and main driveshaft flex couplings.

CAUTION

Do not use jacks to raise the engine.

a. Attach engine sling with a suitable hoist to the engine, take up slack until the sling is supporting the weight of the engine.

b. Open pillow block caps (2, figure 2-50) to release main trunnion bearings.

c. Remove bolts (19), nuts (23) and washers (18) securing bipod mount (1) to service deck. Spring (13) is secured by bolts (19 and 20) attaching rear leg and clamp on rear leg.

NOTE

Flat spring (13) is installed on the aft leg of bipod to hold bipod upright when engine is removed.

d. Remove bolts (15), nuts (17) and washers (16) securing forward support tube (12) and tripod mount (10) to service deck.

e. To separate pillow block (2) from bipod mount (1) or tripod mount (10) remove attaching nut, washers, and bolts.

f. To remove main trunnion (8) from engine, remove bolts (4) and washers (3) securing trunnion to engine. A support for engine electrical wiring is on lower forward bolt of left trunnion.

g. Remove nut and washer to remove bearing (7) from main trunnion (8).

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h. To remove forward trunnion (25), remove bolts (29 and 30) and washers (28 and 32) securing trunnion to engine. Upper bolts also secure droop compensator cambox (27) bracket.

i. Leave deck fittings in place except when removal is required for inspection, replacement, or change of shims to correct driveshaft alignment. To remove fittings and shims, remove bolts and screws through deck.

2-270. Inspection -Engine Mounts.

a. Inspect forward support tube (12, figure 2-50), bipod mount (1) and tripod mount (10) for bent, cracked or damaged tubes, or loose rod end attachment rivets. If crack is suspected, refer to TM 1-1520-256-23 AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

(1) Bends are not permitted.

(2) Scratches not exceeding **0.004** inch depth in tube may be repaired. Transverse scratches longer than 0.3125 inch are not acceptable.

(3) Scratches or dents adjacent to welded areas are not acceptable.

(4) No dents are permitted in the middle third of tube. Smooth dents of large diameter which do not cause bending of the tube (end to end) are permitted, provided there is not crimping or cracking in the dent, and there is not visible deformation adjacent to the dents.

(5) Dents may not exceed a total depth of **0.030** inch.

(6) No cracks allowed in weld area. If crack is suspected, refer to TM 1-1520-256-23 AVUM/AVIM nondestruction
inspection procedures for UH-1 helicopter series.

(6.1) Inspect aft engine mount fittings (trunnions) for damage in excess of limits shown in figure 2-50.1. If crack is suspected, refer to TM 1-1520-256-23 AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

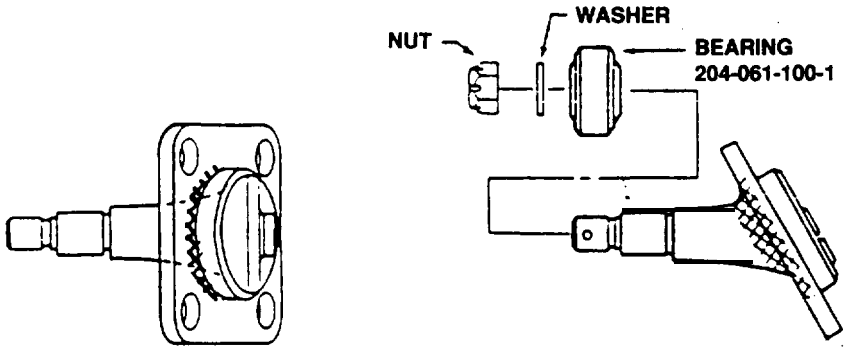
(7) Loose or missing rivets in tripod, bipod, or forward support tube is cause for mount replacement.

NOTE

Prior to performing step b., c., and d., below engine must be raised. Refer to paragraph 2-269.

b. Inspect bearings (7) for wear and excessive play (**0.006** inch radial and **0.012** inch axial maximum).

c. Inspect all rod end bearings for wear and excessive play (**0.005** inch radial and **0.020** inch axial maximum).



ENGINE MOUNT FIITTING (TRUNNION) 204-060-152-1

DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED	
CRACKS	None	None
NICKS, SCRATCHES, DENTS AND CORROSION	0.010	0.020
MAXIMUM AREA PER FULL DEPTH REPAIR	Not critical	Not critical
NUMBER OF REPAIR AREAS	Not critical	Not critical
EDGE CHAMFER	0.010	0.020
BORE DAMAGE	0.002 for 1/4 Circumference	
THREAD DAMAGE ON FIITTING AND NUT	None acceptable	
BEARING WEAR (LOOSENESS)		
Radial	0.006	
Axial	0.012	

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

Figure 2-50.1 Damage Limits — Aft Engine Mount Fittings (Trunnions) and Bearings

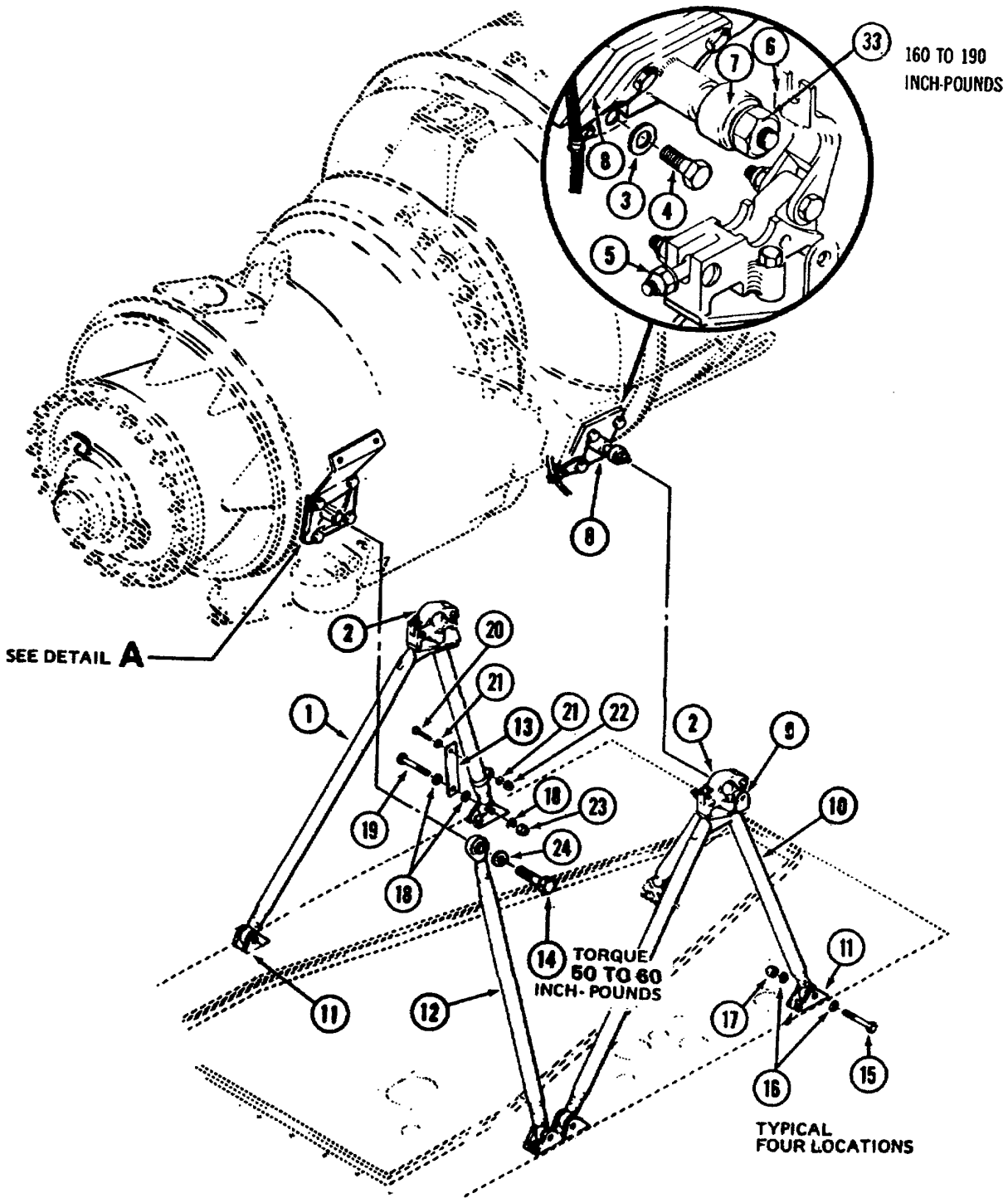
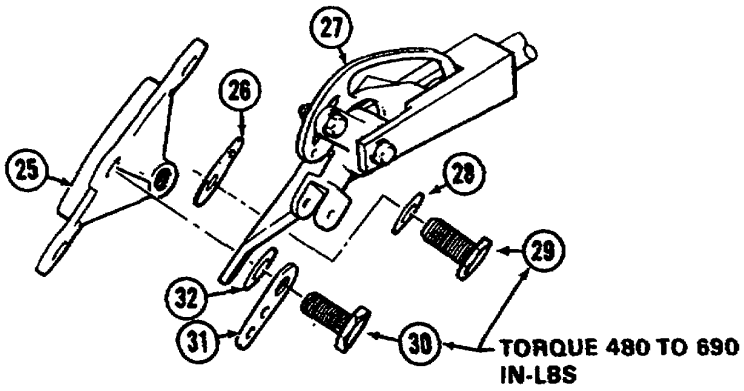


Figure 2-50. Engine Mount (Sheet 1 of 2)



1.	Bipod mount	12.	Forward support tube	23.	Nut
2.	Pillow block	13.	Flat spring	24.	Washer
3.	Washer	14.	Retaining bolt	26.	Support
4.	Bolt	15.	Bolt	25.	Forward trunnion
5.	Latching eyebolt	16.	Washer	27.	Droop compensator cambox
6.	Bearing cap	17.	Nut	28.	Washer
7.	Bearing	18.	Washer	29.	Bolt
8.	Main trunnion	19.	Bolt	30.	Bolt
9.	Bellcrank bracket	20.	Bolt	31.	Bracket
10.	Tripod mount	21.	Washer	32.	Washer
11.	Deck fitting	22.	Nut	33.	Nut

Figure 2-50. Engine Mount (Sheet 2 of 2)

d. Inspect trunnion (8) for cracks, damage, or scored bearing shaft. If crack in the trunnion (engine mount fitting) is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

e. Inspect forward trunnion (25) for cracks or damaged threads. If crack in the forward trunnion (engine mount fitting) is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

f. Inspect all deck fittings for security, cracks, and general condition. If crack in deck fittings is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation 3 Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

g. Replace support spring (13) if cracked or broken.

2-270.1. Inspection -Pillow Blocks. Inspect pillow blocks (2, figure 2-50) for the following:

a. Cracks. No cracks allowed. If crack in pillow block is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

b. Corrosion/Mechanical damage. Corrosion and/or mechanical damage of nicks, scratches and/or dents that are severe enough to affect the function of the pillow block are not allowed.

c. Wear. The pillow block bearing caps are worn beyond the limit when the caps will no longer grip the trunnion bearing.

d. Hardware. Check serviceability.

2-270.2. Repair or Replacement - Pillow Blocks. Polish out minor scratches and/or corrosion using fine india stone (C264) and touch-up with primer (C219).

2-271. Repair or Replacement - Engine Mounts.

a. Replace parts when wear or damage exceed inspection limits. If rod end bearings exceed wear limits, replace assembly.

b. Polish out allowable scratches with fine abrasive cloth (C1). Length of blend shall be at least **30** times the depth of the scratch but no longer than **2.25** inches and shall not exceed **0.3125** total peripheral dimension at any one section. Paint repaired area with primer (C312).

2-272. Installation -Engine Mounts.

a. Install forward trunnion (25, figure 2-50) on mount pad at left side of engine inlet housing. Apply primer (C312) to trunnion (25, figure 2-50) and engine mounting pad. Let dry completely. Install trunnion on mount pad at left side of engine inlet housing.

(1) Position trunnion (25) to engine with droop compensator cambox (27) bracket over upper holes. Place washer (32) and bracket (31) for hose support clamps over forward upper bolt (30). Use thin washer on upper rear bolt.

(2) Place washer (28) and support (26) for fuel control vent hose on lower rear bolt (29). Use thin washer on lower forward bolt.

(3) Torque all bolts **480 TO 690** inch-pounds.

(4) Lockwire droop compensator cambox bolt (30) to forward support tube bolt (14). Triple safety wire three remaining bolts (C155), refer to paragraph 4-11.e for alternate procedure.

b. Install bearing (7) on shaft of main trunnion (8) with washer and nut (33). Torque **160 TO 190** inchpounds.

c. Install two main trunnions (8) on mount pads of engine diffuser housing, each secured by four bolts (4) and thin washers (3). On lower forward bolt of left trunnion, install stand-off clip for electrical cable support clamp. Torque trunnion mount bolts to **160 TO 190** inchpounds. Lockwire (C155) bolt heads in pairs.

d. Install pillow blocks (2) on bipod mount (1) and tripod mount (10) with two bolts, washers, and nuts. Place washers under nuts.

e. Check installation of deck fittings. Place rod ends of tripod (10) in three fittings at left and rear of deck. Install close tolerance bolts (15) with washers (16) under heads and nuts (17).

f. In similar manner, install bipod (1) in right deck fittings. Attach spring (13) under bolt head (19) on outboard side of rear fitting, and attach upper end of spring with a bolt (20) and washer (21) to clamp on bipod leg. Install washers (18 and 21) and nuts (22 and 23).

g. Install forward support tube (12) in left forward fitting.

h. Open hinged bearing caps (6) on pillow blocks. Lower engine to seat main trunnion bearings. Close bearing caps and secure with latching eyebolts (5), torque latching eyebolts to **50 TO 70** inch-pounds. Lockwire pillow block bearing caps (C155).

i. Align rod end of support tube (12) with forward trunnion (25). Install bolt (14) with washer (24). Torque bolt **50 TO 60** inch-pounds. Lockwire (C155) bolt (14) to one of the trunnion mounting bolt heads.

j. If driveshaft misalignment is suspected for any reason or if shims under deck fitting have been changed, check drive shaft alignment (paragraph 6-24).

k. Install particle separator, connect droop cam control rod (27) and the fuel control throttle arm. Fasten the aft engine firewall fasteners. Secure forward engine belmouth V-band clamp. (Refer to paragraph 4-11.i.)

2-273. HEAT SUPPRESSOR.

2-274. Description -Heat Suppressor. Certain helicopters are equipped with provisions to accept infrared suppression equipment contained in Auxiliary Suppressor Kit, Exhaust (Heat) Suppressor (205-706-082-1). This kit includes an upturned insulated exhaust duct assembly, oil cooler exit shield, two engine side shields, forward duct assembly, and necessary attaching hardware.

2-275. Removal -Heat Suppressor.

a. Disconnect rotating beacon light, and remove cover assembly (1, figure 2-51) from insulated exhaust duct assembly (2).

b. Disconnect duct assembly drain line (29) from reducer (30).

c. Remove tailpipe fairing (7) with forward duct assembly (10) and position tailpipe fairing on suitable workbench.

d. Disconnect tailpipe drain link (26) from adapter tube (27) and tailpipe.

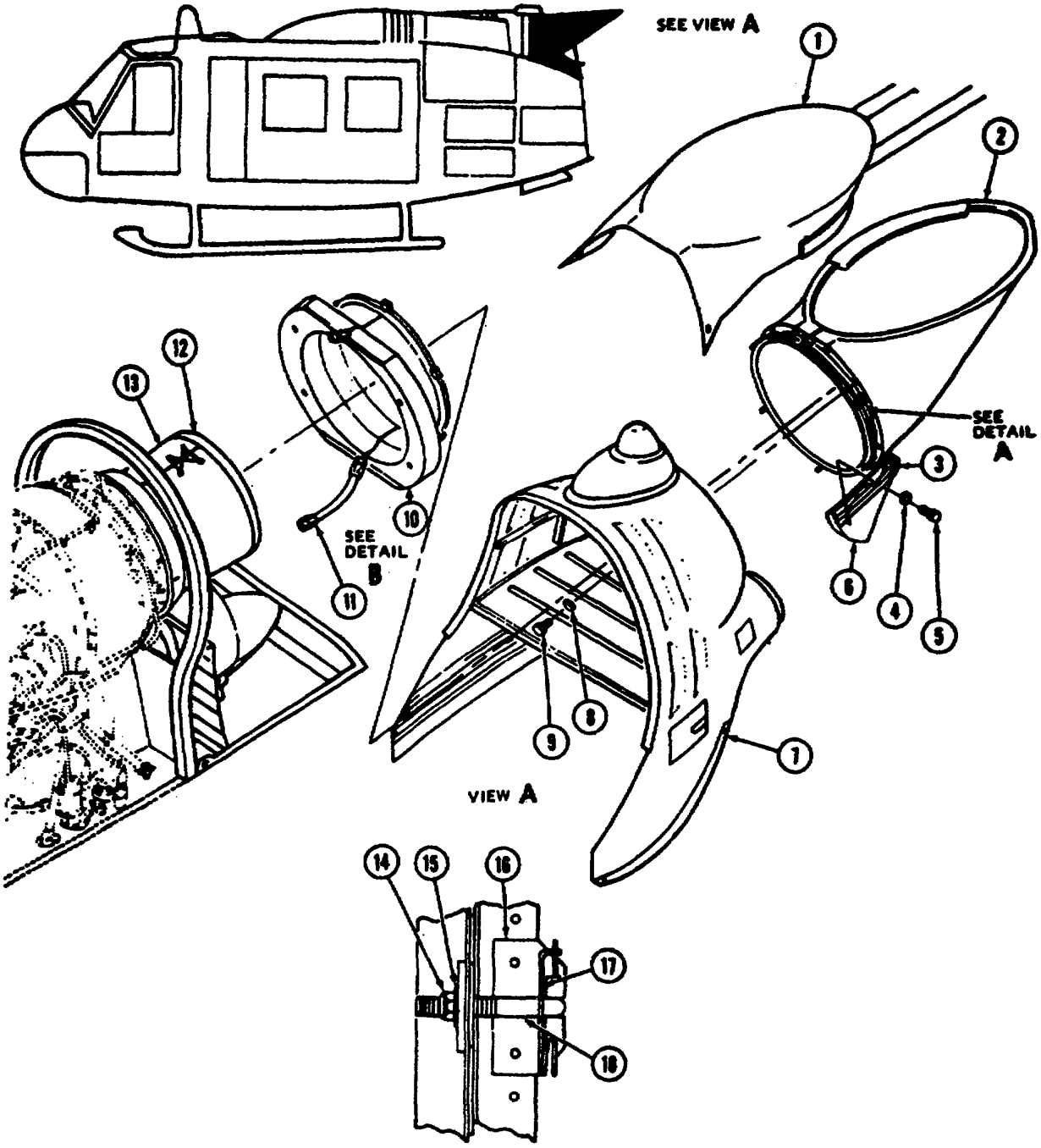
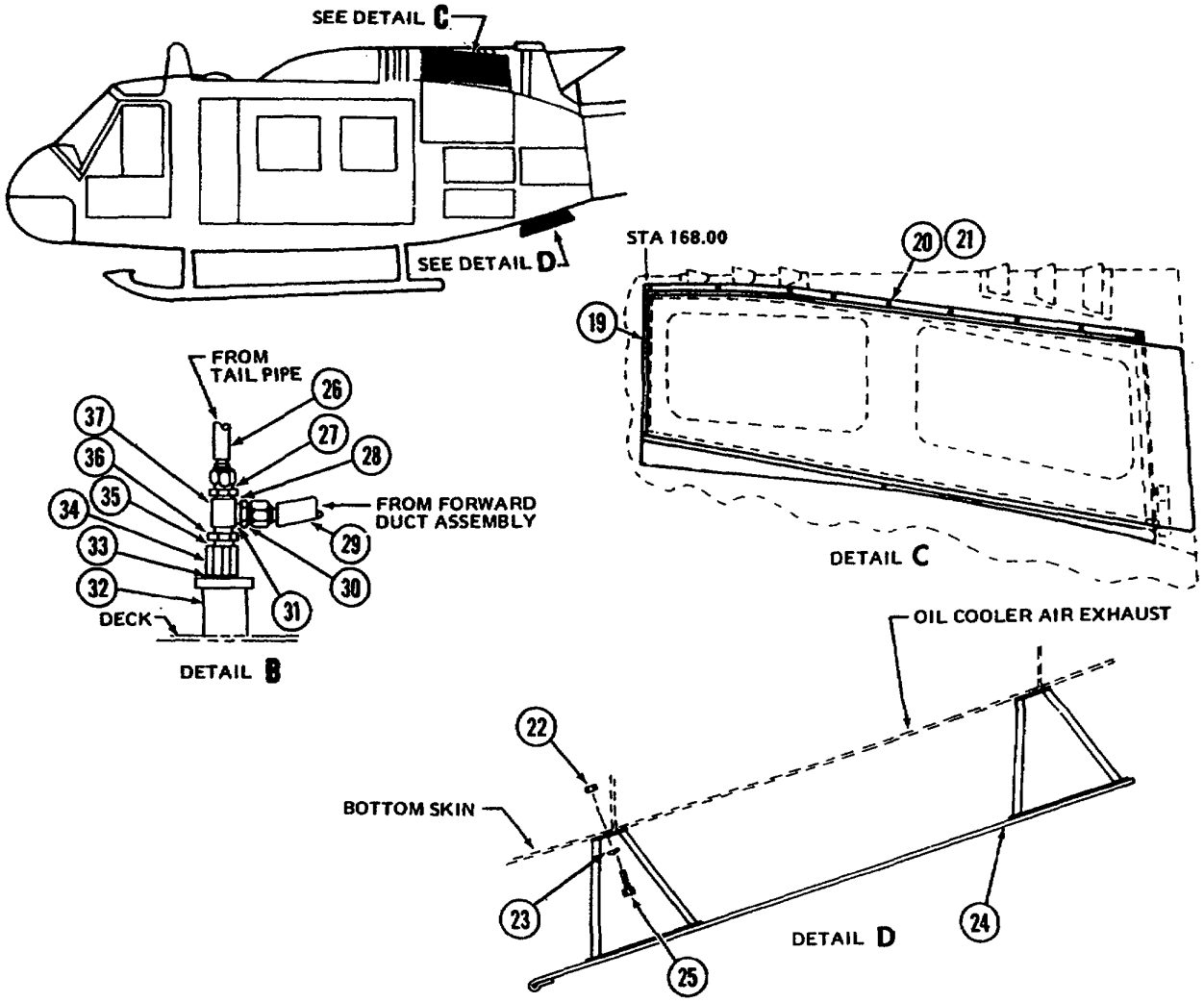


Figure 2-51. Heat Suppression Components (Sheet 1 of 2)



1. Cover assembly
2. Insulated exhaust duct assembly
3. Insulator
4. Washers
5. Screws
6. Fairing assembly
7. Tailpipe fairing
8. Washers
9. Screws
10. Forward duct assembly
11. Drain fitting
12. Exhaust tail pipe
13. Insulation blankets
14. Nut
15. Washer
16. Mount bracket
17. Lockpins
18. Jog bolts
19. Shield assembly
20. Screws
21. Washers
22. Nut
23. Washer
24. Oil cooler shield
25. Bolt
26. Tail pipe drain line
27. Adapter
28. Preformed packing
29. Duct assembly drain line
30. Reducer
31. Preformed packing
32. Coupling half
33. Preformed packing
34. Coupling
35. Preformed packing
36. Nut
37. Tee

Figure 2-51. Heat Suppression Components (Sheet 2 of 2)

e. Remove adapter tube (27) and packing (28) from tee (37). Discard packing (28).

f. Remove coupling (34) with tee (37) attached from coupling half (32). Install adapter tube (27) in coupling half (32) using new packing (28).

g. Remove existing tailpipe and install tailpipe (2) (paragraphs 4-69 and 4-73).

h. Connect tailpipe drain line (26) to adapter tube (27) and tailpipe.

i. Remove nuts (14) with washers (15) and remove forward duct assembly (10) from fairing assembly (7).

j. Remove lock pins (17) and remove jog bolts (18).

k. Remove fairing assembly (6) by removing screws (5) with washers (4). Retain insulator (3) with fairing assembly (6).

l. Remove screws (9) with washers (8) and remove insulated exhaust duct assembly (2).

m. Remove screws (20) with washers (21) and remove left shield assembly (19). Repeat step for right shield assembly.

n. Remove aft panel (53, figure 2-18) and remove nuts (22, figure 2-51) with washers (23). Remove bolts (25) and oil cooler shield (24).

o. Install tailpipe fairing (8, figure 4-2) and connect rotating beacon light.

p. Cap or cover all open ports. Retain complete Auxiliary Equipment Kit, Exhaust Suppressor (205-706-082-1) in local stock for future reinstallation.

2-276. Cleaning - Heat Suppressor. Wipe components of heat suppressor with cloth dampened with solvent (C261).

2-277. Inspection - Heat Suppressor.

a. Scratches and small shallow dents are considered negligible and do not require repair.

b. Inspect exhaust tailpipe (12, figure 2-51) for cracks, dents and burned out or buckled areas. If crack in exhaust tailpipe is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

c. Inspect duct assemblies (2 and 10) for cracks, dents, and burned out or buckled areas. If crack in duct assembly is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

d. Inspect lockpin (17) for cracks and security. If crack in lockpin is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

e. Inspect bolts (18) for cracks and damaged threads. If crack in bolt is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

f. Inspect insulation (13) for holes and tears.

g. Inspect cowling and fairings (6 and 7) for cracks, dents, corrosion, security, and loose or missing fasteners. If crack to cowling or fairing is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

2-278. Repair or Replacement - Heat Suppressor.

a. General repair limits for exhaust duct (10, figure 2-51).

(1) Cracks and holes in surface of duct should not exceed **3.0** inches in diameter after cleanup. Adjacent repair areas must allow a minimum of **2.0** inches of parent metal between patches.

(2) Heating, as evidenced merely by discoloration of the metal is permissible. However, if the condition becomes progressive, indicating a possible burn-through, the part should be replaced.

(3) Dents in the surface of duct are permissible, providing the surface is not broken, and there are no sharp creases or projections into exhaust stream.

(4) Damage to circumferential mounting frames shall be evaluated locally as to feasibility of repair or replacement. It is not feasible to replace the frame on the duct.

b. General repair limits for exhaust duct (2, figure 2-51).

(1) Cracks end holes in the interior surface of duct will not exceed **3.0** inches in diameter after cleanup. Adjacent repair areas must allow a minimum of **2.0** inches of parent metal between patches.

(2) Cracks and holes in exterior surface of duct will not exceed **4.0** inches in diameter after cleanup. Adjacent repair areas must allow a minimum of **2.0** inches of parent material between patches.

(3) Damage which penetrates the temp-mat insulation between the interior and exterior surfaces of the duct will not exceed **4.0** inches in diameter after cleanup.

(4) Dents in the interior or exterior surfaces are permissible, providing the surfaces are not broken, and there are no sharp projections into the exhaust stream.

(5) Damage to the mounting flange and outlet rim of the duct will be evaluated locally as to feasibility to repair, or need for replacement.

c. General repair procedures. Repair to the exhaust heat suppression system components will employ standard sheet metal repair practices in conjunction with procedures described herein.

(1) Minor dents in exterior surfaces require no rework if the surface is not broken, or if no sharp crease or projection exists in the interior surface.

(2) Work out minor dents having sharp projections into the interior of the duct, by restoring to original contour and smoothing off any sharp projections with fine abrasive paper.

(3) Large dents (surface impressions) will be worked out by restoring the surface to original contour.

(4) All cracks will be stop-drilled to prevent continuation.

d. (AVIM) Repair cracks or holes in forward exhaust duct (10, figure 2-51) as follows: (figure 2-52, Detail A.)

(1) Stop drill crack at both ends.

(2) If two or more cracks converge, cut out area encompassed by cracks and smooth out edges to form a hole, not to exceed 3.0 inches.

(3) Trim patch, 205-706-083-3 (Repair kit 205-706 -083-1) as necessary, to provide a minimum of 0.25 inch edge distance between rivets and hole in parent metal, and between rivets and edge of patch.

(4) Position patch and layout rivet hole locations.

(5) Drill rivet holes and install rivets, MS20615-3M4, with heads on interior of duct.

e. (AVIM) Repair cracks or holes in interior surface of aft exhaust duct (2, figure 2-51) as follows: (figure 2-52, Detail B):

(1) Cut hole through outer surface of duct to encompass damaged area, not to exceed 4.0 inches in diameter.

(2) Cut out and remove insulation material (temp-mat) not to exceed 4.0 inches.

(3) Cut out damaged area of interior surface of duct, not to exceed 3.0 inches in diameter.

(4) Trim patch, 205-706-083-3 (Repair kit 205-706-083-1) as necessary to provide a minimum of 0.25 inch edge distance between rivets and hole, and between rivets and edge of patch.

(5) Position patch on outside of interior surface, and layout rivet hole locations.

(6) Drill rivet holes, and install rivets, with heads on interior of duct.

(7) Cut patch 205-706-083-5 (Repair kit 205-706-083-1) to fit insulating core area.

(8) Apply adhesive paste (C37) and install patch.

(9) Trim patch, 205-706-083-7 (Repair kit 205-706-083-1) and provides minimum of 0.50 inch overlap on outer surface of duct.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(10) Lightly abrade area 0.060 inch wide around hole in outer surface. Clean area with methyl-ethyl-ketone (C177).

(11) Apply adhesive (C29) to area around hole.

(12) Remove backing from patch, and apply patch over hole. Press smoothly into place.

(13) Allow adhesive to cure for 24 hours at room temperature. Alternate cure time is one hour at 175 degree F (79 degrees C).

f. (AVIM) Repair cracks or holes in exterior surfaces of aft exhaust duct (2, figure 2-51) as follows (figure 2-52, Detail B, View C-C):

(1) Cut out damaged area of outer skin, not to exceed 4,0 inches in diameter.

(2) Trim patch, 205-706-083-7 (Repair kit 205-706 -083-1) to provide a minimum of 0.50 inch overlap on outer surface of duct.

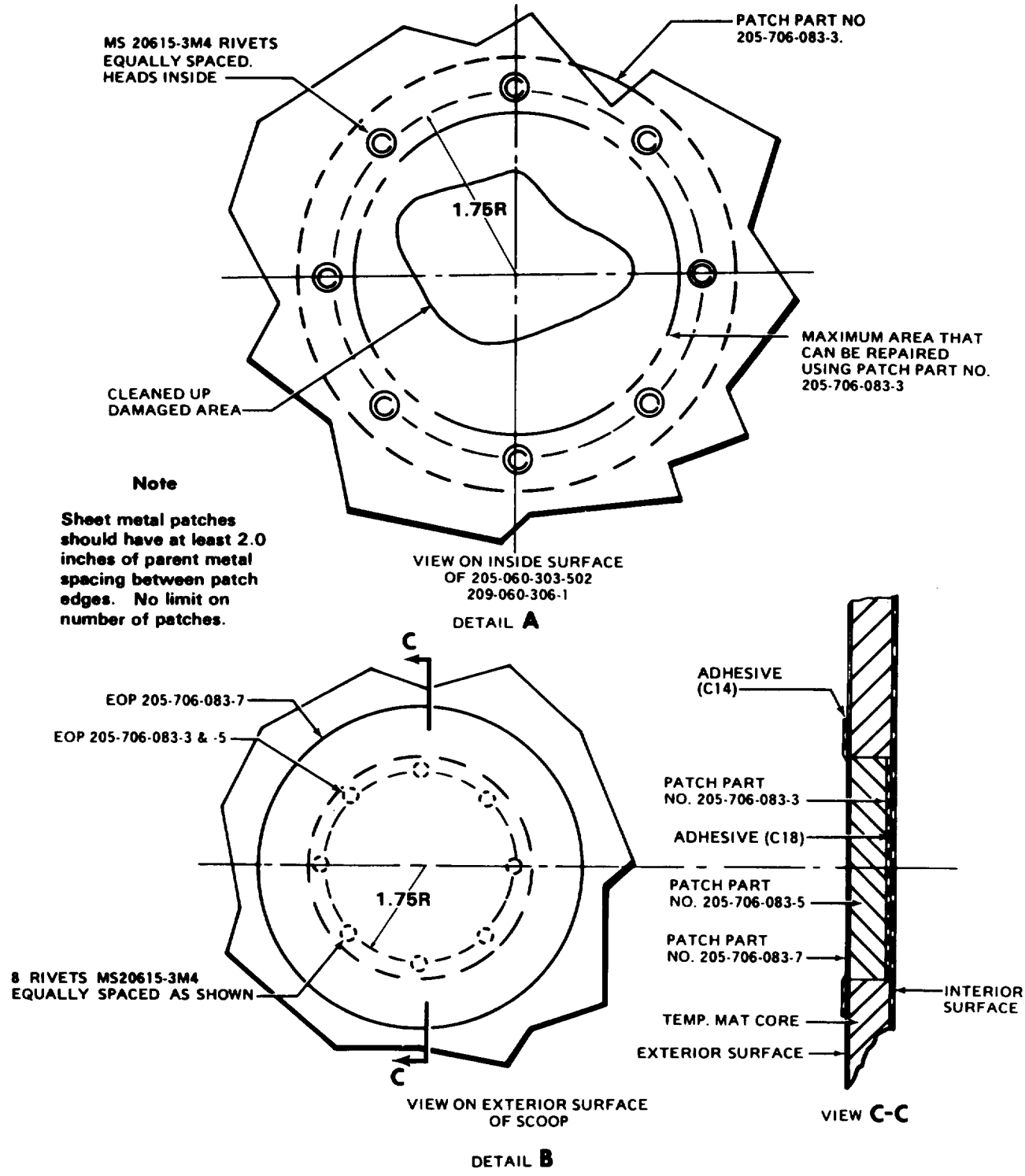


Figure 2-52. Heat Suppressor Repair Procedures

(3) Lightly abrade area 0.60 inch wide around hole. Clean area with methyl-ethyl-ketone (C177).

(4) Apply adhesive (C14) to area around hole.

(6) Remove backing from patch, and apply patch over hole. Press smoothly into place.

g. Allow adhesive to cure for 24 hours at room temperature. Alternate cure time is one hour at 175 degree F (79 degree C).

g. Repair holes which penetrate completely through exterior and interior surfaces of aft exhaust duct (2, figure 2-51, step e.).

h. (AVIM) Repair holes or tears in insulation blanket (13, figure 2-51) as follows:

(1) Clean up the hole, either make round or rectangular with 1/4 inch minimum corner radius.

(2) Go to the nearest edge of the area to be repaired, unfold edge and separate the two skins.

(3) Select 0.002 inch stainless steel of the proper skin texture, diamond pattern on inside and corrugation on outside.

(4) Cut skin doubler. Allow 1/2 inch minimum overlap.

(5) Place doubler on inside, line up skin pattern "Class C" spot weld. Spotweld doublers to inside and outside skins.

(6) Cut insulation material plug (0.25 inch fiber asbestos) to fit hole, (cut to1/16 inch oversize).

(7) Spotweld edges together. Make sure insulation material is 1/2 inch minimum inboard of spot weld area.

(8) Fold up edge to existing square corner.

i. Repair damaged exhaust cowling or fairing.

(1) (AVIM) Repair cracks, dent and corrosion.

(2) Replace loose or missing fasteners.

2-279. Installation — Heat Suppressor. a. Disconnect rotating beacon light, and remove tailpipe fairing (8, figure 2-18), position tailpipe fairing on suitable workbench.

b. Position insulated exhaust duct assembly (2, figure 2-51) on rear flange of tailpipe fairing (7) with lower external supports extending over the external supports mounted on the tailpipe fairing transition section.

NOTE

Insulators (3) do not extend the full length forward.

c. Secure insulated exhaust duct assembly (2) with screws (9) and washers (8).

d. Position fairing assembly (6) between external supports. Insert insulators (3) (one on each side) between upper supports and fairing assembly side skins extending from the fairing aft surface forward and secure with screws (5) and washers (4).

e. Install jog bolts(18) in mount bracket(16) on forward flange of insulated exhaust duct assembly(2) (inside engine fairing) and secure in place with lockpins (17) (detail a).

f. Position forward duct assembly (10) against forward flange of insulated exhaust duct assembly(2) with drain fitting (11) at the lower 6 o'clock position and jog bolts (18) extending through the mount tabs.

g. Install nuts(14) and washers(15) on jog bolts (18) and secure forward duct assembly (10) in position.

h. Position left side shield assembly (19) on engine left side cowl and secure in position with screws (20) and washers (21). Repeat step and install right side shield assembly on engine right side cowl and secure in place.

NOTE

Do not Install oil cooler shield on aircraft equipped with the command console (AN/ASC-15).

i. Remove aft panel (53, figure 2-13)and position oil cooler shield (24, figure 2-51) over oil cooler outlet with roiled edge of shield forward and mounting holes in legs centered over mount holes. Install one bolt (25) through each of the leg mount holes and secure in position with nuts (22) and washers (23). Install aft panel (53, figure 2-18).

j. Disconnect drain line and remove exhaust tailpipe (paragraph 4-69). Remove exhaust tailpipe drain line.

k. Remove coupling half (32, figure 4-18), adapter tube (27), and packing (28). Dispose of packing and retain remaining parts for reuse.

l. Install coupling half (32) in deck fitting. Install packing (33) on coupling (34). Install coupling (34) in coupling half (32).

m. Thread nut (36) on extended end of tee (37). Install packing (35) on extended end of tee (37). Install tee (37) in coupling (34) center port facing aft and tighten nut (36).

n. Install packing (31) on reducer (30). Install reducer (30) in tee (37).

o. Install packing (28) on adapter tube (27). Install adapter tube (27) in tee (37).

p. Install replacement tailpipe assembly (12), (paragraph 4-73) with insulation blankets (13) secured around tailpipe with lockwire (C155). Attach tailpipe. Connect tailpipe drain line to tailpipe and adapter tube (27).

q. Connect duct assembly drain line (29) to forward duct assembly drain fitting (11). Install tailpipe fairing and duct assembly. Connect duct assembly drain line (29) on reducer (30) and secure fairlng assembly with turnlock fasteners and screws and washers, Connect rotating beacon light.

r. Install cover assembly (1) over insulated exhaust duct assembly (2) and secure to fasteners on fairing assembly sides.

NOTE

Tailpipe P/N 204-060-302-19 removed during installation of the Auxiliary Equipment Kit, Exhaust Suppressor (205-706-082-1) must be retained in local stock for future reinstallation.

2-279.1 INFRARED SUPPRESSOR - DUCT ASSEMBLY OUTER JACKET

2-279.2. Description - Infrared Suppressor. The outer jacket of duct assembly is made from Inconel asbestos fabric, impregnated with a resin epoxy to form a composit such as fiberglass. In order to minimize weight only one layer of fabric is used. The jacket has very little rigidity by itself and will deflect visibly under moderate fingertip force. Both halves are joined in a three quarter inch lap with a resin epoxy. The joint area is smoothed by an overcoat of fairing compound that is relatively hard but brittle. The outer jacket protects asbestos insulating blanket from winds and rain.

2-279.3 Handling - Infrared Suppressor. a. To avoid premature replacement or repair reasonable care should be used in handling duct assembly.

b. Avoid excessive probing of outer jacket. Excessive flexing will cause paint and primer to peel and resin epoxy to break down allowing rainwater to enter insulation blanket. Excessive flexing will also cause fairing compound to crack and separate from jacket, particularly at feathered edges.

c. When suppressor is removed from aircraft, avoid contact of aft lip area with a hard or abrasive surface.

2-279.4. Inspection - Infrared Suppressor. inspect duct assembly as follows:

a. Cracks in fabric of outer jacket. Cracking of fairing compound covering lap joint is allowable provided underlying fabric is intact. Judicious probing can determine if fabric is intact. Use caution when probing with instruments having sharp points or edges so fabric is not punctured or cut.

b. Integrity of prior fiberglass patches.

c. Paint and/or primer for peeling.

d. Surface waviness of outer jacket is allowable up to 0.25 inch (crest to trough distance).

e. Loosening or tearing of adhesive between outer jacket and steel upper lip.

2-279.5. Repair - Infrared Suppressor. a. Fiberglass repair kit, NSN 1560-00-856-9222 is recommended for repairing cracks in fabric of outer jacket. Repair procedures are contained in the repair kit and in TM 55-1500-204-25/1. Prepare surface properly before applying resin epoxy.

b. Cracks in fairing compound only can be filled with adhesive (C22). Prime and paint (ref TM 55-1500-345-23) after adhesive has cured.

c. Damaged adhesive between outer jacket and steel upper lip should be removed. Adhesive that still adheres to surface need not be removed. Clean gap surfaces with a cloth saturated with methyl-ethyl-ketone (C177). Fill gap with adhesive (C22).

SECTION II TAILBOOM

2-280. TAILBOOM ASSEMBLY.

2-281. Description – Tailboom Assembly. The tailboom is a semimonocoque structure that supports the elevator, tail rotor drive train components and the tail rotor. Four attachment fittngs are provided for installation of the tailboom on the forward fuselage assembly.

NOTE

Deleted.

2-282. Removal — Tailboom. a. Open access door in tailpipe fairing and disconnect electrical plug to rotating beacon. Release snap fasteners securing tailpipe fairing to fuselage and remove fairing.

b. Disconnect tail rotor driveshaft between fuselage and tailboom. Remove shortest section of driveshaft just forward of tailboom attachment point (paragraph 6-163).

c. Remove all access panels on bottom of tailboom.

d. Open access door on right aft side of fuselage for access to four tailboom attachment bolts

e. Disconnect electrical harnesses and antenna cables.

e.1. Disconnect two bonding straps (1, figure 2-53.1.1) by removing screws (2) and washers (3).

f. Disconnect tail rotor and synchronized elevator control tubes Remove from tailboom Refer to steps j. through n. if tailboom is removed for replacement.

g. Support tailoom and remove bolts at four corners attaching tailboom to fuselage frame,

h. Pull out lift arms (If Installed), stowed aft of elevator, to extended position. Remove snap plug near forward end of tailboom at each side. Insert a suitable lifting bar through lift points provided.

i. Remove tailboom and place on a suitable support.

j. Remove tail rotor (paragraph 5-92).

k. Remove driveshafts, hanger bearings and gearboxes paragraphs 6-162,6-171,6-183 and 6-194).

l. Remove tail rotor controls (paragraph 11-160).

m. Remove elevator (paragraph 2-290) and elevator controls (paragraph 11-175).

n. Remove electrical and avionics installation.

2-283. Inspection — Tailboom Assembly. Refer to paragraph 2-295. Tailboom Structure, for classification of damage to tailboom structure and paragraphs 2-289 and 2-291 for inspection of elevator assembly.

a. Inspect tailboom attach fittings and fuselage attach fittings for cracks, corrosion, wear (refer to Table 2-7 and figure 2-64).

b. Inspect condition of sealing tape located on aft fuselagebulkhead.

2-284. Repair or Replacement — Tailboom Assembly. Refer to paragraph 2-292 for elevator repair and paragraph 2-296 for repair on tailboom structure.

a. If any of the following structural components are damaged beyond repairable limits, send tailboom to depot for replacement jigs and fixtures are required)

(1) Tailboom longerons.

(2) Bulkheads.

(3) Bellcrank and quadrant support.

(4) Support fittings for 42° and 90° gearboxes.

(5) Vertical fin.

(6) Elevator support brackets BS 143.28.

b. Replace damaged seal on fuselage aft bulkhead as follows:

(1) Clean area wide enough to accommodate 0.75 inch wide tape on surface around outside edge of as side of bulkhead.

(2) Apply tape (C277); 1/8 inch thick and 3/4-inch wide, to aft outer edge of fuselage bulkhead. Starting from lower left tailboom attaching point, lay tape along edge, up left side around upper edge of bulkhead and down to lower right tailboom attaching point. Press tape firmly to bulkhead surface. Do not apply tape over attaching point plates. Trim tape to clear.

(3) Accomplish temporary method of sealing gap between tailboom and fuselage when tailboom removal is not practical.

(a) Apply putty (C218) to existing gap between fuselage aft bulkhead and tailboom sufficient to seal gap and provide smooth contour. Area covered should be as indicated for pressure sensitive tape.

(b) Putty may be painted to color scheme of helicopter. On removal of tailboom for any purpose, the putty should be replaced with tape.

c. Replace attachment fitting as follows:

(1) Inspection.

(a) Inspect for scratches, nicks, gouges and corrosion.

(b) Blend out damage/corrosion using steel wool (C310). Maximum depth of damage allowable after cleanup is 10 percent of fitting thickness.

(c) Treat repaired area for corrosion control in ac cordance with procedures described in TM 55-1500-204-25/1.

(d) Inspect fittings for tailboom attachment bolt hole elongation. Replace fittings if bolt hole exceeds maximum wear limitation as shown below:

Location	Max Allowable Hole Elongation	Max Hole Dia After Cleanup
Upper L/H:	0.015 Inch	0.521 Inch
Upper R/H:	0.015 Inch	0.521 Inch
Lower L/H:	0.015 Inch	0.396 Inch
Lower R/H:	0.015 Inch	0.396 Inch

(e) Inspect for loose fitting fasteners. Replace as required for hole oversize/elongation with 1/64 in. oversize Hi-Lot bolts as follows:

Existing Fastener	1/64 In. Over size Fastener
HL2086	HL6475 or HL6487
HL2186	HL6575 or HL6587
HL3086	HL6679, HL6682 or HL6694

(2) Replacement

Fitting replacement requires the use of the locally manufactured alignment/drill fixture. See Figure 2-533.

CAUTION

Replace only one fitting at a time. Three fittings must be in place to use the alignment/drill fixture. Fitting replacement requires removal of tail-boom, engine, transmission and mast assembly and main rotor prior to commencing work.

(a) Attach hoist to mast retaining nut and support the main rotor, mast and transmission by hoisting vertically until the lift link retaining bolt can be rotated freely. A free rotating lift link retaining bolt indicates that the load has been removed.

(a.1) Note position and direction of existing fastener heads and collars to assure proper reinstallation configuration at time of reinstallation. Hi-Lot bolts should be substituted for Hi-Shear rivets.

(b.) Attach engine sling and hoist to engine. Loosen pillow blocks on engine mounts. Support the engine by hoisting vertically until engine is loose in the pillow blocks.

(b.1) Remove fastener collars from fasteners. Take care to prevent damage to surrounding structure and fastener holes. (The Hi-Lot bolt collars can be removed using an Allen wrench and pliers). Push fastener pins out of holes.

NOTE

On the lower left fitting, one (1) MS20426AD4 rivet must be removed from the aft aide of the fitting.

(c) Remove fitting from aircraft.

(d) Clean and inspect area where fitting was removed.

(e) Align new fitting with the main beam cap angle and aft fuselage bulkhead. (Fitting must butt flush against forward side of bulkhead)

(f) Clamp new fitting into position. Back drill fitting attachment holes with an undersize drill bit, then ream holes to correct size for close tolerance fit as follows:

(1) Upper left side fitting: 0.1895-0.1915 inch diameter.

(2) Upper right side fitting: 0.1895-0.1915 inch diameter.

(3) Lower left aide fitting: 0.1895-0.1915 inch diameter for Hi-Lot bolt holes: 0.128 inch diameter for rivet hole through aft side of fitting.

(4) Lower right Side fitting: 0.1635-0.1655 Inch diameter for Hi-lot bolt holes through aft side of fitting: 0.1895-0.1915 inch diameter for all other Hi-loc bolt holes.

(g) Install Hi-Lot bolts and collars per Figure 2-53.2. Use same installation pattern and head direction as noted when old fitting was removed.

(h) Install alignment/drill fixture on the aft side of the aft fuselage bulkhead with correct size bolts through the remaining three fittings.

(i) Install the proper size drill bushing as shown in Figure 2-53.3. Drill fitting using correct size drill bit.

(j) Remove drill bushing.

(k) Install correct size ream bushings and carefully ream to size as follows:

(1) Upper L/H and R/H: 0.501-0506 inch diameter.

(2) Lower L/H and R/H: 0.376-0.381 inch diameter.

(I) Spotface forward side of fitting hole as follows:

(1) Upper L/H fitting: 1.0 inch diameter, 0.030 inch corner radius, minimum remaining thickness 0.470 inch.

(2) Upper R/H fitting: 1.0 inch diameter, 0.030 inch comer radius, minimum remaining thickness 0.400 inch.

(3) Lower L/H and Lower R/H fittings: 0.88 inch diameter, 0.030 inch corner radius, minimum remaining thickness 0.330 inch.

(m) if a discrepancy exists, shim between the tool and the bulkhead as required at the location(s) where the tool does not seat properly so as to provide proper tool placement against the fuselage bulkhead.

(n) Fabricate and install new chafing plate(s) to reflect the additional thickness determined by the shim in Step (m).

(o) Remove alignment/drill fixture.

2-285. Installation " Tailboom Assembly. If a replacement taiboom is to be installed, remove serviceable parts from the removed tailboom for build up of the replacement tailboom (steps h. through k.).

NOTE

If support pins do not align with pilot holes in tailboom, the support pins may be removed from the airframe.

a. Raise tailboom. Use lift arms (if installed) on rear end and a bar through lift points at forward end. Support forward end on fuselage using two support pins provided.

b. Open access doors at right side of fuselage to gain access to four tailboom attachment bolt hole installation.

c. Align bolt holes between tailboom and fuselage and install bolts and washers as outlined in step d. following.

WARNING

Do not use aluminum nuts or lugs used for retaining tailboom in shipping crate to mate tailboom with fuselage. Use NAS577 nuts only.

d. Place a chamfered washer under head of each attachment bolt. Install AN960 washers between chamfered washer and fuselage fittings so that not less than one thread and not more than three threads are showing after bolts are torqued (figure 2-53).

e. Insert bolts through four fuselage fittings engaging barrel nuts in tailboom fittings. Torque upper bolts **770 TO 950** inch-pounds and lower bolts **240 TO 270** inch-pounds. The preceding torque is in addition to the tare torque of the bolts.

f. Retorque (apply torque force in the tightening direction only) attachment bolts after the first flight. Apply slippage marks (C141) from the heads of the bolts to the fuselage attachment fitting.

g. Check the effectiveness of the gap seal between the tailboom and fuselage. Check seal area for light from inside the helicopter.

NOTE

Check all Alignment between #1 and #3 hanger bearing support.

h. Install tail rotor hanger bearings, driveshafts and gearboxes (paragraphs 6-166, 6-174, 6-179, and 6-190). Install tail rotor (paragraph 5-98).

i. Install elevator (paragraph 2-293) and elevator controls (paragraph 11-173). Rig elevator controls (paragraph 11-172).

j. Install electrical and avionics equipment.

k. Install tail rotor driveshaft (paragraph 6-165).

l. Install tail rotor controls cables (paragraph 11-130). Rig tail rotor controls (paragraph 11-110).

m. Connect electrical, avionics, and antenna harness and cables (Chapter 9).

m.1. ☒ Connect two bonding straps (1, figure 2-53.1.1) using screws (2) and washers (3).

n. Install access panels on underside of tailboom.

o. Close and latch access door on right aft side of fuselage section.

p. Position tailpipe fairing and secure with fasteners.

q. Connect rotating beacon and close access panel.

2-285.1. Driveshaft Covers.

2-285.2. Description. The rotor driveshaft is enclosed by four covers (1, figure 2-53.1) two of which are located between the tailpipe fairing and the 42-degree gearbox. The third is a separate cover for the 42-degree gearbox, while the fourth cover extends up the vertical fin to the 90-degree gearbox attaching point. With the exception of cover over the 42-degree gearbox, the covers are hinged along the right hand side, and are secured, in the closed position by fasteners on the left-hand side.

2-285.3. Removal - Driveshaft Covers.

a. Disconnect fasteners along left-hand side of door and swing door to open position.

b. Pull hinge pin on right-hand side of door, and remove door from tailboom.

2-285.4. Inspection - Driveshaft Covers. Inspect for damage, dents, and cracks; hinges and fasteners for serviceability. If crack in drive shaft cover is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

2-285.5. Repair or Replacement - Driveshaft Cover.

a. Replace damaged or unserviceable hinges or fasteners.

b. To prevent chafing of the driveshaft cover and the tailboom, install rubber bumpers (6) as shown in figure 2-53.1.

2-285.6. Installation - Driveshaft Covers.

a. Position door on tailboom and install hinge pin on right-hand side.

b. Swing door to closed position, and secure fasteners on left-hand side.

2-286. ELEVATOR ASSEMBLY.

2-287. Description - Elevator Assembly. Synchronized elevator installation consists of two elevator assemblies, a horn assembly, two support sets, and attaching parts. The elevators are mounted horizontally through sides of tailboom, and secured to structure by supports which serve as bearings for rotational movement. A control arm on horn provides attachment for linkage from fore-aft cyclic control system at swashplate. Each elevator is a horizontal airfoil section built up on a spar tube, which is inserted into a projecting end of horn assembly and secured by a single bolt. (Figure 2-54).

2-288. Adjustment - Elevator Assembly. Rig elevator in accordance with paragraph 11-172.

2-289. Inspection - Elevator Assembly (Installed). Prior to removal of elevator accomplish the following inspection:

a. Prior to removal of elevator, inspect support brackets (21, figure 2-54) on both sides of tailboom for loose attaching rivets. Inspect rivets visually and by hand contact for sign of movement. Replace loose, damaged, or missing rivets.

b. Check radial play as follows:

(1) Radial play between the elevator horn (11, figure 2-54) and the supports (6) is not allowed. Play in this area requires reshimming of the supports per paragraph 2-293.

NOTE

Radial play between the elevator spar (22) and the horn (11) cannot be checked without removal of the elevator attachment bolt (4).

(2) Remove attachment bolt. Lightly move elevator up and down. If play is evident, remove elevator and check inside diameter of horn and outside diameter of the spar as follows:

(a) Measure the outside diameter of the elevator spar for wear and out-of-round. Replace the spar if the diameter is less than **2.475** inches or if the out-of-round exceeds **0.004** inch.

(b) Measure the inside diameter of the horn for wear and out-of-round. Replace the horn if the inside diameter of the horn is more than **2.485** inches or if the out-of-round exceeds **0.003** inch.

(c) If the elevator and horn are not worn beyond limits, they may be reinstalled.

NOTE

To check for axial play of the horn assembly, it may be necessary to loosen the nuts (19) and bolts (7) securing the support assembly allowing the horn assembly to move in the supports.

c. Check axial play of elevator horn assembly in support assemblies as follows:

(1) Move horn assembly to one side allowing the raised lip of the horn assembly to bottom out on the support assembly. Using a feeler gage, measure the gap between the opposite support assembly and the raised lip on the other end of the horn assembly. A minimum gap of **0.005** inch and a maximum gap of **0.030** inch should exist (figure 2-52.1).

(2) If the play is not within tolerance, adjust shims (5) as necessary.

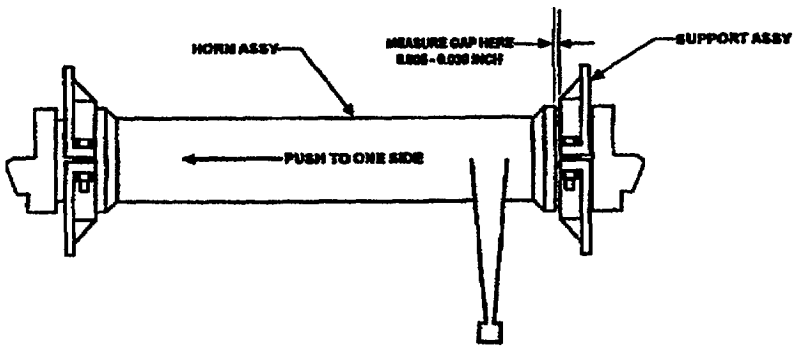
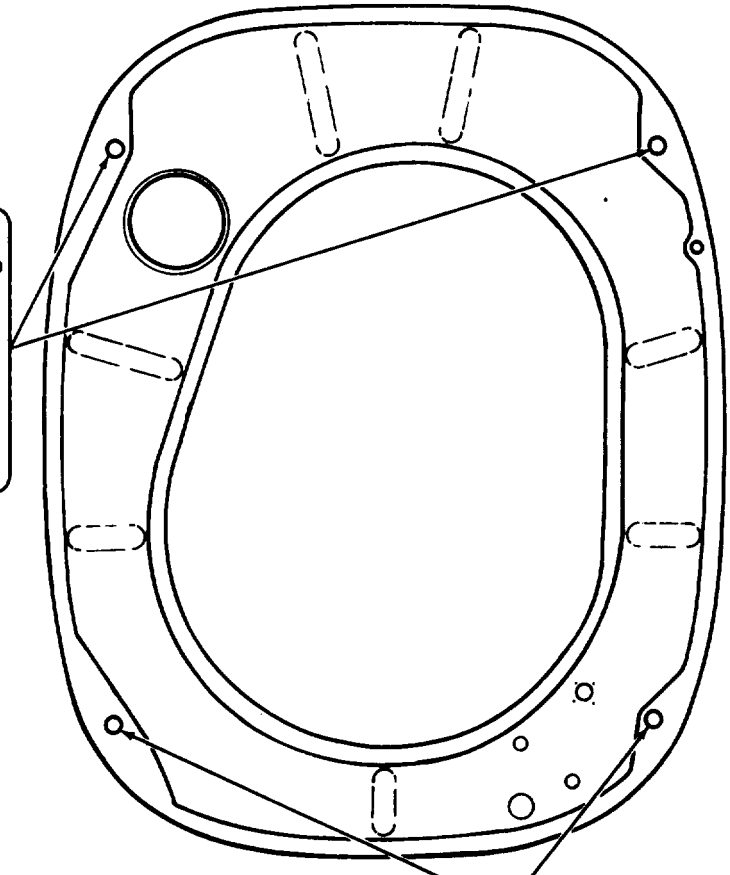


Figure 2-52.1. Elevator Bearing Limits

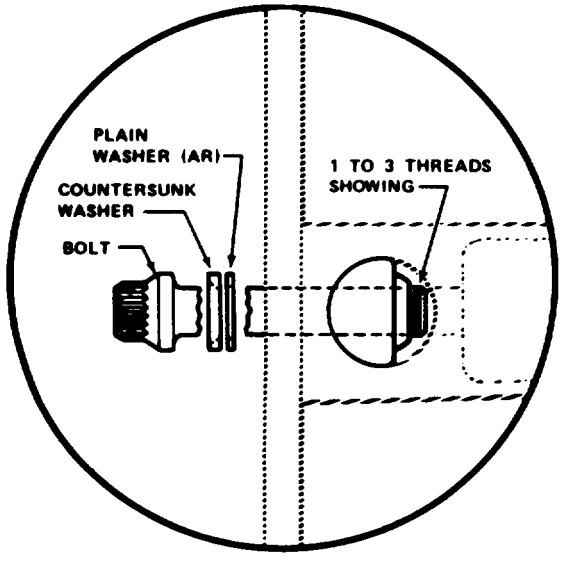


NAS628-20 BOLT 2 REQD
MS20002C8 WASHER, UNDER HEAD 2 REQD
WITH COUNTERSINK TOWARD BOLT HEAD
AN960-816 WASHER (AS REQD)
NAS577-8A BARREL NUT 2 REQD
NAS578-8A RETAINER 2 REQD
INSTALL AN960-816 WASHERS BETWEEN
MS20002C8 WASHER & FITTING SO THAT

NOT LESS THAN ONE THREAD & NOT MORE THAN THREE THREADS ARE SHOWING. TORQUE BOLTS TO 770-950 IN.-LBS.

NAS626-18 BOLT 2 REQD
MS20002C6 WASHER, UNDER HEAD 2 REQD
WITH COUNTERSINK TOWARD BOLT HEAD
AN960-616 WASHER (AS REQD)
NAS577-6A BARREL NUT 2 REQD
NAS578-6A RETAINER 2 REQD
INSTALL AN960-616 WASHERS BETWEEN
MS20002C6 WASHER & FITTING SO THAT

NOT LESS THAN ONE THREAD & NOT MORE THAN THREE THREADS ARE SHOWING. TORQUE BOLTS TO 240-270 IN.-LBS.

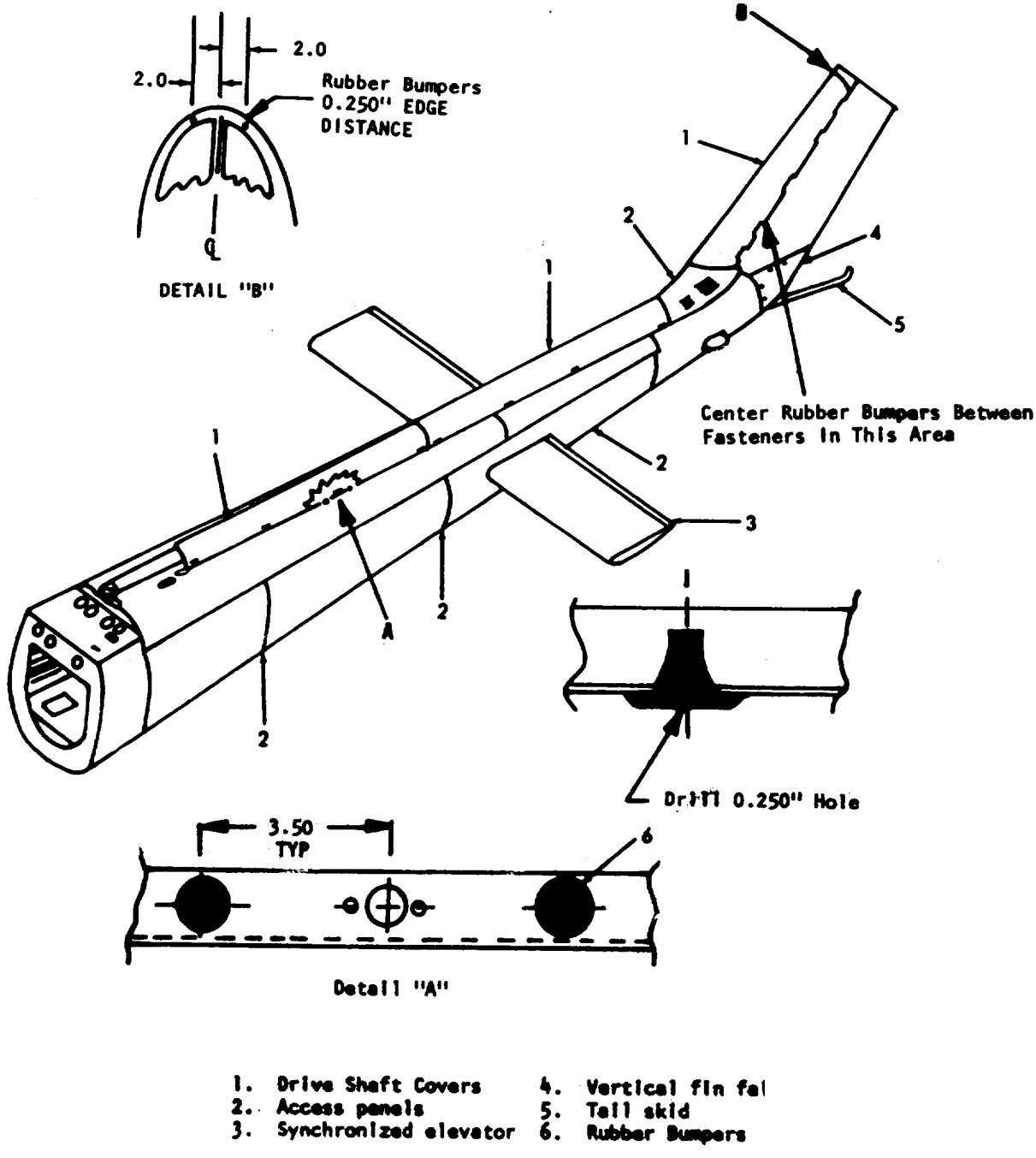


TYPICAL BOLT INSTALLATION

TAILBOOM AND FUSELAGE ATTACHMENT FITTIN HOLE WEAR LIMITS

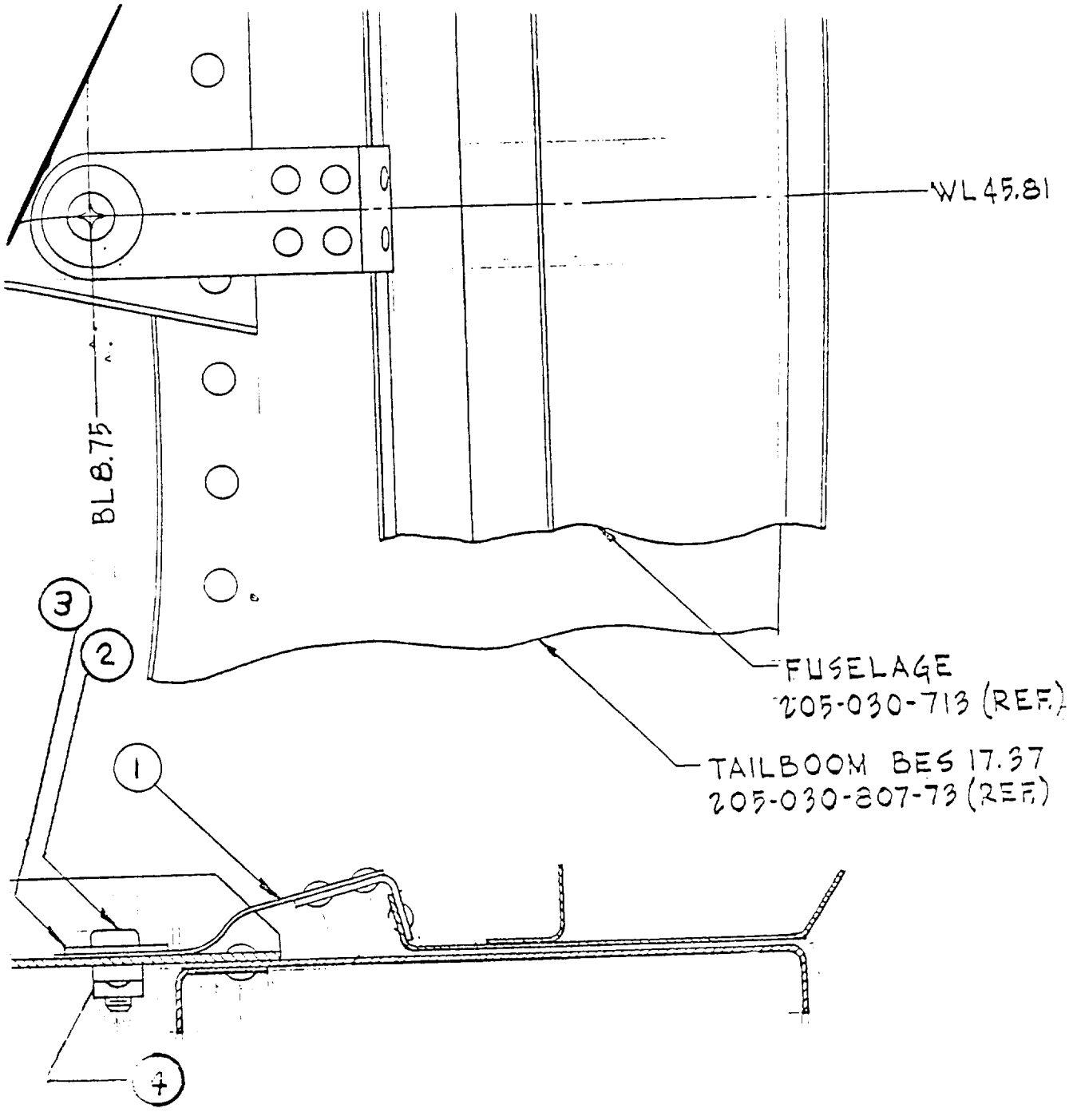
LOCATION		NEW PART MIN.	NEW PART MAX.	WEAR LIMIT
LOWER	—	0.376	0.381	0.396
UPPER	—	0.501	0.506	0.521

Figure 2-53. Tailboom Installation



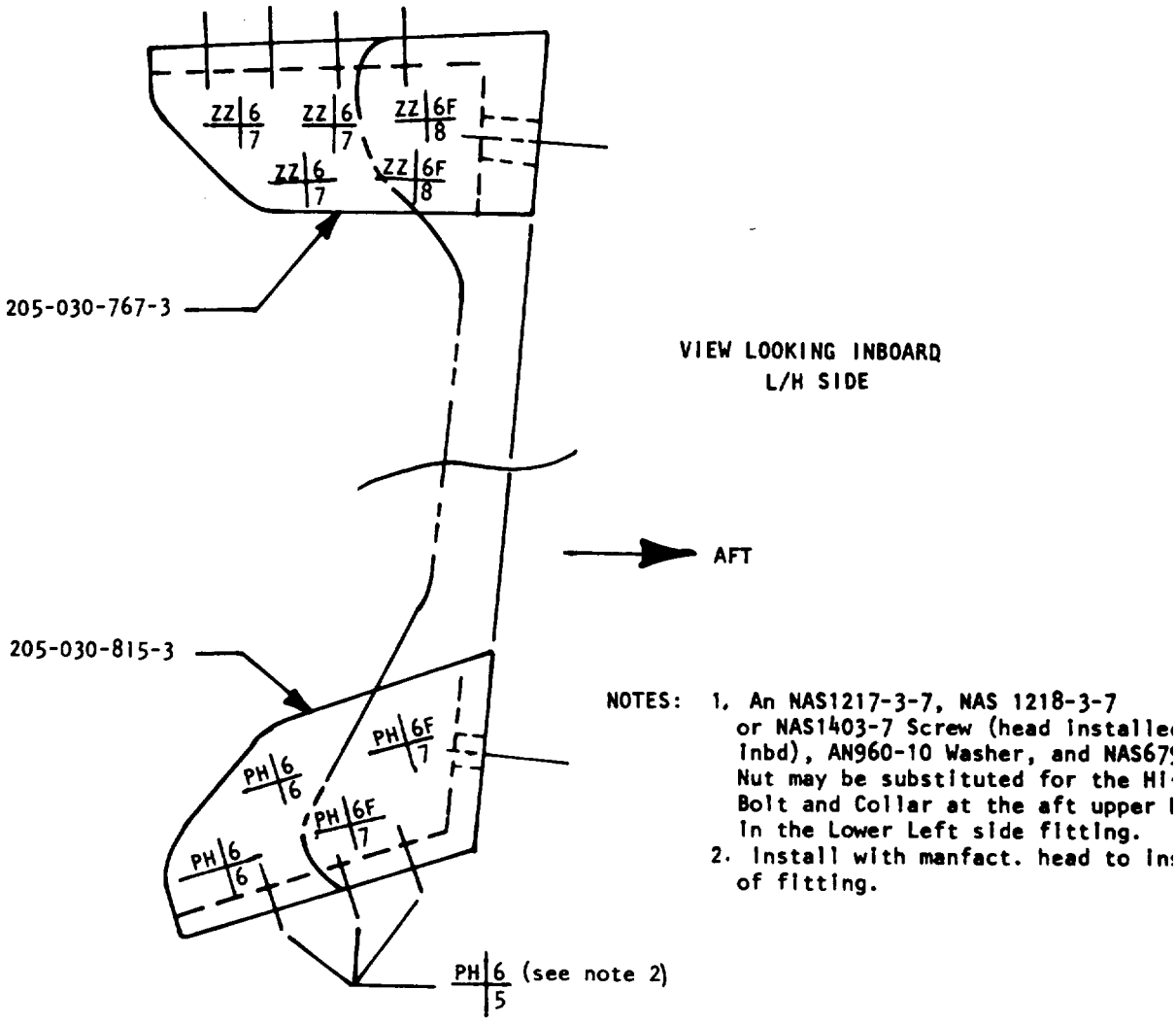
1. Drive Shaft Covers
2. Access panels
3. Synchronized elevator
4. Vertical fin fai
5. Tail skid
6. Rubber Bumpers

Figure 2-53.1. Typical tail boom



1. BONDING STRAP
2. SCREW
3. WASHER
4. NUT, PLATE

FIGURE 2-53.1.1 [X] TAILBOOM BONDING STRAP INSTALLATION



FASTENER CODE

Example: PH 6N / 6

Description:

BASIC CODE	DASH NO. DIA N-MFG HEAD NEAR SIDE F-MFG HEAD FAR SIDE DASH NO. FOR LENGTH

BASIC CODE	BASIC PART NO.
ZZ	HL 3086
PH	HL 2085

Figure 2-53.2. Tailboom attach Fitting Replacement (Sheet 1 of 2)

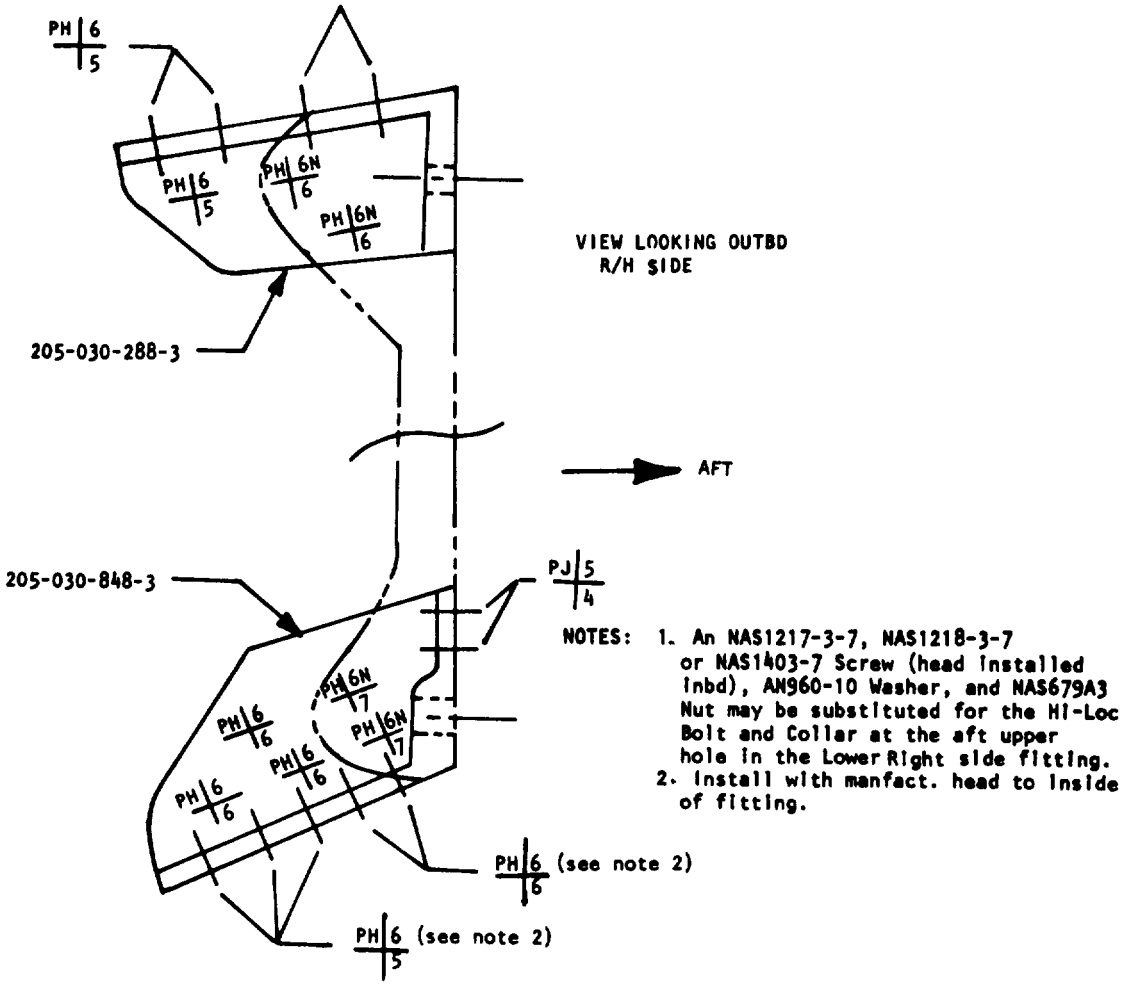
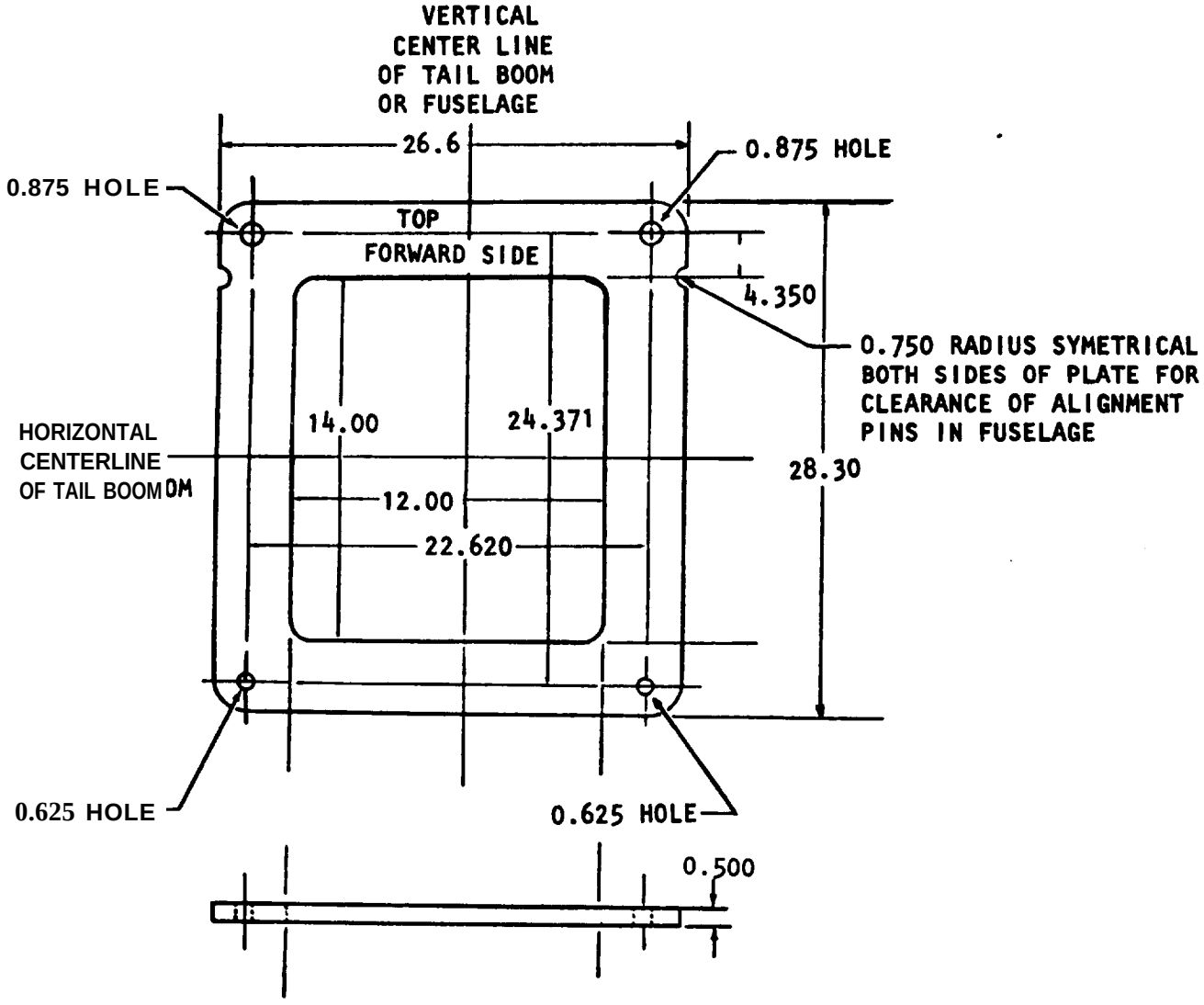


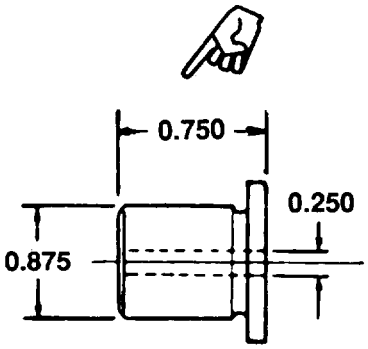
Figure 2-53.2. Tailboom Attach Fitting Replacement (Sheet 2 of 2)



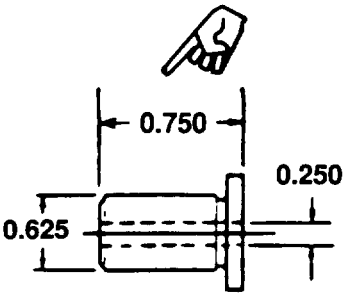
1. Fabricate Alignment/drill fixture from 0.50 inch aluminum plate dimensions shown and drill four holes. The plane of the plate which contracts the plate which contacts the tail boom must be true within 0.005 inch.

2. Fabricate bushings from steel (4130 or similar) and harden. Do not continue to use bushings which have become worn through use. It will not be necessary to fabricate all the bushings illustrated when only a upper left-hand longeron is to be replaced, refer to text.

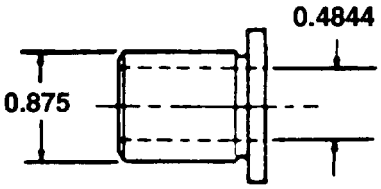
Figure 2-53.3. Work Aid - Alignment/Drill Fixture for Tail Boom and Aft Fuselage (Sheet 1 of 2)



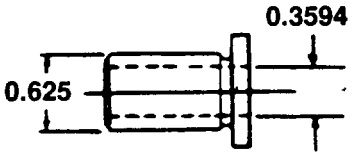
DRILL BUSHING



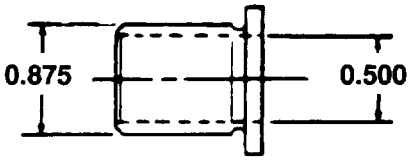
DRILL BUSHING



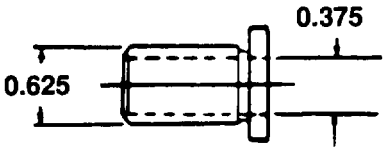
DRILL BUSHING



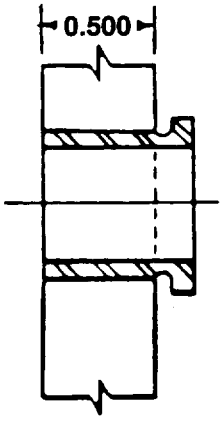
DRILL BUSHING



REAM BUSHING

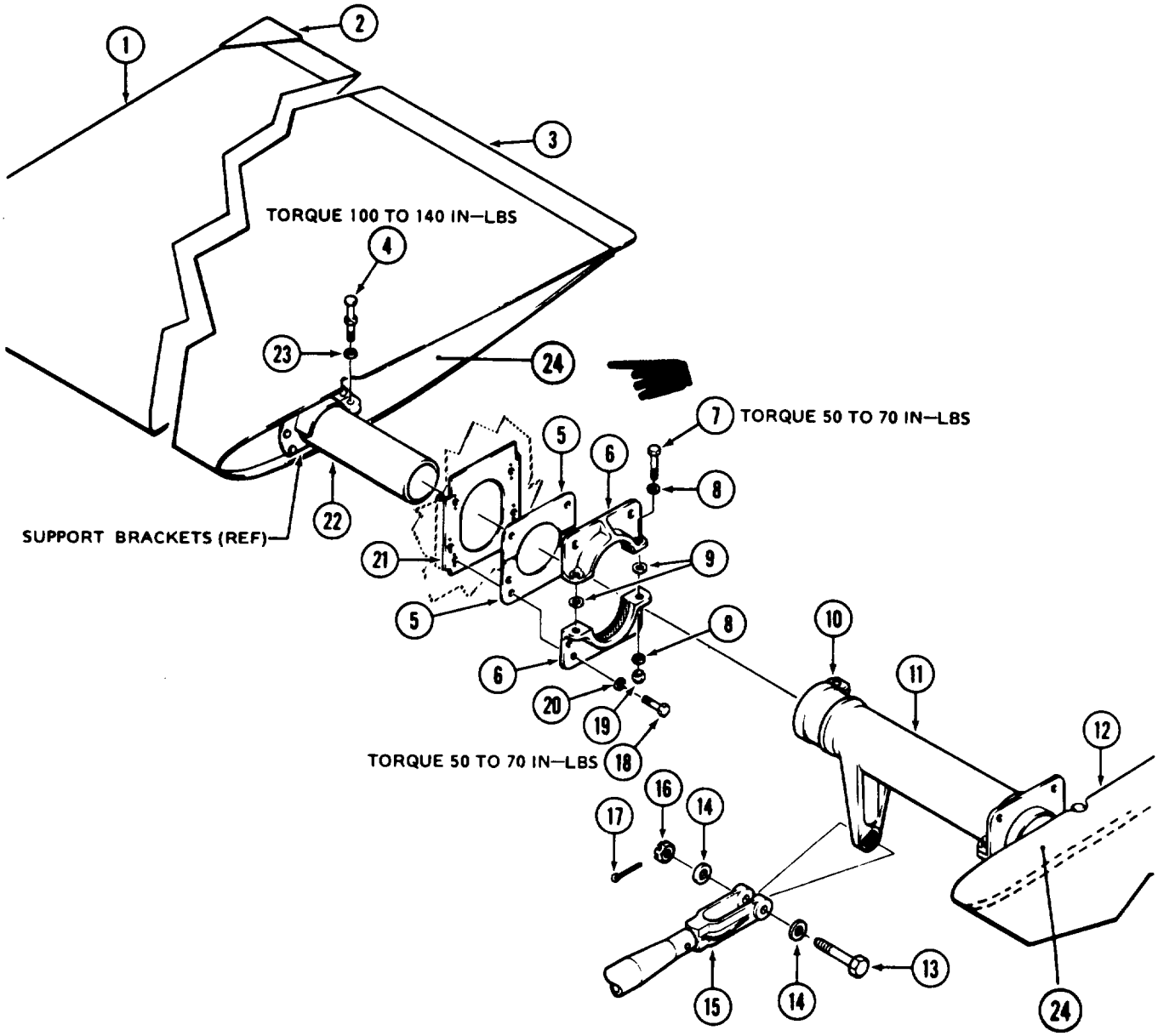


REAM BUSHING



VIEW OF BUSHING INSTALLED
IN ALIGNMENT PLATE/DRILL FIXTURE

Figure 2-53.3. Work Aid - Alignmen/Drill Fixture for Tail Boom and Aft Fuselage (Sheet 2 of 2)



1. Elevator assembly
2. Cap
3. Trailing edge
4. Bolt
5. Shim eat
6. Support assembly
7, Bolt
8. Washers
9. Shims
10. Mounting lug
11. Horn assembly
12. Elevator assembly
13. Bolt
14. Washers
15. Control tube
16. Nut
17. Cotter pin
18, Bolt
19, Nut
20. Washer
21. Tailboom bracket
22. Spar
23. Washer
24. Closing (Inboard) Rib

Figure 2-54. Elevator control assembly – removal and installation

(2) If the play is not within tolerance, adjust shims (5, figure 2-54) as necessary.

NOTE

Heavy force used in moving the elevator will cause flexing of the spar tube and give a false indication of excess play.

d. Check for excess play by lightly moving the elevator up and down. If play is evident, remove the elevator (paragraph 2-290b) and proceed as follows:

(1) Measure the outside diameter of the elevator spar (22, figure 2-54) for wear and out-of-round. Replace the spar if the diameter is less than **2.475** inches or if the out-of-round exceeds **0.004** inch.

(2) Measure the inside diameter of the horn (11) for wear and out-of-round. Replace the horn (paragraphs 2-290 and 2-293) if the inside diameter of the horn is more than **2.485** inches or if the out-of-round exceeds **0.003** inch.

(3) If the elevator and horn are not worn, reinstall the elevator (paragraph 2-293.1).

2-290. Removal - Elevator Assembly.

a. Disconnect horn (11, figure 2-54) and tube (15).

b. To remove either elevator: Remove retaining bolt (4) with washer (23) to detach elevator fitting from mounting lug (10) on horn assembly (11). Withdraw elevator (1 or 12) straight outward until spar tube (22) is pulled free.

NOTE

Horn assembly (11) can be left in place, except when replacement of parts is necessary.

c. To remove horn assembly (11), after removal of both elevators (1 and 12), proceed as follows:

(1) Remove access doors (16 and 17, figure 2-18) from tailboom below elevator installation.

(2) Remove cotter pin (17, figure 2-54), nut (16), washers (14) and bolt (13) and disconnect control tube (15) from horn assembly (11).

(3) At each end of horn assembly (11), inside tailboom, remove two bolts (7) with nuts (19) and washers (8), and shims (9) between upper and lower support assemblies (6) of support. Keep parts in sets for each location.

(4) Carefully remove each support set with shims (5), attaching bolts (18), and washers (20) from tailboom brackets (21) in tailboom. Keep parts in sets.

CAUTION

Handle support assemblies (6) with care to avoid damaging inner surface of bushings, which are dry bearing material bonded in place.

(5) Remove horn assembly (11) through access opening.

2-291. Inspection - Elevator Assembly.

a. Inspect elevator tip caps (2, figure 2-54) for secure bonding.

b. Visually inspect four support retainers (6) for evidence of cracks in the vicinity of each of the holes in the retainers. Make fluorescent penetrant inspection (TM 55-1500-335-23) of any suspect areas. If any cracks are present and/or if any hole is elongated, reject that support retainer set. If crack in support retainer is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

c. Visually inspect four support retainers (6) for defective bushing inserts (figure 2-56, detail A, sheet 2). If the bushing is loose, cracked, has scratches deeper than **0.015** inch, or if less than **0.040** inch bushing insert material remains, reject that support retainer set. If the support retainer set cannot be properly shimmed during installation to provide prescribed drag or eliminate chatter and binding when the horn is rotated, reject that support retainer set.

d. Inspect the elevator horn assembly (11, figure 2-54) for corrosion and mechanical damage (which includes cracks, dents, scoring, scratches and wear). If crack is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

(1) Inspect the two bearing surfaces on the elevator horn barrel as shown by cross hatched areas Figure 2-56, Sheet 1. No scoring is permitted. Clean up other damage by polishing to a smooth finish. Brush Alodine 1200 (C62) and spray on dry film lubricant (C163) to a thickness of **0.0003 - 0.0005** inch.

(2) Inspect elevator horn lugs as shown by shaded areas in Figure 2-56, Sheet 1. No cracks are permitted. Clean up other damage by polishing to a smooth finish. Brush Alodine 1200 (C62) and apply one coat of epoxy Polyamide Primer (C206).

(3) Inspect the outside of the horn barrel and horn arm as shown by the clear area in Figure 2-56, Sheet 1. No dents are permitted. Clean up other damage by polishing to a smooth finish. Brush Alodine 1200 (C62) and apply one coat of epoxy Polyamide Primer (C206).

(a) Scratches, nicks and scoring on OD of horn will not exceed **0.015** inch in depth, except for bearing and critical areas shown in Detail B, figure 2-56.

(b) Bearing area will have no scoring. Nicks, scratches and corrosion are limited to **0.005** inch in depth after clean up and polished to a smooth surface.

(c) Scratches, nicks and corrosion will not exceed **0.010** inch in depth after clean up in critical inspection areas shown in Detail B, figure 2-56.

(d) Corrosion in ID of horn will not exceed **0.005** inch in depth after clean up with abrasive paper (C6) and polished to a smooth surface.

(e) Scoring, nicks and scratches on ID of horn will not exceed **0.015** inch in depth after repair.

(f) Any damage in the categories called out in steps **(a)** through **(e)** above will not exceed linear measurements of **0.500** inch radially and/or **0.750** inch longitudinally.

(4) Make fluorescent penetrant inspection of critical inspection areas shown on detail B, figure 2-56. If crack is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series. If any cracks are present, reject the part.

(5) Inspect the bore (inside diameter) horn assembly. The criteria for inspection is denoted by "0" bore Figure 2-56, Sheet 1. Clean up damage by polishing smooth with abrasive paper (C6). Brush/dip Alodine 1200 (C62) and brush/dip coating of epoxy Polyamide Primer (C206).

(6) Inspect the bearing in the elevator horn arm. See Figure 2-56, Sheet 2, Detail B for location. The horn shall be rejected if wear exceeds **0.012** inch radial or **.030** inch axial deflection.

e. Inspect elevators skins for mechanical and corrosion damage. Inspect skins to limits given for tailboom skins in Table 2-7, Classification of Damage Tailboom Assembly. If a void is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

f. Inspect spar for damage in accordance with Figure 2-57. Remove elevator skin as required to inspect spar.

g. Deleted.

2-292. Repair or Replacement - Elevator Assembly.

Premaintenance requirements for repair of elevator assembly

Conditions	Requirements
Model	UH-1HN
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C1), (C40), (C64), (C86), (C87), (Ci43), (C 177), (C178), (C206), (C231), (C288), (C312)
Special Environmental Conditions	None

a. (AVIM) Polish out minor damage on spar which is within repairable limits with abrasive paper, 400 grit or finer (C1) (figure 2-57). Apply two coats of primer (C312) to cleanup areas with the exception of that portion of spar which mates with horn. Refer to paragraph 2-293 for instructions to apply corrosion preventive compound to this area of spar at installation.

b. Repair cracks, holes, tears, etc,. which are within repairable limits in accordance with standard repair procedures (TM 1-1500-204-23-10). Figure 2-58 illustrates internal structure of elevator assembly.

(1) Negligible Damage. Small scratches and smooth contour dents, free from cracks, may be disregarded, provided adjacent areas are not affected and that the damage is not on the spar (paragraph 2-289).

(2) Damage Repairable by Patching. Small cracks must be stop-drilled and lay-on patch of like material and gage applied. If the elevator incurs damage which indicates the spar may have been damaged. Refer to paragraph 2-289.

(3) Damage Repairable by Insertion. Holes, tears or large cracks can be repaired by cutting out the damaged area and inserting a filler plate and backing patch of like material and gage. If the elevator incurrs damage which indicates that the spar may have been damaged. Refer to paragraph 2-289.

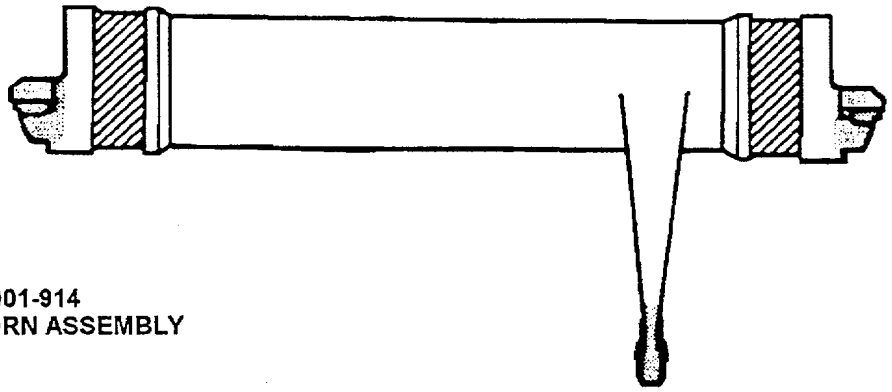
(4) Damage Necessitating Replacement. Damage greater than is practical to repair.

c. Replace unserviceable support retainer sets (6, figure 2-54).

d. Replace bearing in horn (11) if damaged or worn (paragraph 11-180).

e. Replace elevator if repair limits are exceeded.

f. Replace tip cap (2) as follows:



P/N 205-001-914
ELEVATOR HORN ASSEMBLY

	BORE			
MECHANICAL DAMAGE (AFTER CLEAN UP)	.015	.015	.010	.005
CORROSION DAMAGE				
(BEFORE CLEAN UP)	.005	.008	.005	.003
(AFTER CLEAN UP)	.008	.015	.010	.005
MAXIMUM AREA PER FULL DEPTH REPAIR	1 IN SQ	1 IN SQ	.10 IN SQ	.07 IN SQ
EDGE CHAMFER	.05 x .05	.05 x .05	.04 x .04	NONE

NOTES:

1. No damage to horn barrel or bore will exceed .500 in. radially or .750 in. longitudinally.
2. Number of repairs will not exceed one per damage area.

Figure 2-56. Damage limits - Elevator Support and Horn Assembly (Sheet 1 of 2)

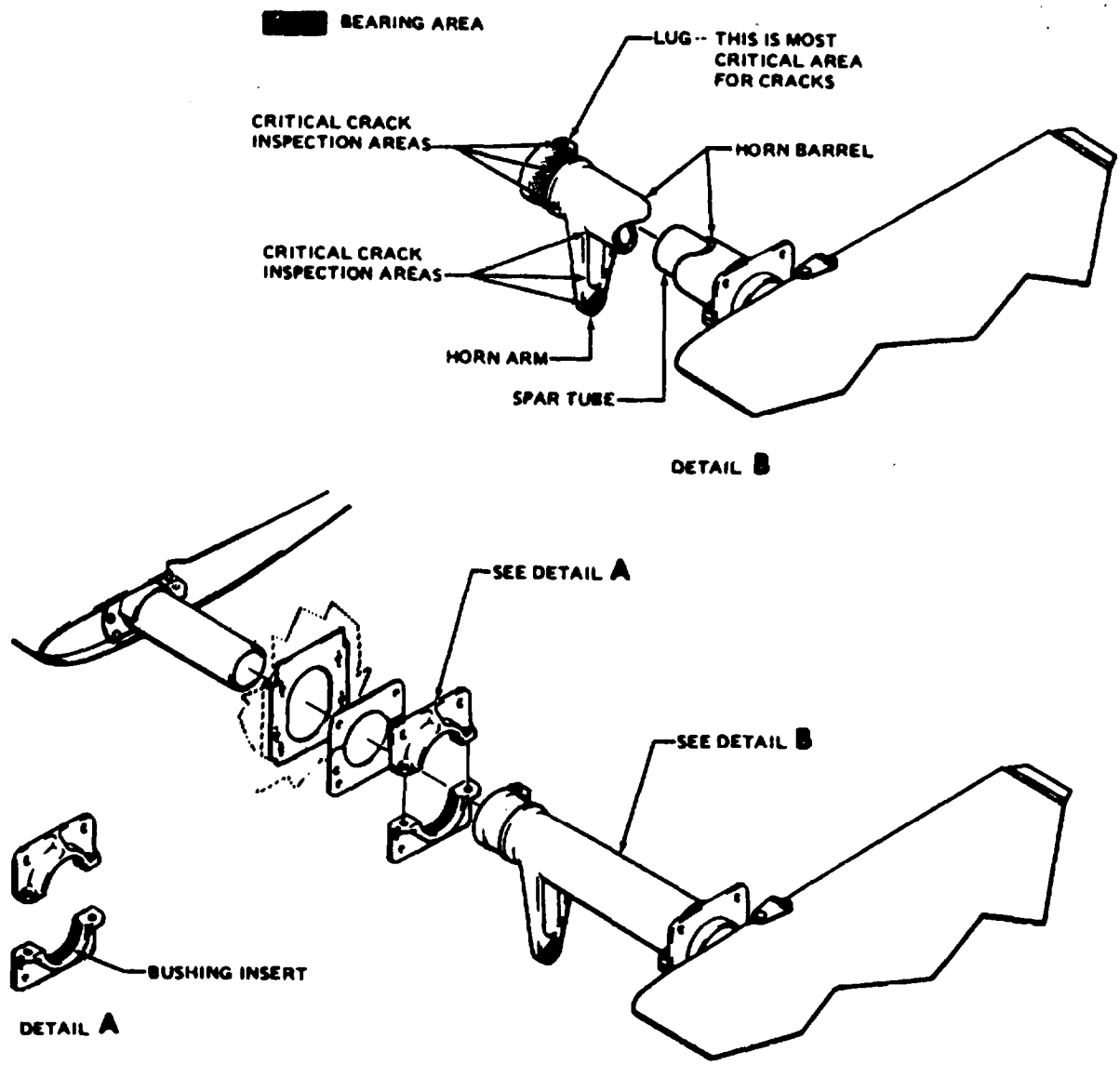


Figure 2-56. Wear and Damage Limits - Elevator Support and Horn Assembly - Elevator Control System (Sheet 2 of 2)

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(1) Clean bonding area on elevator tip with naphtha (C143).

(2) Clean inside area of cap (2) with toluene (C288).

(3) Brush a thin coat of adhesive (C40) approximately 0.010 inch thick on elevator tip (cleaned area) and inside of cap (2).

(4) Allow approximately 1 hour drying time until adhesive becomes tacky. Install cap (2) on elevator tip as shown.

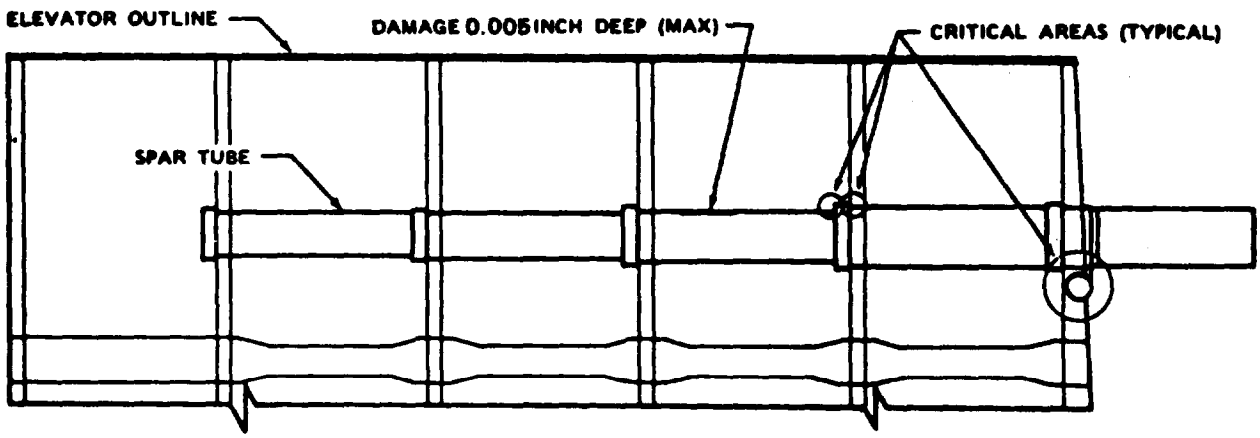
(5). Hold cap (2) in place for a minimum of 15 seconds.

(6) Allow a minimum of 24 hours drying time before releasing aircraft for flight.

WARNING

Do not allow chromic acid to corn. in contact with skin or clothing. Avoid breathing fumes. Contact with combustible materials may cause fire.

g. Minor nicks, scratches, and corrosion to horn assembly (11) maybe repaired by polishing damaged area to original finish with 600 grit sandpaper (C234). Treat sanded area with chromic acid (C64) followed with a light coat (by brush) of primer (C206).



NOTE

The entire elevator spar tuba is critical fatigue area. The area where the elavator attaches to the horn and the radii adjacent to the rib lands are especially critical because these are the points where loads are transferred to the spar. If a n elevator or sustains damage, the elevator skin must be removed for inspection of the spar prior to repair of the internal damage.

LIMITS - REPAIRABLE DAMAGE

Scratch and scoring damage is limited to 0.005 inch depth after clean-up with 400 grit or smoother abrasive paper (C1) to a polished smooth surface. Scratch and scoring damage is further limited as follows:

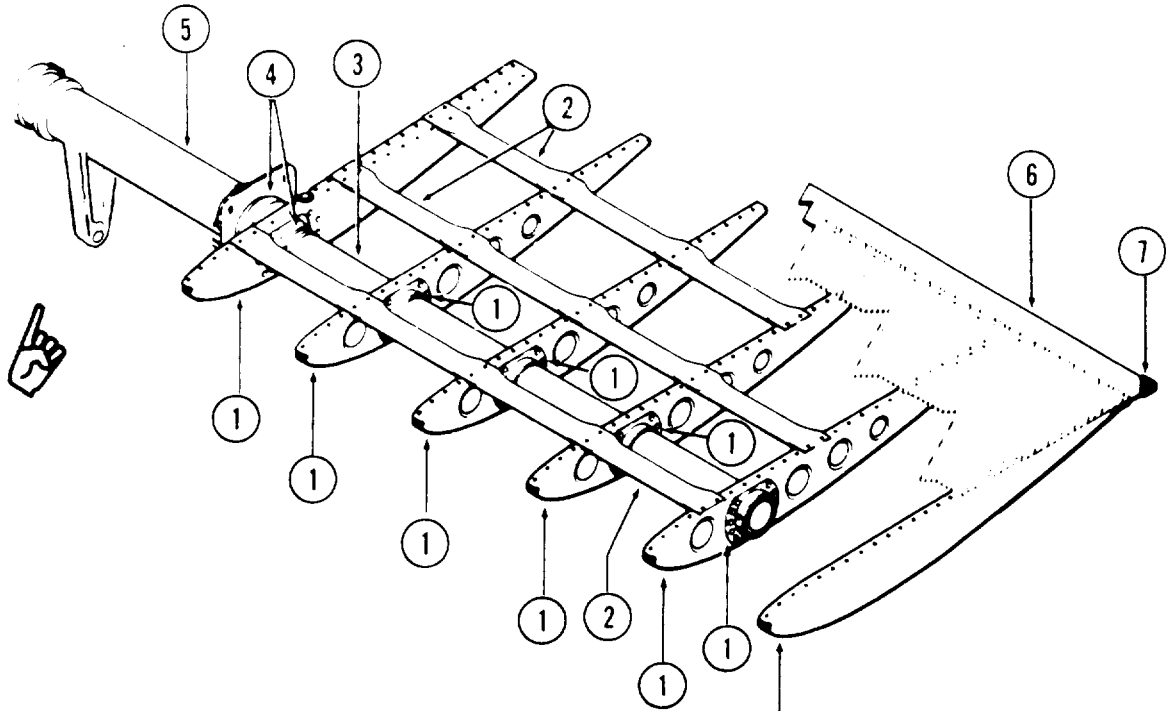
0.005 inch depth after clean-up limited to 0.50 inch rodiolly end/or 1.00 inch longitudinally.

No dents which result in visible tube wall depressions are permitted. The allowable limit on pit corrosion is 10% of wall thickness. No corrosion is permitted after clean-up.

NOTE

Apply two coats of unreduced zinc chromate primer (C219) to spar in cleanup areas, but do not apply primer to portion of spar which hits inside horn.

Figure 2-57. Synchronized Elevator Spar Inspection/Repair



INDEX NO.	TYPE	MATERIAL	SPECIFICATION	HEAT TREAT
1	Al. Aly.	2024	QQ-A-362	T42
2	Al. Aly.	2024	QQ-A-250/5	T3
3	Al. Aly.	2024	WW-T-785	T3
4	Al. Aly. forging	2014	QQ-A-367	T6
5	Al. Aly. casting	A356	MIL-A-21180	—
6	Mag. Aly.	AZ31 B	QQ-M-44	H24
7	Rubber, Silicone	G2087TS	FSCM 84914 (Black)	

Figure 2-58. Elevator Internal Structure

2-293. Installation — Elevator Horn Assembly.

CAUTION

Handle the horn assembly (11) with care to avoid damaging the bearing surfaces at each end.

a. **Insert horn assembly (11, figure 2-54) into tailboom through access door. Position the horn assembly with the control arm down and to the right of center, and insert the horn ends through the right and left tailboom brackets (21).**

CAUTION

Handle support assembles (6) with care to avoid damaging the bushing surfaces.

NOTE

Shim sets (5) shall be of equal thickness at both ends of horn (11).

b. Install shim sets (5), support assemblies (6), washers (20), and bolts (18) on tailboom brackets (21). Torque bolts 50 to 70 inch-pounds and check the axial play (paragraph 2-289b). Add or peel shims (5) as necessary to obtain an axial play of 0.005 to 0.030 inch on the horn (11).

c. Loosen upper support assembly mounting bolts (18) at both ends of the horn(11), and install shims (9), washers (8), bolts (7), and nuts (19) in both support assemblies (6). Do not tighten bolts and nuts (7 and 19) at this time.

NOTE

When performing the following step, do not tighten the bolt and nuts (7 and 19) in the left support (6). When checking the drag, be sure to keep the spring scale at 90 degrees to the horn control arm during rotation.

d. Torque bolts and nuts (7 and 19) in right support (6) 50 to 70 inch-pounds. Attach a spring scale to the clevis hole in horn (11) control arm, hold the spring scale at 90 degrees to control arm, and check the drag required to rotate the horn, If necessary, add or remove shims (9) to obtain 13 to 16 pounds drag.

e. Torque bolts and nuts (7 and 19) in left support (6) 50 to 70 inch-pounds. Attach a spring scale to the clevis hole in horn (11) control arm, hold the spring scale at 90 degrees to the control arm, and check drag required to rotate the horn. If necessary, add or remove shims (9) to obtain 26 to 32 pounds drag.

f. Torque upper bolts(18) in left an right supports (6) 50 to 70 inch-pounds.

g. Connect control tube(15) to control arm of horn (11) using bolt (13), washers (14), nut (16), and cotter pin (17).

2-293.1. Installation — Elevator Assembly,

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

NOTE

Do not use zinc chromate as a substitute for corrosion preventive compound. If zinc chromate has been applied to horn or spars, remove chromate with MEK (C177) and a soft rag. Do not saturate spar assembly with MEK as it may remove electrofilm coating.

a. Apply corrosion preventive compound (C87 or C91) to elevator spar and horn assembly.

b. Install each elevator (1) by inserting spar (22) into the horn (11). Align mounting lug (10) with the elevator support bracket, install washer (23), special bolt (4), and torque 100 to 140 inch-pounds.

c. Check elevator control rigging (Paragraph 11-172).

d. Install access doors(16 and 17, Figure 2-18) on under side of tailboom.

2-294. TAILBOOM STRUCTURE (Figures 2-59 and 2-60).

2-295. Classification of Damage — Tailboom Structure. Refer to table 2-7.

Table 2-7. Classification of Damage-Tailboom Structure (Cont)

DEFECT	NEGLIGBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
a. Rivets: Missing, loose, sheered or improperly driven.		a. Replace as required. NOTE Do not use bolts or screws in place of rivets	
b. Fasteners end Nutplates: Broken, damaged or missing.		b. Replace as Required.	
c. Access Doors: Inspect for cracks holes, tears		c. Cracks or tears no longer then 25 percent of shortest cover dimension. Holes 3.0 inch max. dia. Cleanup no closer then 2.0 inch to suuporting structure..	c. Damage exceeds repairable limits
d. Miscellaneous Brackets, Clips and Supports: cracks, tears, holes and distortion.			d. Replace parts if damage is extensive impractical to repair.
e. Hinges: Cracked, worn or missing loops. Check angles for cracks, holes, distortion and damaged or missing fasteners.	e. See figure 2-61 for damage limits.		
f. Bearing Hanger Support Fitting: Nicks, scratches, corrosion, hole elongation or wear.	f. See figure 2-62 for wear and damage limits	f. A maximum 11/16 inch spot-face with 0.06 inch radius may be used to dean up corrosion around four fittings to bulkhead attachment holes.	f. Fitting cracked or damage exceeds repairable limits.

Table 2-7. Classification of Damage – Tailboom Structure (Cont)

DEFECT	NEGLIGIBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
f.1. INTERMEDIATEGEARBOX SUPPORTINSTALLATION.		See figure 2-62.1	
1. Cracks.			Any cracks are cause for replacement.
2. Distortion of support installation components.			Replace distorted componenls. Replacement of support fittings must be done by next higher maintenance level.
3. Gearbox attachment hole damage,		See figure 2-62.1	
4. Scratches, nicks, dents.		See figure 2-62.1	Treat deep scratches, nicks, and dents as cracks for inspection.
5. Corrosion		See figure 2-62.1	Treat deep corrosion same os cracking for inspection.
6. Nutplates damaged.		Replace damaged nutplates.	

Table 2-7. Classification of Damage – Tailboom Structure (Cont)

DEFECT	NEGLIGIBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
		fitting to bulkhead holes, providing spot-face clears forging. See figure 2-62. Minimum wall thickness after clean up is 0.150 in.	
g. Ninety Degree Gearbox Support Fitting: Nicks, scratches, corrosion, chaff ing wear, hole elongation and wear.	g. See figure 2-63 for wear and damage limits.	g. Refer to paragraph 2-296, step h.	g. Damage exceeding repairable limits.
h. Tailboom Attachment Fittings: Nicks, scratches, corrosion, hole elongation and wear.	h. See figure 2-64 for wear and damage limits.	h. See figure 2-64.	h. Fitting cracked or damage exceeding limits of figure 2-64 requires replacement of both the fitting and longeron. Evacuate to depot.
i. Skin:			
1. Dents.	1. Smooth coutour free of cracks, nicks or wrinkles. Depth and diameter not to exceed: DEPTH — DIAMETER 1/64 — 1.0 inch 3/64 — 2.0 inch 1/16 — 3.0 inch	1. Cracks or sharp nick in dent. Damage areas after cleanup (including prior repairs) shall not exceed 25% of total area for a single skin panel. Damage 6.0 inch minimum from similar repair.	1. Total Damage (including prior repairs) exceeds 25% of total area of a single skin panel, or damage spans entire distance between two bulkheads or two longerons.

Table 2-7. Classifcation of Damage — Tailboom Structure

DEFECT	NEGLIGIBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
			NOTE
	3.0 inch minimum undamaged material between dents and 1.0 inch minimum from internal structure. Nicks and scratches which can be blended out not to exceed 1.0% of material depth.		Evacuate tailboom to depot if a skin panel requires replacement,
2. Cracks, holes, tears, nicks, scratches, corrosion and wrinkles.	2. Nicks and scratches no deeper than 10% of material thickness and not exceeding 1.0 inch length by 0.25 inch width after cleanup. Corrosion damage less than 10% of material thickness and not exceeding 4.0 square inches after cleanup. Damage no closer than 1.0 inch to a supporting structure.	2. Damage exceeds negligible limits but does not exceed 25% (including prior repairs) of total area for a single skin panel.	2. Same as dents.
3. Trapped or stretched skin.	3. Inward or outward bulges located in a sectional area, that can be corrected by removing attaching hardware, allowing skin to shift. Mismatch of rivet holes shall not exceed that which	3. Creased dents not classified as oil can or stretched skin, not exceeding 25% of a sectional area and no closer than 1.0 inch to a supporting structure. Oil can condition, free of sharp dents or	3. Stretched skin, oil cans, or creased dents that cannot be repaired by unloading, insertion repair or back up stiffeners.

Table 2-7. Classification of Damage – Tailboom Structure (Cont)

DEFECT	NEGLIGt8LE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
	can be cleaned up by drilling and installing one size larger rivet and maintain proper rivet edge distance. However, if condition does not disappear after unloading panel, area is stretched or oil canned and must be replaced or repaired. Oil canning or stretched condition can be determined by pressing in on a sectional area and that section remains depressed and a bulge appears in that section or adjacent structure.	creases and not extending over into supporting structure may be required by inserting a backup stiffener over the damaged area. Figure 2-16 illustrates a typical oil can repair.	
j. Stringers: Dents, cracks, holes tears, corrosion and distortion.	j. Scratches or smooth shallow dents not extending into formed radius and less than 10% of material thickness and 0.50 inch length after cleanup. Damage in radius treat as a crack. One treated area per length between bulkheads. Edge damage not to exceed 0.025 inch depth and 0.75 inch length after cleanup. One repair per length between bulkheads.	j. Damage Repairable by Patching: Lateral cracks and smooth contour dents less than 0.10 inch depth that are less than 1/2 stringer width and dew extend into radius, stringer splice or bulkhead. Longitudinal cracks maximum 0.10 inch width and 1.0 inch length. Damage Repairable by Insertion: Damage exceeds limits for patching, but does not exceed 12.0 inch length after cleanup.	j. Damage requires more than one insertion type repair between bulkheads. Damage exceeds repairable limits or repair does not warrant time expended.

Table 2-7. Classification of Damage — Tailboom Structure (Cont)

DEFECT	NEGLIGIBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
		One repair per length between bulkheads. Damage not to extend into splice or bulkheads. If combined stringer and skin damage is present, above limits and limits for skin damage shall not be exceeded.	
k. Longerons (Excluding Tailboom Attach Fittings): Cracks, corrosion, dents, holes, tears, nicks, scratches, buckle or wrinkled.	k. Corrosion: Less than 10% of material thickness and not exceeding an area 0.10 inch width by 0.75 inch length after cleanup. Damage confined to web area only and no closer than 1.0 inch to a splice, doubler or bulkhead. One repair for each longeron in a by area. No damage in forward bay. (See figure 2-65, detail B.) Nicks and Scratches: Not to exceed 10% of material thickness, 0.010 inch width and 0.75 inch length after cleanup. Scratches in web area that extend into radius or at angle greater than 45 degrees into critical area, treat as a crack, (See figure 2-65, detail B.) Nicks or notches in flange area not to exceed 0.80 inch length, 0.04 inch width	k. Damage Repairable by Patching. 1. Smooth contoured dents, length not exceeding 1.0 inch longitudinal, 0.5 inch lateral and 0.050 inch depth. If dent limits are exceeded, treat as a crack. (See figure 2-65, detail A.) 2. Nick and scratch damage exceeds negligible limits but does not exceed 1.6 inch width by 0.38 inch height and does not extend into critical area after cleanup. (See figure 2-65, detail F, section F-F). Damage in critical area does not exceed 2.0 inch length and 0.40 inch depth after cleanup. (See detail F, section G-G.) 3. Crack, hole or tear damage not exceeding limits of figure 2-65, details D and E, and extending no closer than 1.0 inch	1. Damage exceeds repairable limits or two or more repairs required in a single bay. 2. Damage other than negligible occurs in a bay containing either a splice joint or a previous repair. 3. Damage other than negligible in forward bay. d. Splice required in forward bay. 4. Splice required in second bay. 5. Damage other than negligible comes closer than 1.0 inch to a double, splicer, or bulkhead. NOTE Damage in forward bay area (other than negligible), requires replacement of both the longeron and fitting. Evacuate tailboom to depot.

Table 2-7. Classification of Damage — Tailboom Structure (Cont)

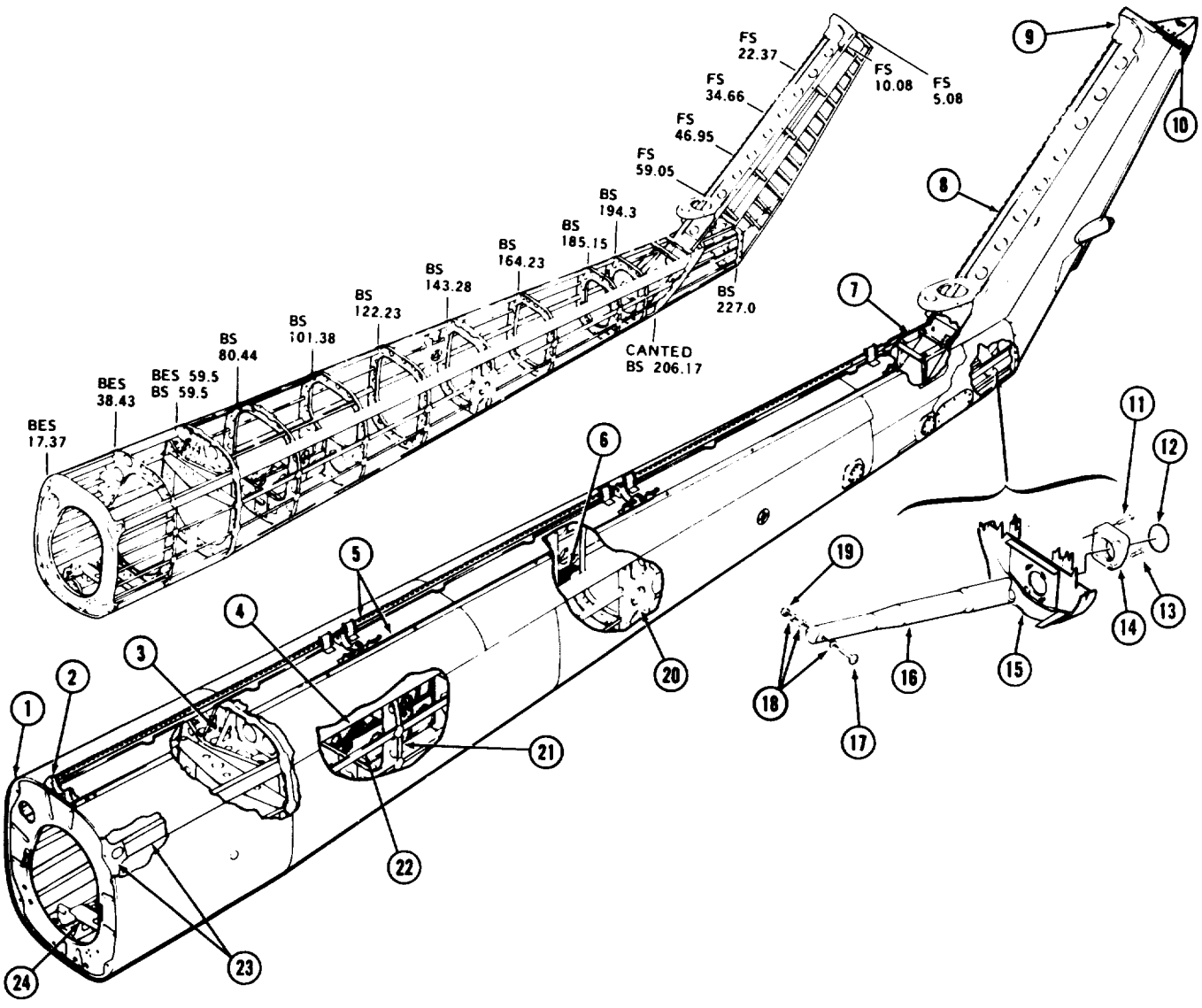
DEFECT	NEGLIGIBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
	and no deeper than 10% of material thickness after cleanup. (See figure 2-65, details B and C.) No repair closer than 1.0 inch to a bulkhead, splice or doubler. Refer to attach fitting illustration for damage limits to fittings.	to a splice, doubler or bulkhead after repair. Damage Repairable by Insertion. 1. Repairable by patching limits exceeding but less than 2.50 inch length after cleanup. (See figure 2-65, details F and G.) 2. Cracks or sharp nicks in dent or damage exceeding patching limits, but less than 2.50 inch after cleanup.	
l. Bulkheads: Corrosion, dents, cracks, holes, nicks and wrinkles.	1. Corrosion less than 10% of web material thickness and not exceeding 4.0 square inch after cleanup. Damage no closer than 0.250 inch to a former, stiffener or radius. Dents, nicks, scratches in bulkhead web, refer to skin damage limits, item i. Damage in a radius, treat as a crack.	1. Damage Repairable by Patching, 1. Corrosion damage greater than negligible but does not exceed 0.70 inch width or 1/3 of a cross section after cleanup. (See figure 2-66, detail B.) Damage no closer than 0.50 inch to a stiffener or attaching parts after cleanup. 2. Dent, cracks, holes and scratches greater than negligible but does not exceed limits of figure 2-66, details A and B. Maximum three damages not to exceed limits of detail A allowed for each bulkhead quadrant. Cracks or	1. Replace stiffeners or any attaching parts for damage other than negligible. Replace bulkhead if repairable li mits are exceeded or if more than one repair to the limits of figure 2-66, detail B is required. Evacuate tailboom to depot for bulkhead replacement.

Table 2-7. Classification of Damage – Tailboom Structure (Cont)

DEFECT	NEGLIGIBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
		damage in radius of former on forward bulkhead except in area of attach fittings. Damage Repairable by Insertion. 1. Corrosion damage exceeds repairable by patching but does not exceed limits of figure 2-66, detail C. 2. Dent, cracks or hole damage exceeds limits of figure 2-66, details A and B, but less than limits of detail C. Cracks or damage in radius of former on forward bulkhead including attach fitting area. Damage exceeding limits of detail C require full splice.	
m. Vertical Fin: 1. Forward and Aft Spars.	1. Surface scratches no deeper than 10% of material thickness after blending. Smooth dents free of cracks and gouges not exceeding 1/64 inch depth and 1.0 inch diameter.	1. Forward Spar. Cracks, holes or cuts in cap flanges that do not extend inside rivet line. Minor separation in bond line of laminated angles which can be bonded and pulled back into position. Web damage not to exceed 3.0 square inches after cleanup may be repaired in areas clear of fitting attach points. Aft Spar. All damage except in area of bottom attach fitting.	1. Fractures in area fittings and bond separation in cap angles that cannot be bonded and pulled into place. Damage that exceeds repairable limits. Evacuate tailboom to depot.

Table 2-7. Classification of Damage — Tailboom Structure (Cont)

DEFECT	NEGLIGIBLE DAMAGE LIMITS	REPAIRABLE DAMAGE LIMITS	DAMAGE REQUIRING REPLACEMENT
2. Trailing Edge.	2. Scratches, nicks and smooth dents which do not deform the air foil shape of fin. Scratches and nicks are acceptable after blending.	2. (See figure 2-67.)	2. Any damage which causes deformation of airfoil or repairable limits exceeded.
3. Skin	3. Refer to skin damage limits, item i.	3. Refer to skin damage limits, item i. Inspect for secondary damage, if skin is damaged in area of 42 degree gearbox mounts.	3. Any damage affecting fin contour or damage so extensive that repair is impractical because of time involved
4. Stringers.	4. Refer to stringer damage limits, item j.	4. Due to length of some stringers, replacement is more practical than repair.	
5. Bulkheads.	5. Corrosion not to exceed 1.0 square inch for single area, 4.0 square inch total area and 10% material thickness after cleanup. Nicks and scratches not to exceed 1.0 inch length, 0.025 inch width and 10% material thickness after cleanup. Treat damage in radius as a crack.	5. Three holes maximum not exceeding 1.0 inch diameter in web area and 3.0 inch minimum distance between damage. Cracks in nutplate holes but not extending into radius. Cracks in web area not exceeding 1.0 inch length after cleanup. No damage to come closer than 0.025 inch to stringer, longeron or structure attaching point.	5. Cracks or holes in area of longeron and stringer attachment. Damage exceeds repairable damage limits.
n. Tail Skid and Support Block.	n. Smooth contoured dents, free of nicks or notches.	n. Corrosion, nicks, or scratches not to exceed 10% of tube wall thickness after cleanup.	n. Replace block if cracked or corroded. Replace tube if yielded in excess of 8 degrees about centerline or if cracked (figure 2-75).



1. Bulkhead former
2. Fitting, bearing hanger support
3. Support, bellcrank and quadrant
4. Support,bellcrank
5. Support angles, driveshaft cover
6. Restrictor
7. Support,42° gearbox
8. Vertical fin
9. Fitting,90° gearbox support
10. Antenna mount
11. Screw
12. Packing
13. Screw
14. Support block, tail skid
15. Support bracket,tail skid
16. Tail skid
17. Screw
18. Washer
19. Nut
20. Doubler and bearing retainer
21. Bulkhead
22. Stringer
23. Attach fitting. doubler and longeron
24. Support,bellcrank

Figure 2-59. Tailboom Structure

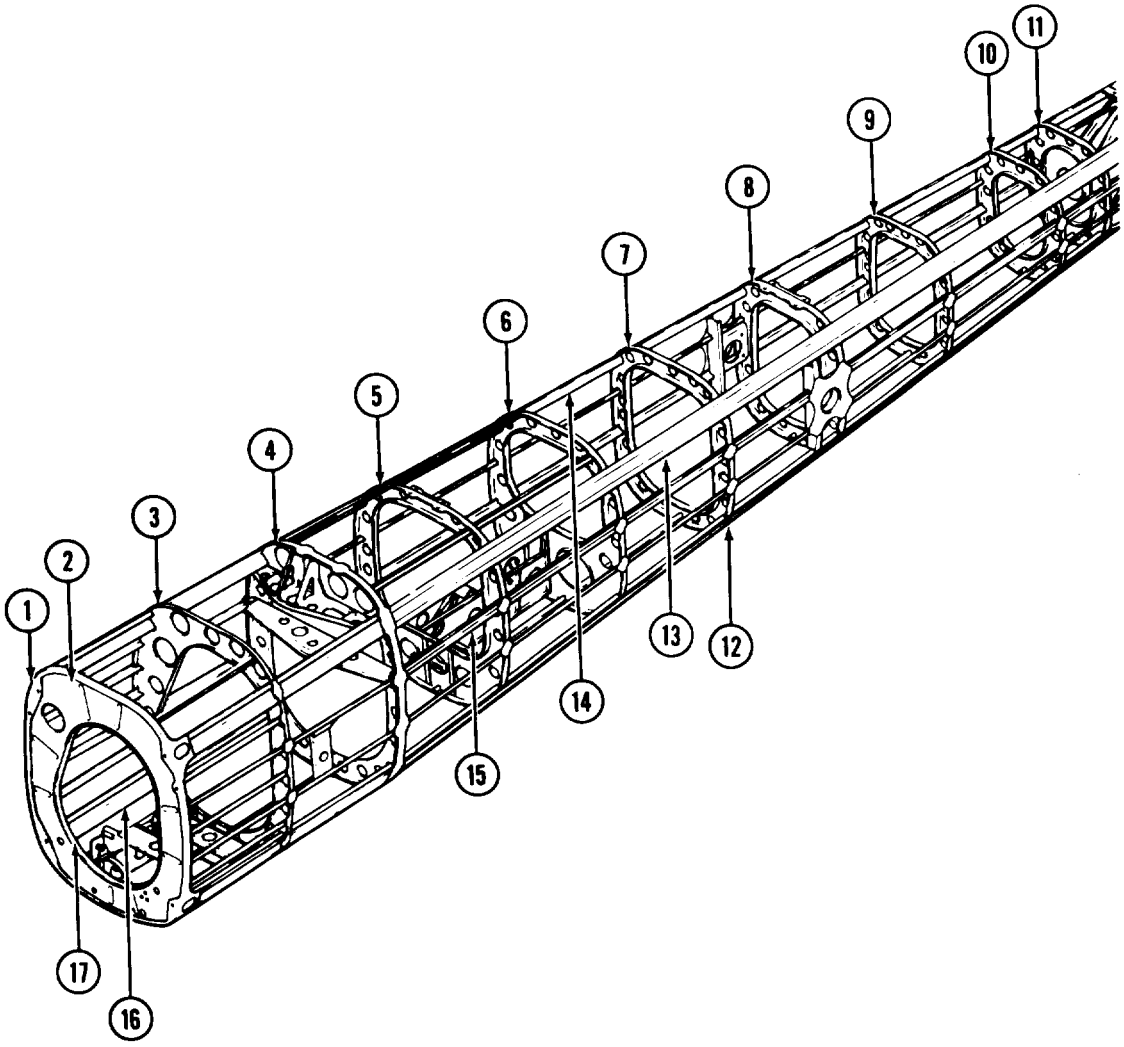


Figure 2-60. Tailboom Structural Material (Sheet 1 of 4)

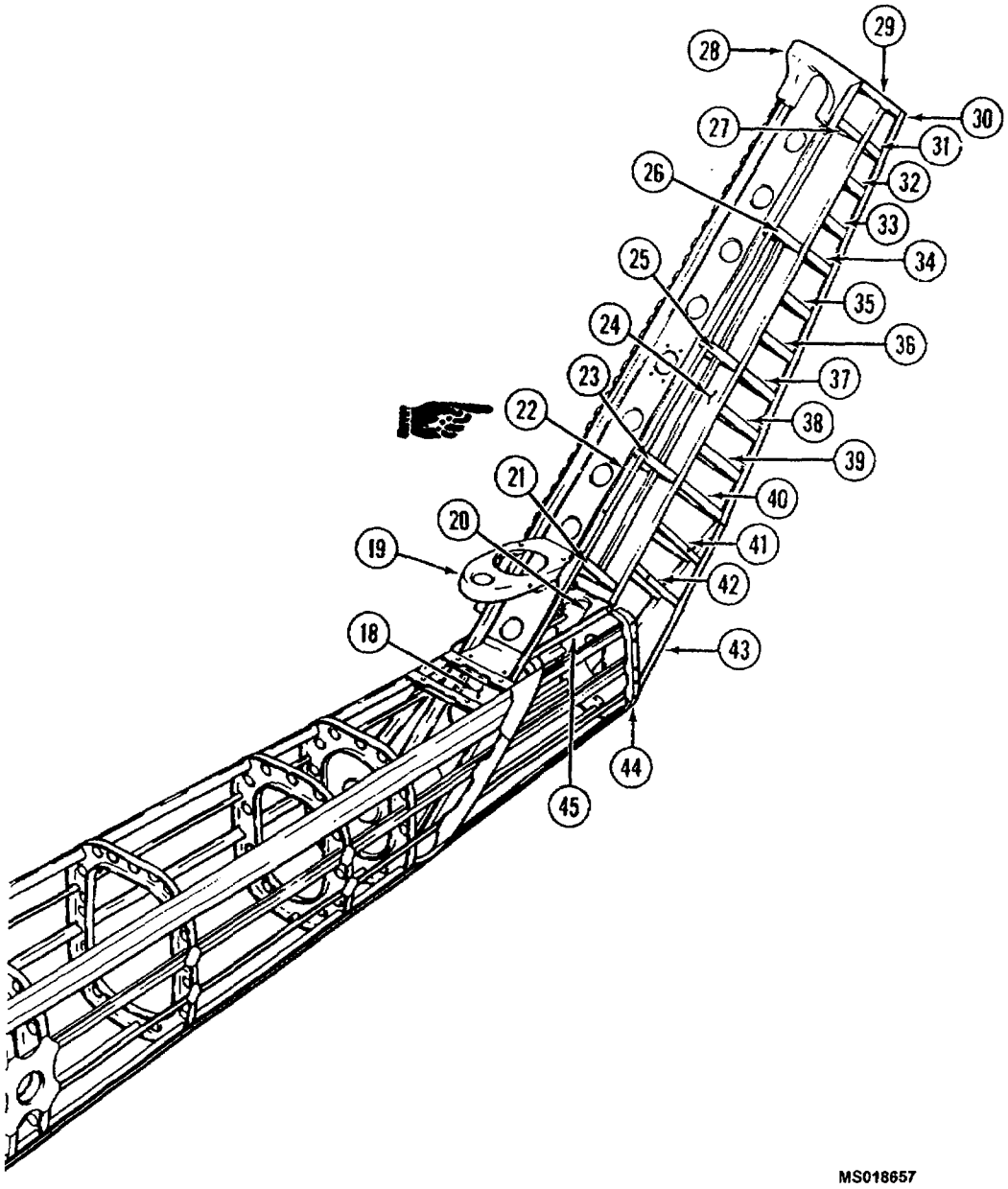


Figure 2-60. Tailboom Structural Material (Sheet 2 of 4)

ITEM	NAME	MATERIAL/ SPECIFICATION	HEAT TREAT CONDITION	THICKNESS
1.	Bulkhead Former, Outer	Al Aly 2024, QQ-A-250/5	T4	0.050
2.	Bulkhead Web	Al Aly 2024, QQ-A-250/5	T3	0.032
3.	Bulkhead	Al Aly 2024, QQ-A-250/5	T42	0.032
4.	Bulkhead	Al Aly 2024, QQ-A-250/5	T4	0.032
5.	Bulkhead	Al Aly 2024, QQ-A-250/5	T42	0.025
6.	Bulkhead	Al Aly 2024, QQ-A-250/5	T42	0.025
7.	Bulkhead	Al Aly 2024, QQ-A-250/5	T42	0.025
8.	Bulkhead	Al Aly 2024, QQ-A-250/5	T42	0.040
9.	Bulkhead	Al Aly 2024, QQ-A-250/5	T42	0.025
10.	Bulkhead	Al Aly 2024, QQ-A-250/5	T42	0.025
11.	Bulkhead	Al Aly 2024, QQ-A-250/5	T42	0.032
12.	Longeron, Lower LH			
	Forward Section	Al Aly 7075, QQ-A-287	T6	0.032
	Center Section	Al Aly 7075, QQ-A-287	T6	0.032
	Aft Section	Al Aly 7075, QQ-A-287	T6	0.032
13.	Longeron, Upper LH			
	Forward Section	Al Aly 7075, QQ-A-287	T6	0.025
	Center Section	Al Aly 7075, QQ-A-287	T6	0.025
	Aft Section	Al Aly 7075, QQ-A-287	T6	0.025
14.	Longeron, Upper RH			
	Forward Section	Al Aly 7075, QQ-A-287	T6	0.032
	Center Section	Al Aly 7075, QQ-A-287	T6	0.032
	Aft Section	Al Aly 7075, QQ-A-287	T6	0.032
15.	Stringers			
16.	Longeron, Lower RH			
	Forward Section	Al Aly 7075, QQ-A-287	T6	0.050
	Center Section	Al Aly 7075, QQ-A-287	T6	0.040
	Aft Section	Al Aly 7075, QQ-A-287	T6	0.040
17.	Bulkhead Former, Inner	Al Aly 2024, QQ-A-250/5	T4	0.050
18.	Bulkhead, Canted	Al Aly 7075, Q-A-250/13	T6	0.025
19.	Nose Rib	Al Aly 2024, QQ-A-250/5	T4	0.032
20.	Fitting, BHT Standard 40-004	Al Aly 2024, QQ-A-267	T4	--
21.	Rib	Al Aly 7075, QQ-A-287	T6	0.025
22.	Vertical Fin Forward Spar Channel	Al Aly 2024, QQ-A-362	T3	0.040
23.	Rib	Al Aly 7075, QQ-A-287	T6	0.025
24.	Vertical Fin Aft Spar Channel	Al Aly 2024, QQ-A-362	T42	0.071
25.	Rib	Al Aly 7075, QQ-A-287	T6	0.025
26.	Rib	Al Aly 7075, QQ-A-287	T6	0.025
27.	Rib	Al Aly 7075, QQ-A-287	T6	0.025
28.	Fitting, Ninety Degree Gearbox Support	Magnesium Aly, AZ91	--	--
29.	Stiffener	Al Aly 2024, QQ-A-362	--	0.040
30.	Rib	Al Aly 2024, QQ-A-262	T42	0.025
31.	Rib	Al Aly 7075, QQ-A-287	T6	0.020
32.	Rib	Al Aly 7075, QQ-A-287	T6	0.020
33.	Rib	Al Aly 7075, QQ-A-287	T6	0.020
34.	Rib	Al Aly 7075, QQ-A-287	T6	0.020
35.	Rib	Al Aly 7075, QQ-A-287	T6	0.020

Figure 2-60. Tailboom Structural Material (Sheet 3 of 4)

ITEM	NAME	MATERIAL/ SPECIFICATION	HEAT TREAT CONDITION	THICKNESS
36.	Rib	Al Aly 7075, QQ-A-287	T6	0.020
37.	Rib	Al Aly 7075, QQ-A-287	T6	0.020
38.	Rib	Al Aly 7075, QQ-A-287	T6	0.020
39.	Rib	Al Aly 7075, QQ-A-287	T6	0.020
40.	Rib	Al Aly 7075, QQ-A-287	T6	0.020
41.	Stiffener	Al Aly 2024, QQ-A-362	T3	0.025
42.	Stiffener	Al Aly 2024, QQ-A-362	T3	0.025
43.	Bulkhead	Al Aly 2024, QQ-A-250/5	T42	0.050
44.	Bulkhead	Al Aly 2024, QQ-A-250/5	T42	0.032
45.	Stiffener	Al Aly 2024, QQ-A-267 Aeronautical Standard AND10134-1003	T4	-

NOTE: All stringers, with two exceptions, are manufactured from the following material: BHC standard 110-001-1, Al Aly 7075-O, QQ-A-250/13, thickness 0.032 inch, temper T6. Two stringers, P/N 205-032-800-39, located on the lower right side of the tailboom between BS 101.38 and BS 122.38 are manufactured from the same material noted above, but are 0.040 inch thick.

Figure 2-60. Tailboom Structural Material (Sheet 4 of 4)

2-295.1. Repair and Replacement - Tailboom Vertical Fin Door Assembly Hinge Pin.

a. Remove nuts (1, figure 2-61, washers (2), screws (3), and hinge pin retainer (4).

b. Notch hinge pin retainer (4) at each end as shown.

NOTE

Heat hinge pin to aid bending and quench in oil (C169) after bending.

c. Remove hinge pins from upper and lower hinge halves (6) and bend hinge pins as shown.

d. Install hinge pins (5) and secure with retainer (4), screws (3), washers (2), and nuts (1).

2-296. Repair - Tailboom Structure. (AVIM).

Premaintenance requirements for repair of tailboom structure

Conditions	Requirements
Model	UH-1H/EH-1H
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(C29), (C110), (C178), (C181), (C244), (C277), (C312)
Special Environmental Conditions	None

NOTE

Standard type repairs (TM 55-1500-324-10) may be used when specified. However, standard repairs shall not be used where the accomplishment of the repair affects weight and balance, structural integrity, interchangeability, or operational characteristics of the helicopter. See figure 2-5 for tailboom skin identification.

NOTE

If crack in the intermediate gearbox support installation, tailboom structure, ninety degree gearbox support fitting, or vertical fin is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

a. Repair of combined skin and/or stringer damage (figure 2-17 and 2-68).

(1) Cut a round or elongated hole around puncture or tear in skins. Hole shall be large enough to include all ragged edges and any stretched metal. Allow generous radii in all corners.

(2) Trim edge of damage in stringer to allow at least one rivet space in skin beyond skin cut out.

(3) Cut skin and stringer inserts of same material and gage as original material. Inserts shall be of size to completely fill cut out areas.

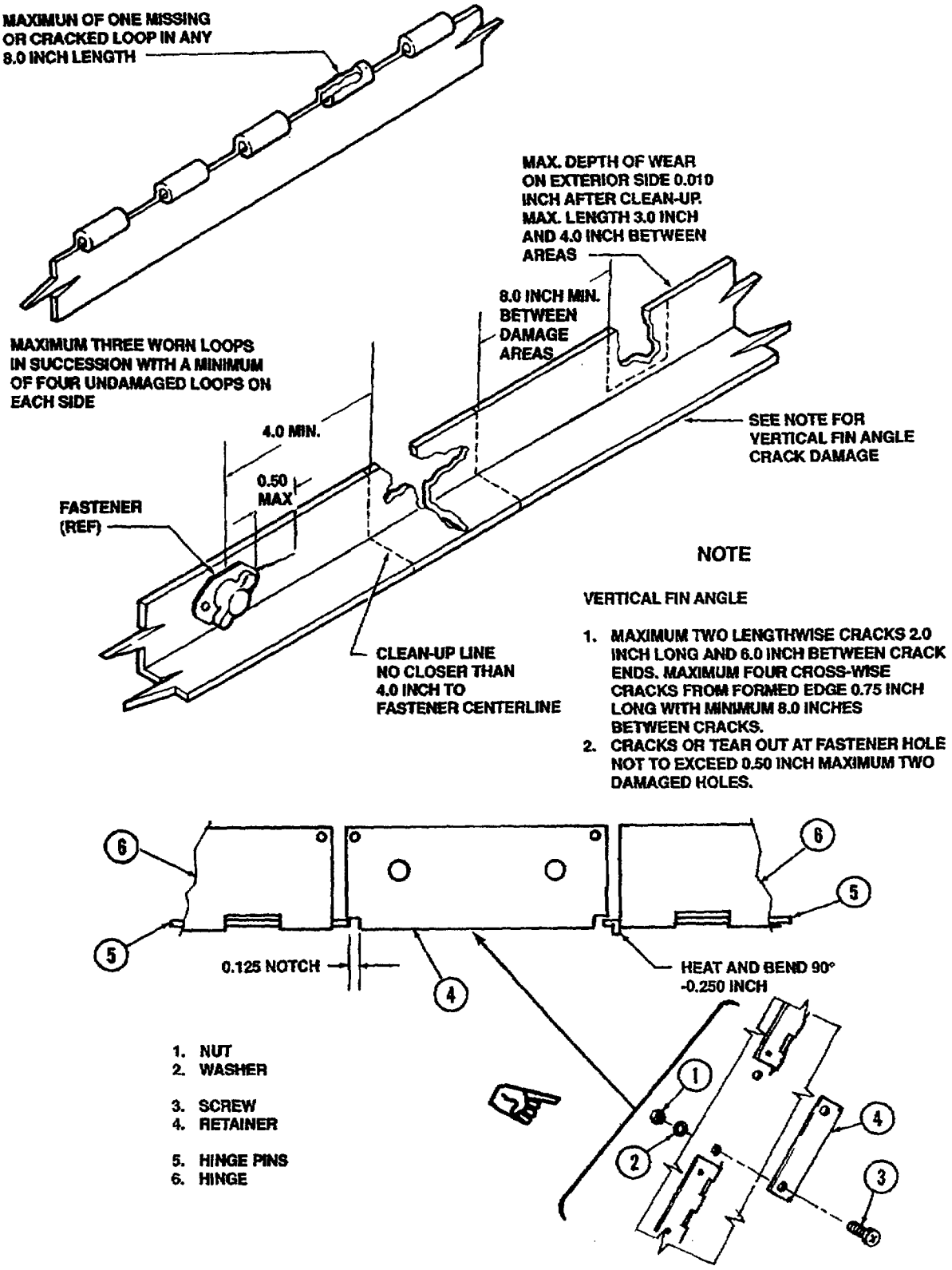
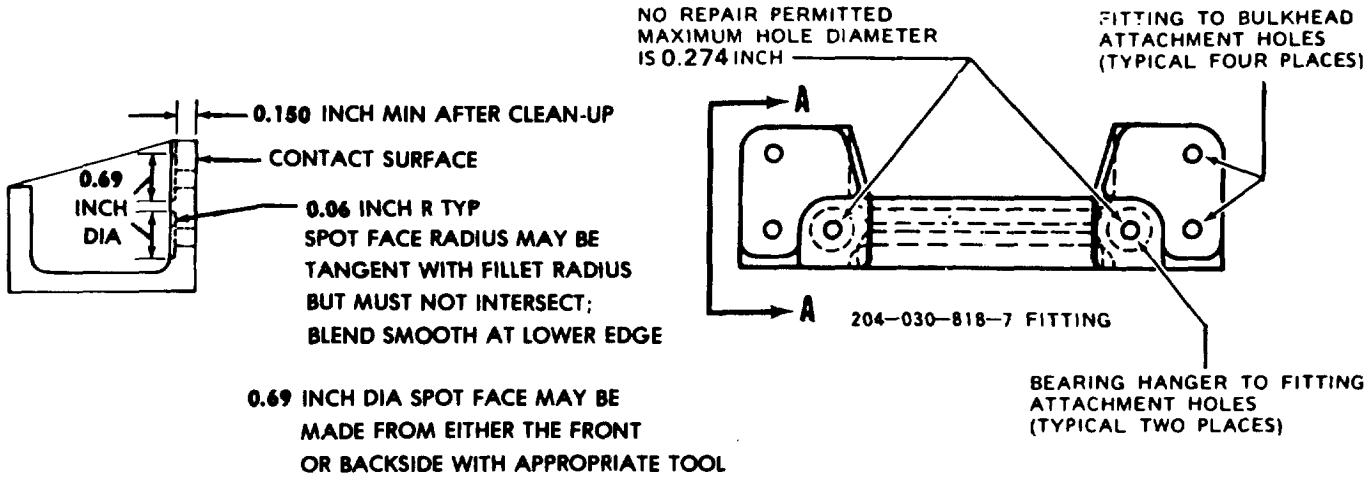


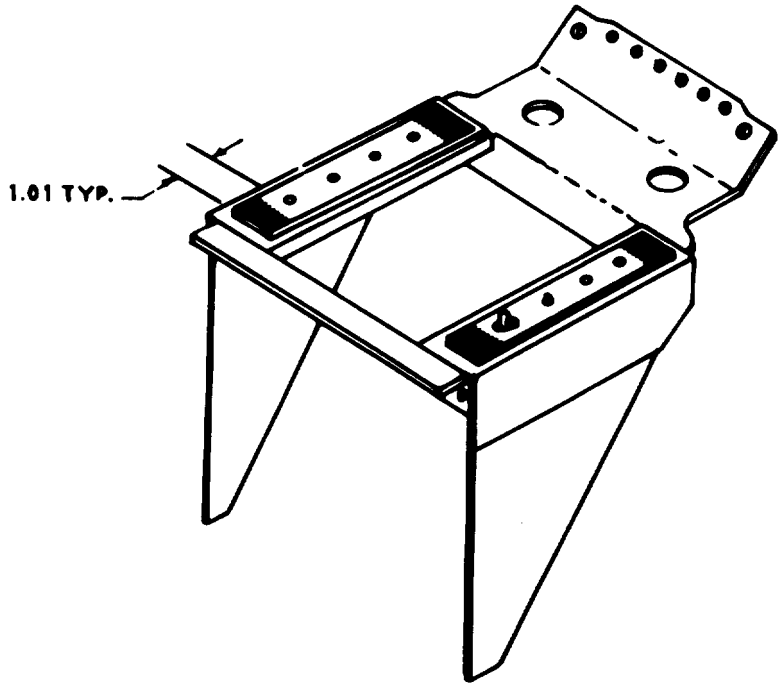
Figure 2-61. Driveshaft Cover Hinges and Angles Damage Limits



VIEW A-A (EXPANDED)

DEFECT	NEGLIGIBLE DAMAGE	REPAIRABLE DAMAGE	DAMAGE REQUIRING REPLACEMENT
1. Scratches, Nicks, Dents and Corrosion on Hole Surfaces.	Maximum depth of 0.01 inch and total discrepant area of 40 percent after cleanup.	Maximum of one bulkhead attach hole exceeding negligible limits.	Two or more bulkhead attach holes and either bearing hanger attach hole exceeds negligible damage limits.
2. Wear or Elongation in Fitting to Bulkhead Attach Holes.	Maximum elongation not to exceed 0.198 inch for three holes and 0.212 for one hole.		Damage exceeding negligible,
3. Wear or Elongation in Hanger to Fitting Attach Holes.	Maximum diameter of 0,274 inch for one or both holes.	None.	Either hole diameter exceeds 0.274 inch.
4. Corrosion Around Fitting To Bulkhead Attach Holes.		A maximum 11/16 inch spot-face with 0.06 inch radius may be used, providing spot-face clears forging. Minimum wall thickness after cleanup is 0.150 inch. (SEE VIEW A-A)	Damage exceeding repairable limits.

Figure 2-62. Bearing Hanger Support Fitting Damage Limits



WARNING

NO REPAIRS PERMITTED ON GEARBOX MOUNTING SURFACE.

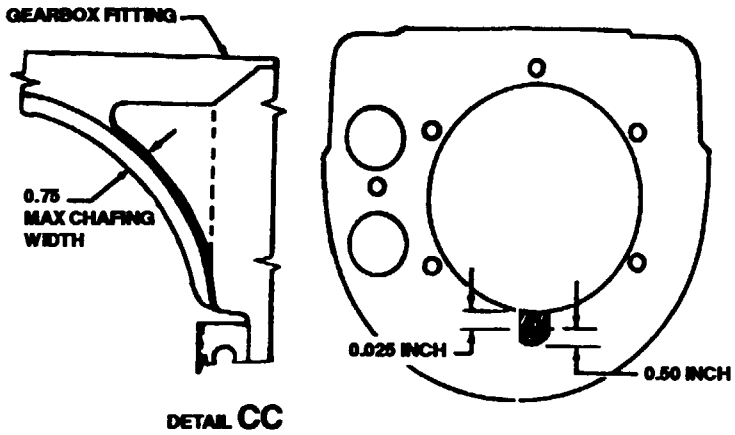
DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
CRACKS ALLOWED	**None**	**None**
MECHANICAL DAMAGE	**None**	**0.020**
CORROSION DAMAGE AFTER REPAIR	**None**	**10 percent of thickness or 0.020, whichever is less.**
MAXIMUM AREA PER FULL DEPTH REPAIR	**None**	**20 percent of surface area cleanup including prior repairs.**

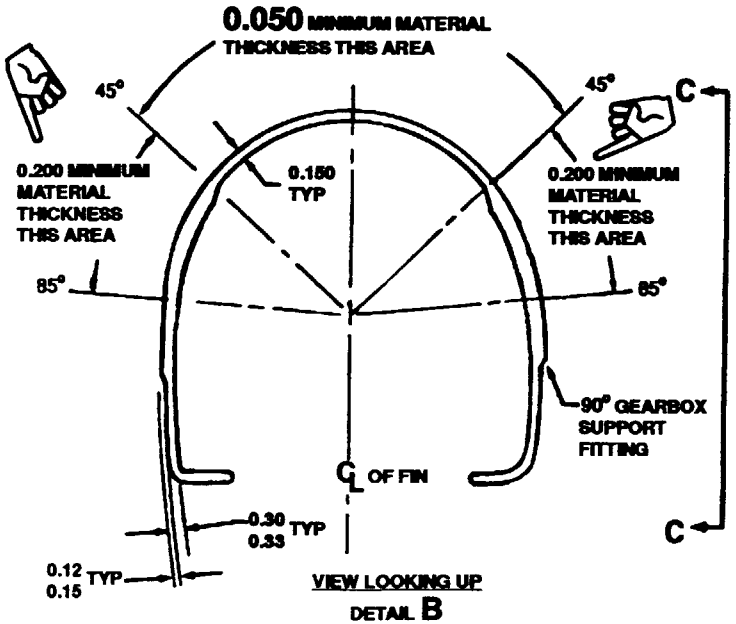
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

NOTES
1. **Only one gearbox attachment hole can he repaired, maximum diameter 0.276.**
2. **No corrosion in attachment holes or within 0.05 of fastener holes or fillets**

Figure 2-62.1. Damage Limits - Intermediate Gearbox Support Installation



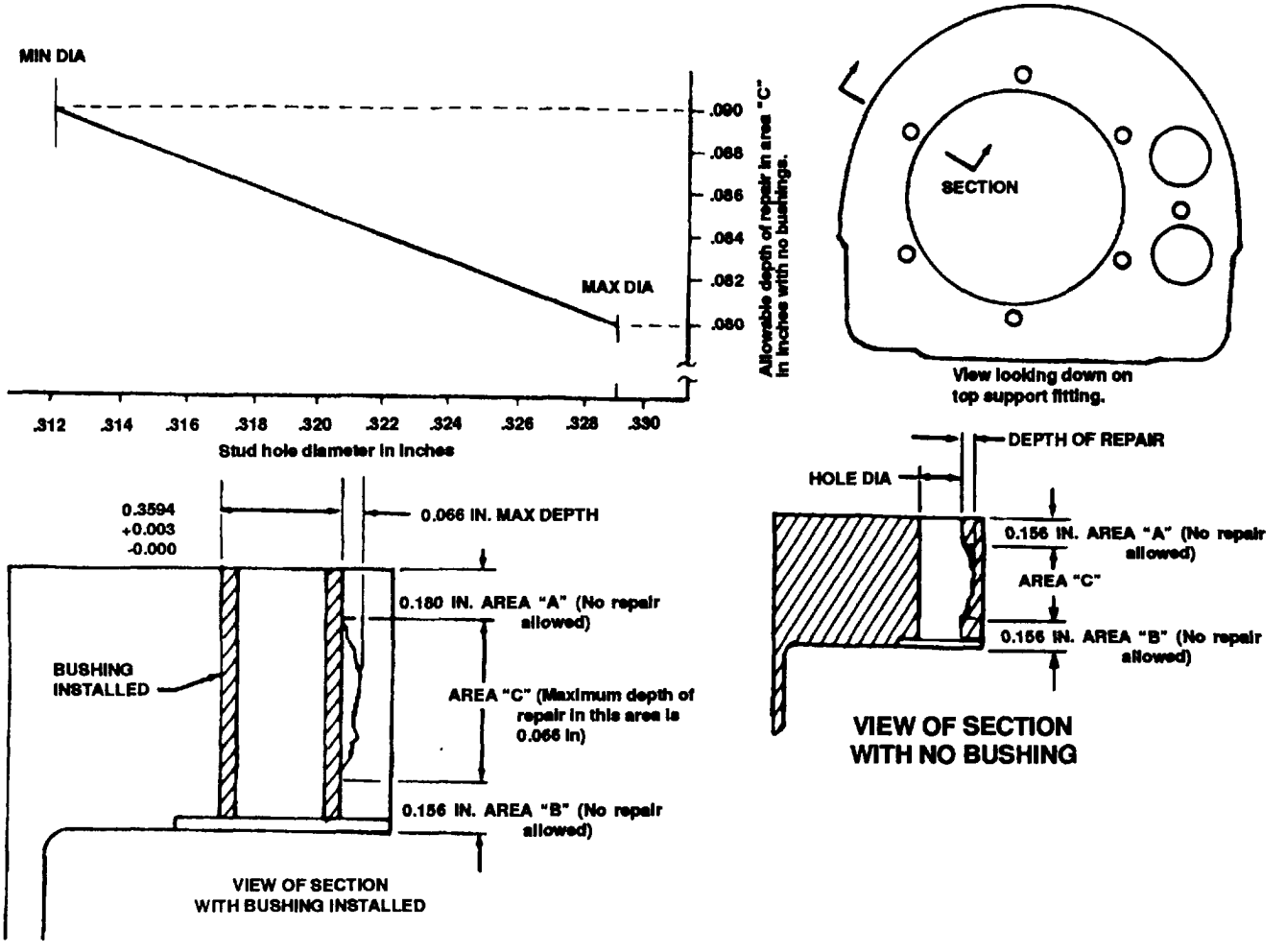
TOP AND LOWER SURFACE DAMAGE LIMITS
(See Detail A)



NOTES

1. Particular damage limits adjacent to holes is applicable to each of the six gearbox stud holes. If the area around two or more holes is damaged to the limits shown above, engineering approval must be requested on an individual basis.
2. Total reworked surface area on the top surface of fitting must not exceed thirty percent of total area.
3. Wear limits (elongation) of stud holes is 0.329 inch. Holes may be repaired by installation of a bushing per paragraph 2-296.h.(2). Corrosion limits for the six (6) stud holes are specified in figure 2-63.1.
4. Maximum chaffing wear. (See detail B).
   a. In area 45 either side of vertical fin center line (viewed from forward side looking up), minimum material thickness is 0.050 inch.
   b. In area 45 to 85 either side of vertical fin center line, minimum material thickness is 0.200 inch.
5. Scratches, nicks, dents and corrosion are allowed on hole surfaces to a maximum depth of 0.010 inch for a total descrepant of 40 percent. Treat corrosion and rework areas per TM 55-1500-344-23.
6. No cracks allowed.

Figure 2-63. Ninety Degree Gearbox Support Fitting Damage Limits



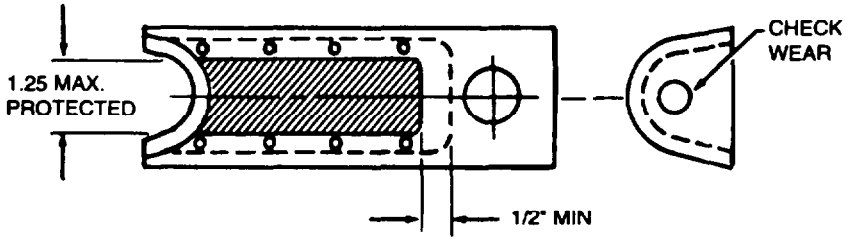
NOTE:

A void will exist between the bushing and the fitting when this repair is accomplished. This is acceptable.

NOTES:

1. The diameter of the 6 gearbox stud holes in AREAS "A and B" may not exceed 0.329 inch after corrosion cleanup. The depth of corrosion cleanup in AREA "C" is specified per the graph above.
2. Holes exceeding the above limits may be repaired using a bushing as specified in paragraph 2-296h(2).
3. If corrosion is still evident after reaming, cleanup is authorized per the limits shown in this figure. No corrosion allowed in AREAS "A and B." Max depth after corrosion cleanup in AREA "C" is 0.066 inch.

Figure 2-63.1 Ninety Degree Gearbox Support Fitting Corrosion and Repair Limits



CLEAN-UP ALLOWED IN SHADED AREA ONLY

NOTES

1. Mechanical and corrosion damage limited to shaded area of above figure. Maximum depth after clean-up shall not exceed 10 percent of material thickness.
2. Inspect attach holes for wear.
3. Inspect using 3 power or greater glass for cracks.

FITTING LOCATION	(NEW PART) MIN.	MAX.	WEAR LIMIT
LOWER LEFT/LOWER RIGHT	0.376	0.381	0.396
UPPER LEFT/UPPER RIGHT	0.501	0.506	0.521

(4) Cut a skin patch of same material and gage as damaged skin. Patch shall be of sufficient size to provide required over-lap of cut out area.

(5) Provide stringer patch of size to over-lap undamaged portion of stringer to provide proper rivet distance for a minimum of four rivets. Use existing rivet spacing as a guide (figure 2-68, sheet 2).

NOTE

if damage to stringer is of a minor nature, repair may be made by nested angle method. (Figure 2-68, sheet 2, View A.)

(6) Position inserts and patches and secure firmiy in place. Drill rivet holes through patches, inserts and original parts. Rivet holes shall be of same size and spacing as original pattern. Deburr all holes.

(7) Clean all paint and dirt from mating areas of skin and stringer, and from both sides of inserts and patches.

(8) Apply a coat of epoxy primer (C110) to all cleaned areas and allow to dry.

(9) Coat side of skin patch which will mate with skin with sealant (C244).

(10) Position inserts and patches and rivet in place.

(11) Apply epoxy primer (C110) to repainted areas. When dry, apply two coats of lacquer of color to match original finish. (Refer to TM 55-1500-345-23).

b. Repair damaged longerons (figure 2-69).

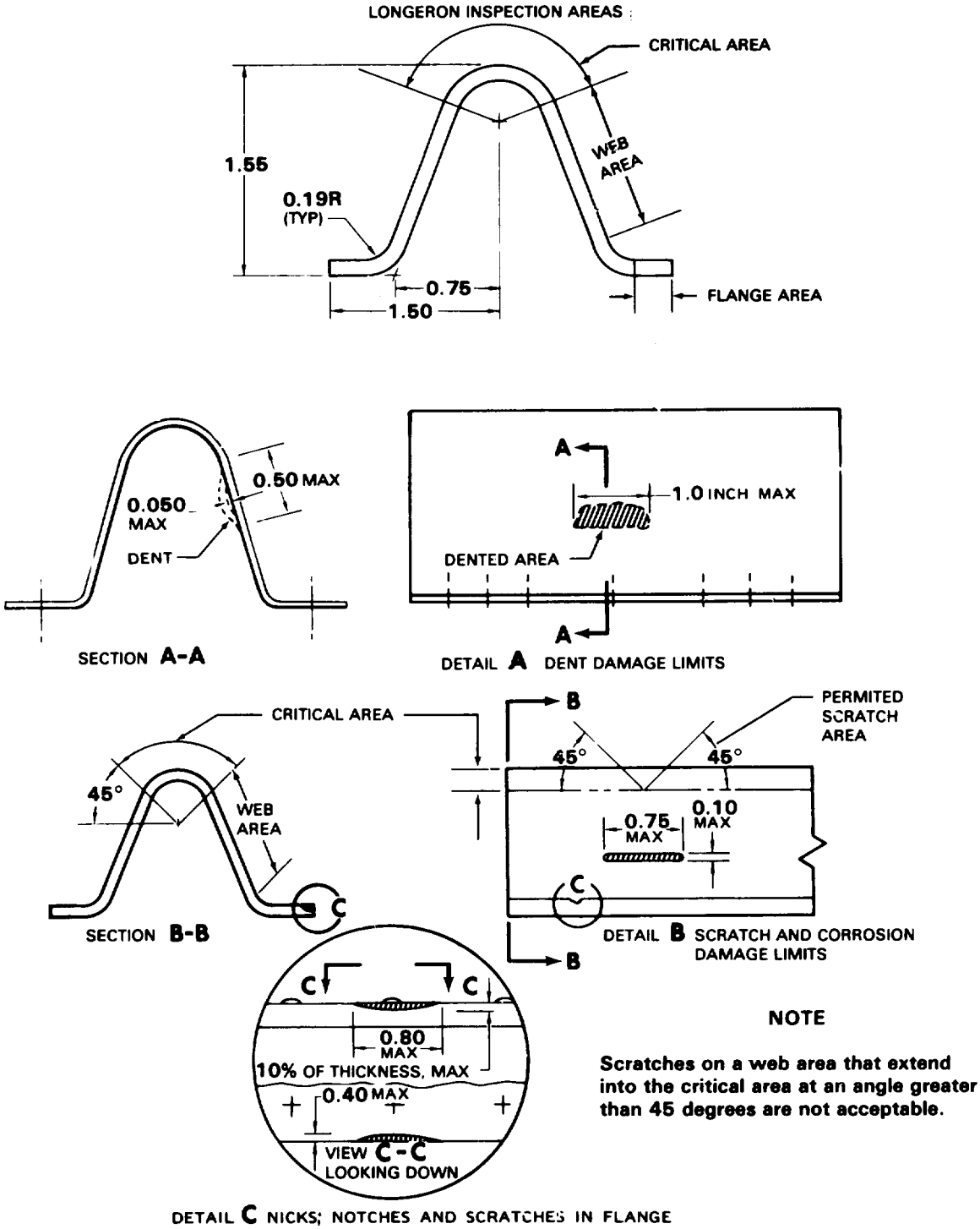
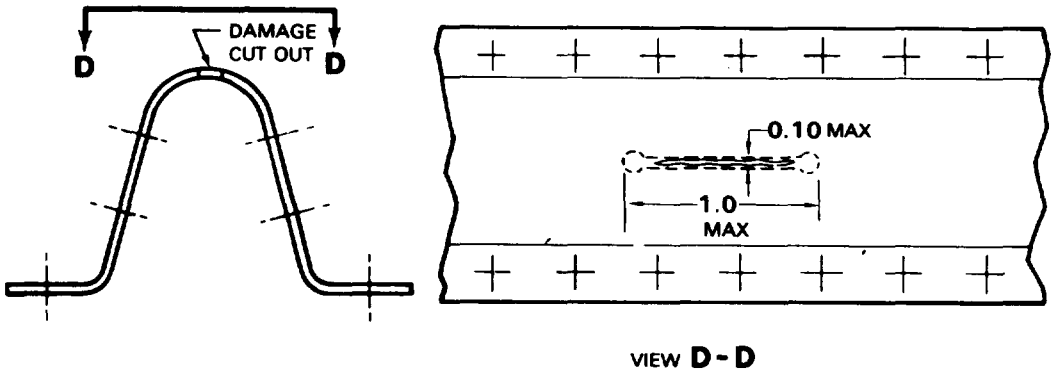
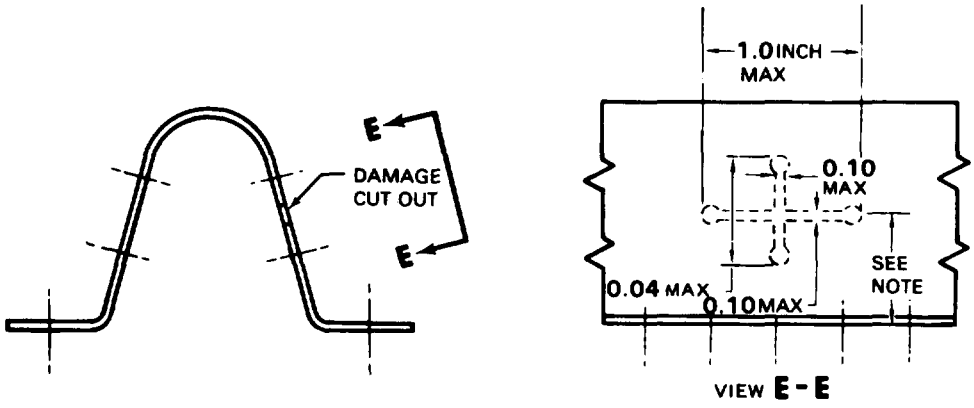


Figure 2-65. Longeron Damage Limits (Sheet 1 of 3)



DETAIL D LONGITUDINAL CRACKS IN CRITICAL AREA

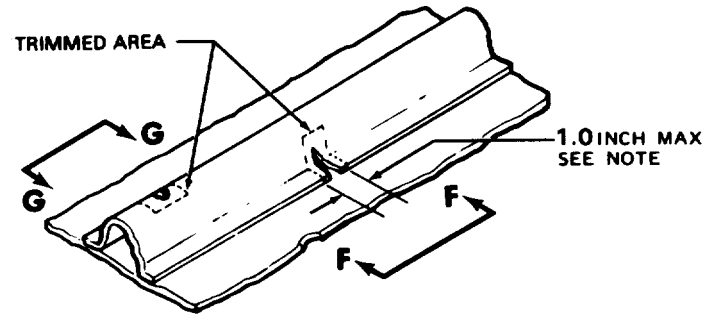


DETAIL E LONGITUDINAL OR LATERAL CRACKS IN WEB AREA

NOTE

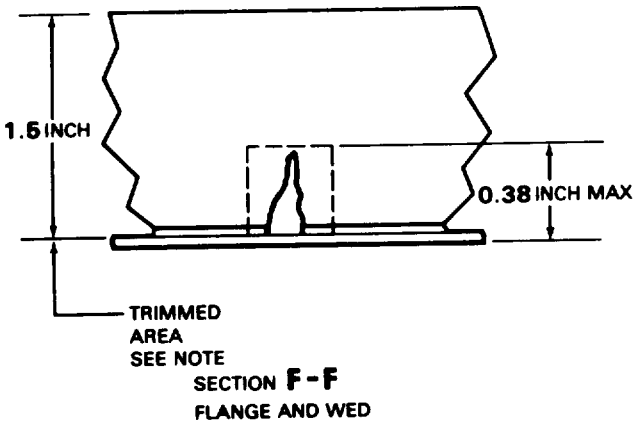
All longitudinal cracks are repairable if they are located within the following limits: 0,45 inch minimum height from longeron flange, 1.04 inches maximum height from longeron flange.

Figure 2-65. Longeron Damage Limits (Sheet 2 of 3)

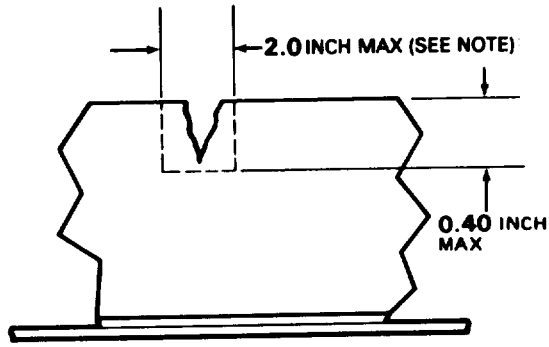


NOTE

When trimmed area exceeds limits shown for either critical area or flange and web, or if combined damage extends from the flange and web into critical area, inspect to limits of detail G.

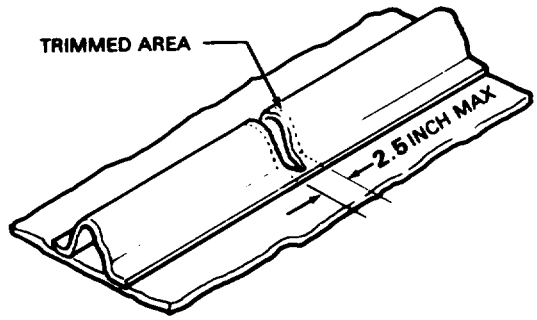


SECTION F-F
FLANGE AND WED



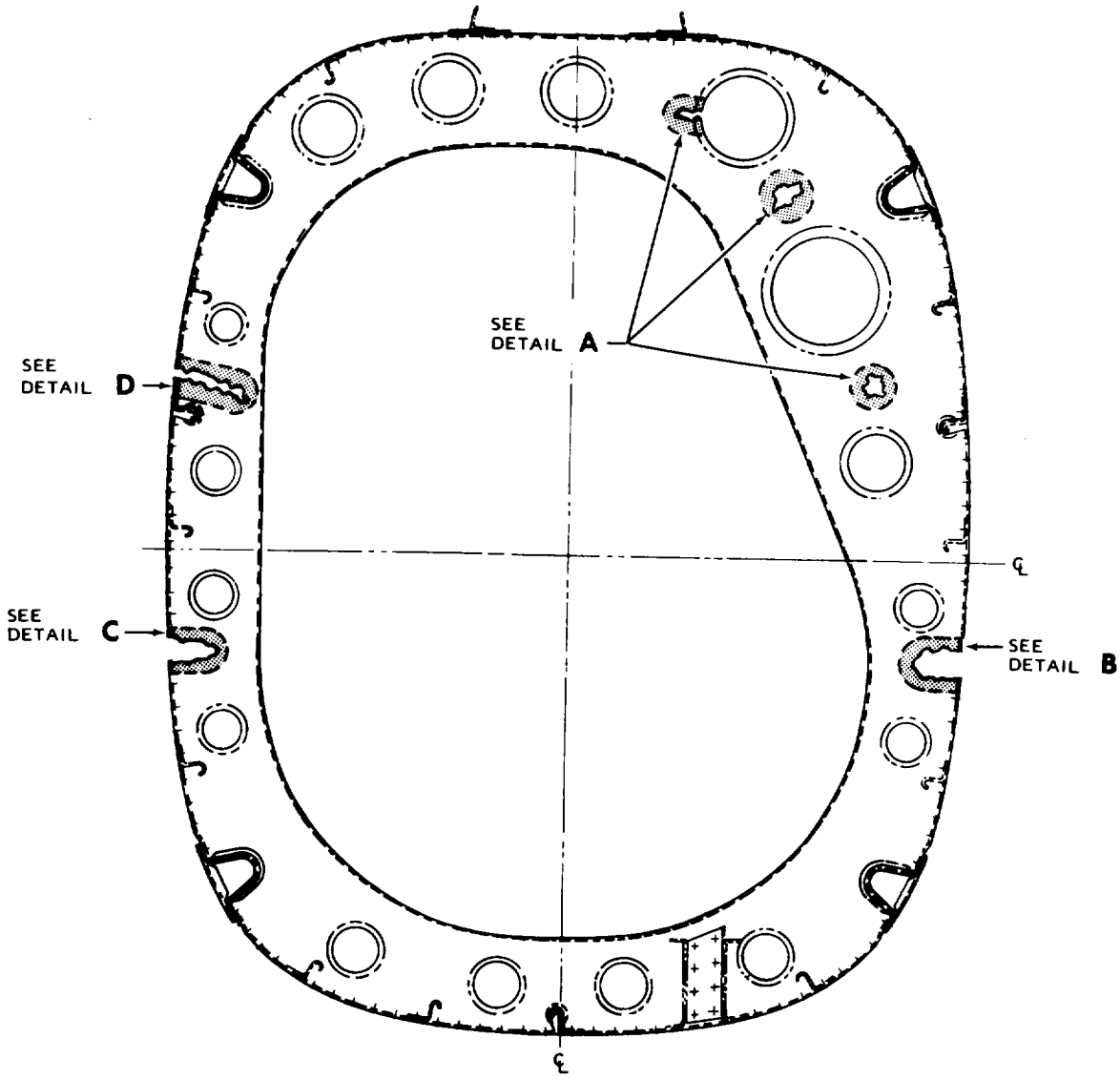
SECTION G-G
CRITICAL AREA

DETAIL F DAMAGE LIMIT TO CRITICAL AREA, FLANGE OR WEB



DETAIL G DAMAGE LIMIT TO CRITICAL AREA, FLANGE AND WEB

Figure 2-65. Longeron Damage Limits (Sheet 3 of 3)



NOTE

Three repairs not exceeding the limits of detail "A" or "B" and minimum 3.0 inches between damage areas are allowed for each quadrant of a bulkhead. One repair not exceeding the limits of detail "C" is allowed in each quadrant of a bulkhead. One repair not exceeding the limits of detail "D" is allowed for each bulkhead. Damage affecting more than one-half of a cross sectional area requires a full splice.

Figure 2-66. Typical Bulkhead Damage Limits (Sheet 1 of 2)

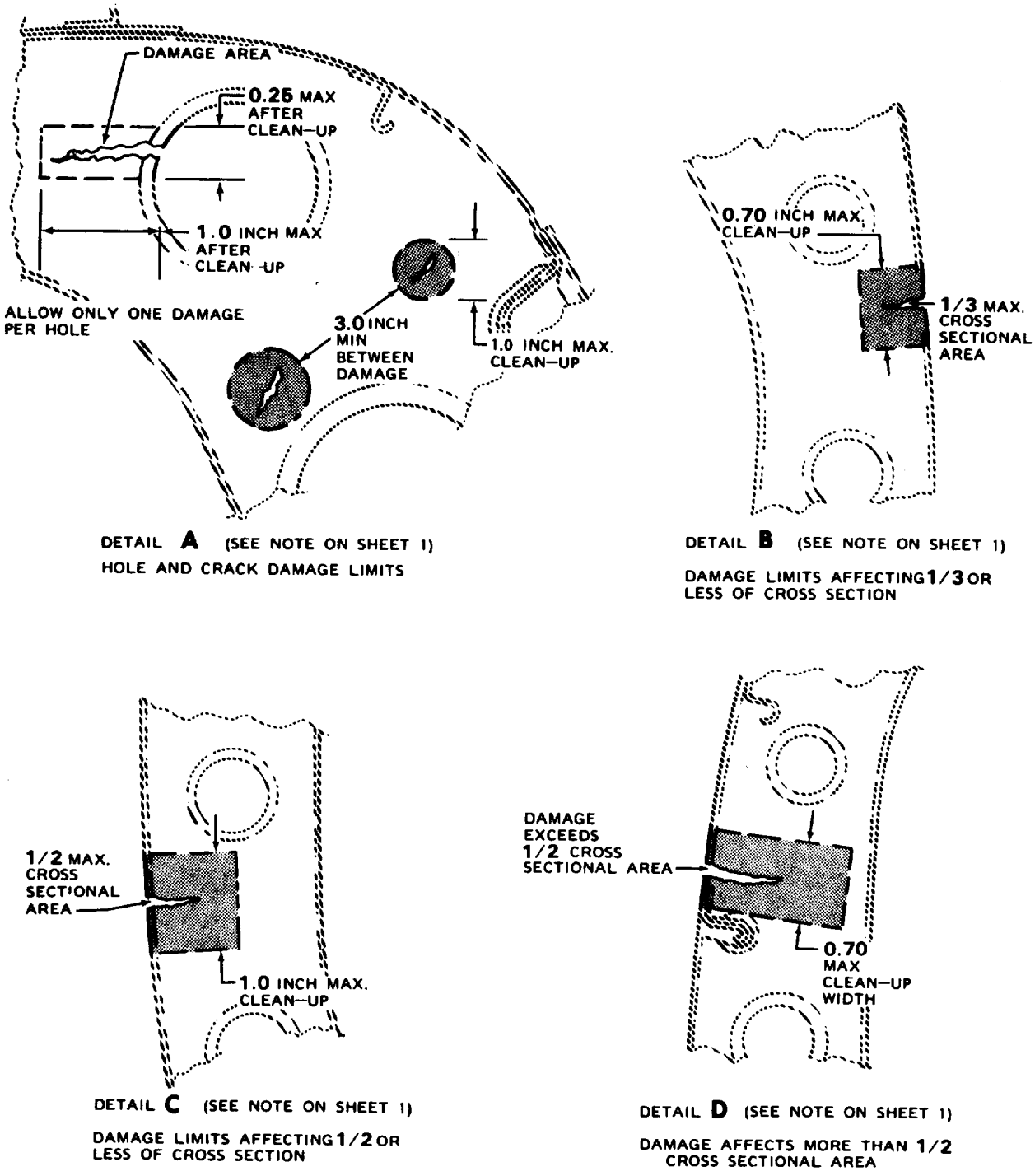


Figure 2-66. Typical Bulkhead Damage Limits (Sheet 2 of 2)

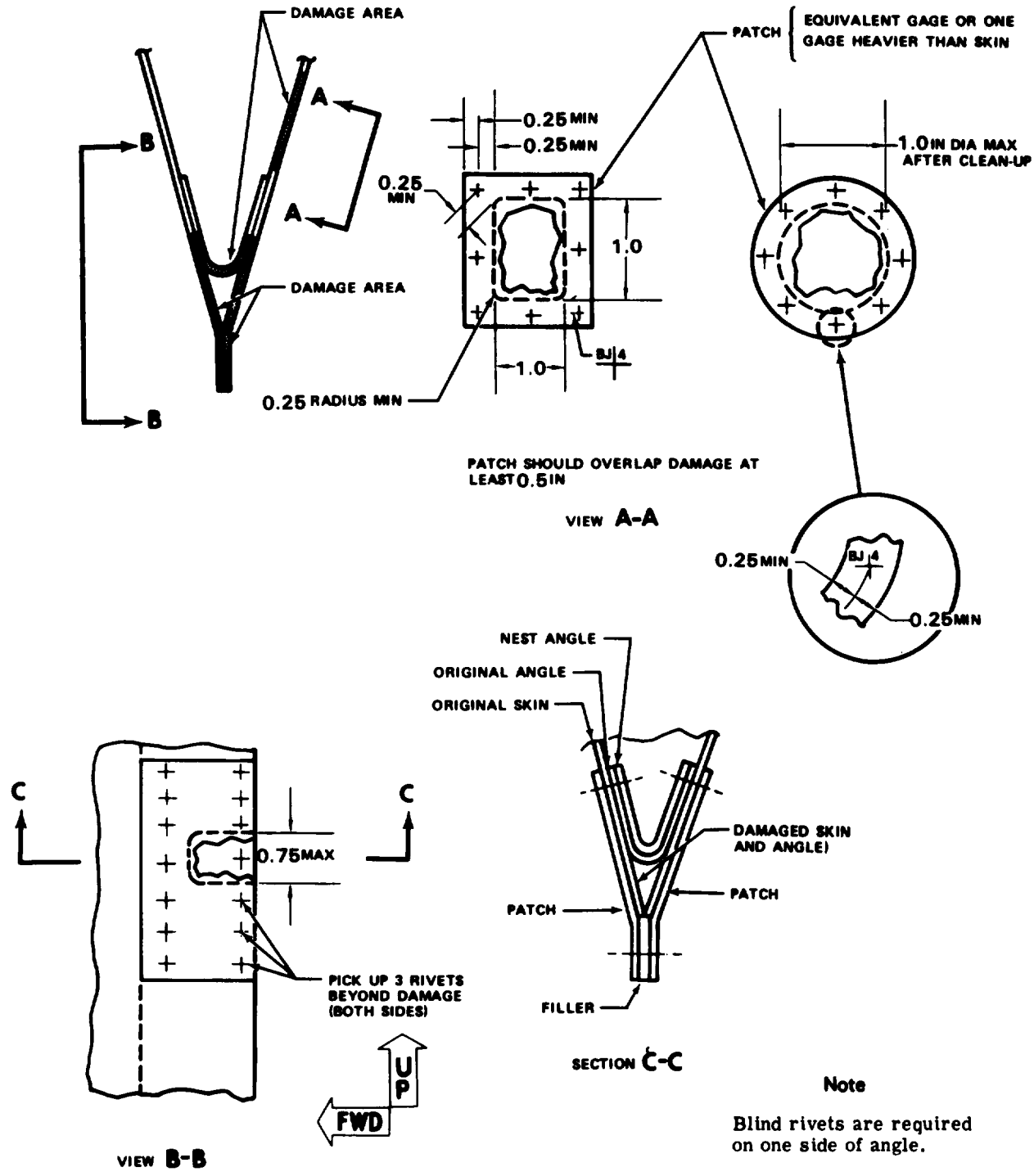
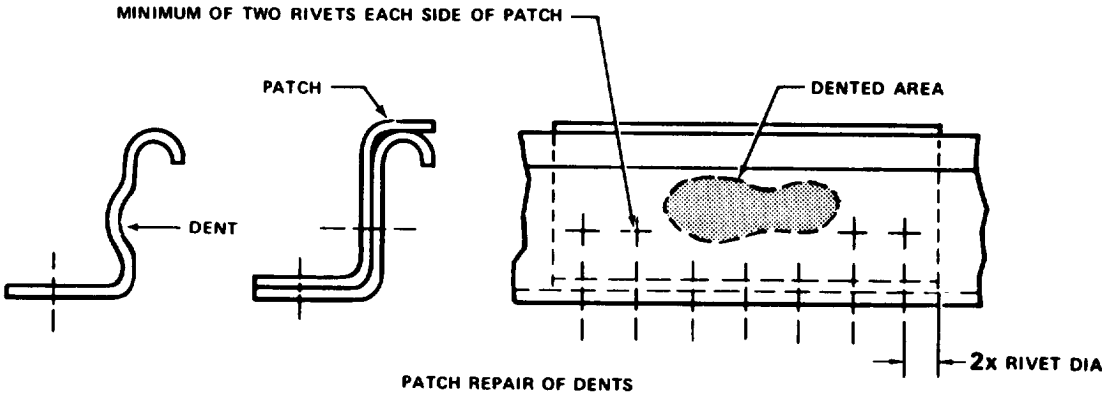
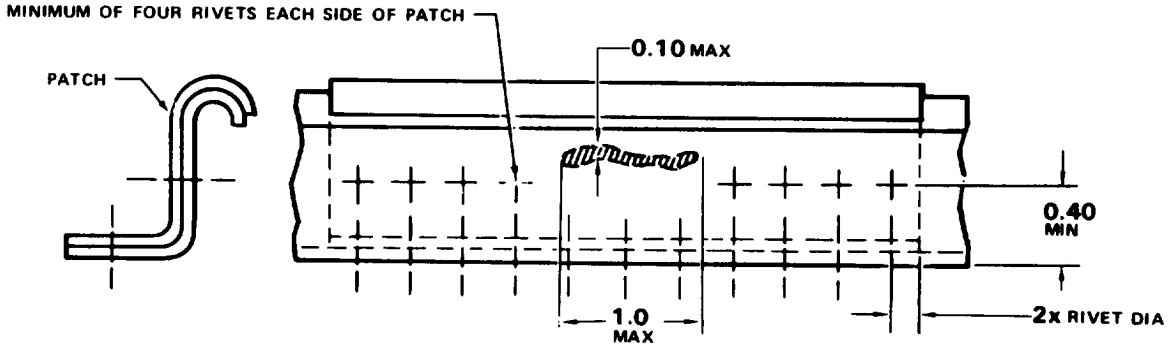


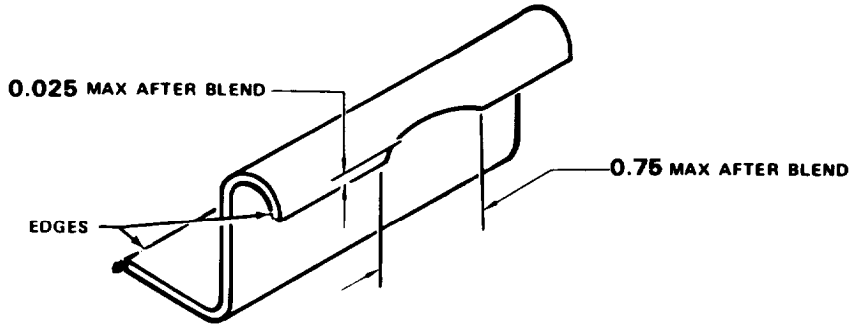
Figure 2-67. Fin Trailing Edge Damage Limits



PATCH REPAIR OF DENTS

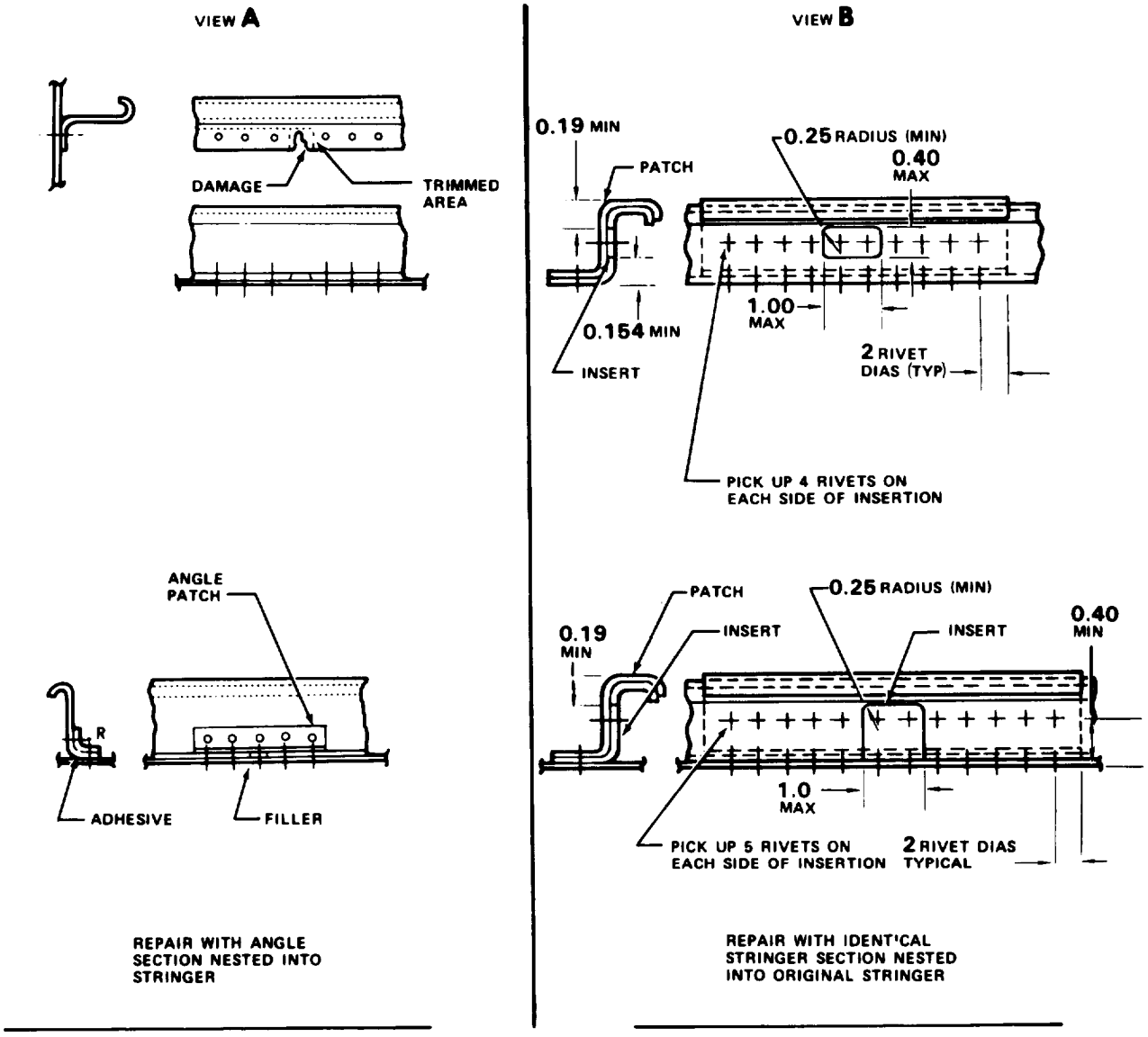


PATCH REPAIR OF LONGITUDINAL CRACKS



REPAIR OF EDGE DAMAGE

Figure 2-68. Stringer Repair (Sheet 1 of 2)

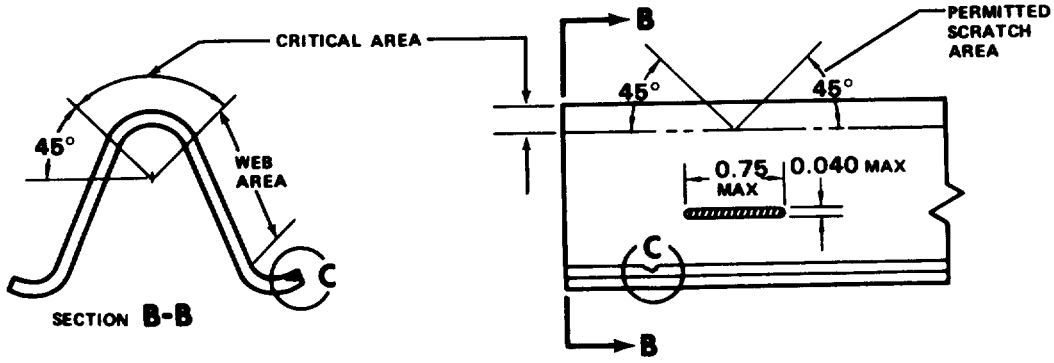


NOTES:

1. **Damage occurring to the crown of the stiffener (not shown) shall be repaired as shown in view "B", except there shall be a minimum of eight rivets on each side of damaged area.**

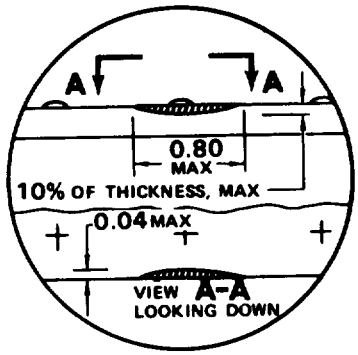
2. **Stiffener severed completely (not shown) shall be repaired as directed in Note 1.**

Figure 2-68. Stringer Repair (Sheet 2 of 2)



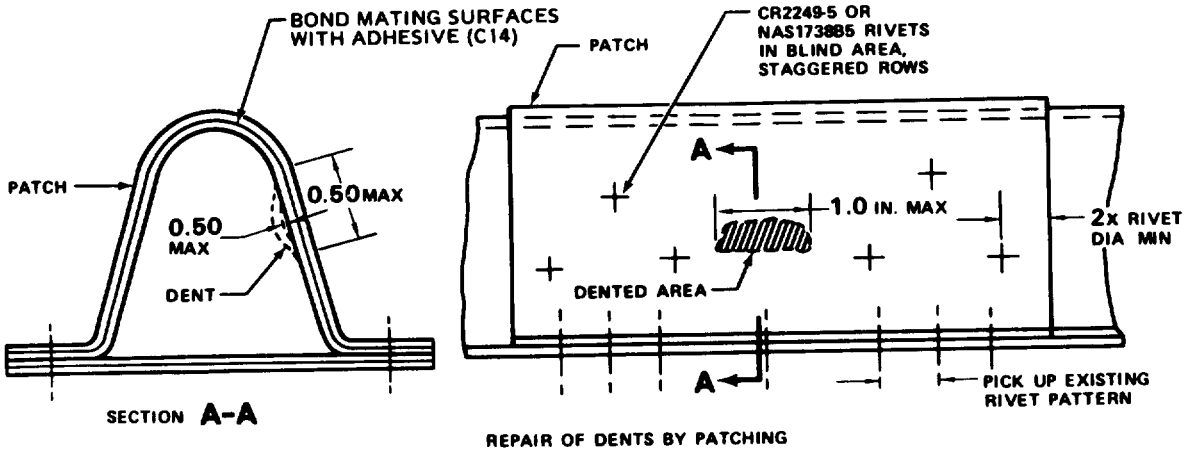
NOTE

Scratches on a web area that extend into the critical area at an angle greater than 45 degrees are not acceptable.



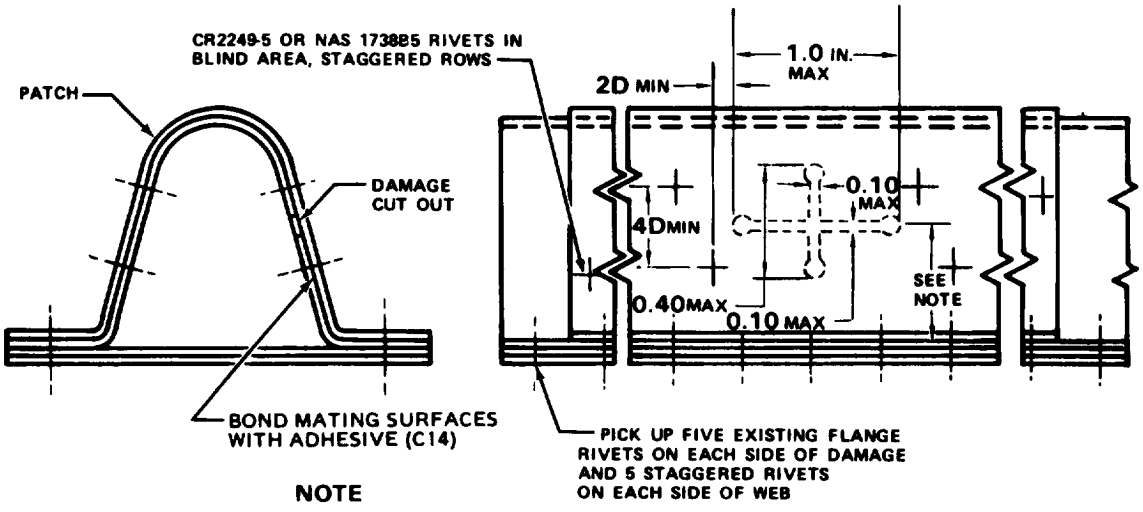
DETAIL C

NICKS, NOTCHES AND SCRATCHES



REPAIR OF DENTS BY PATCHING

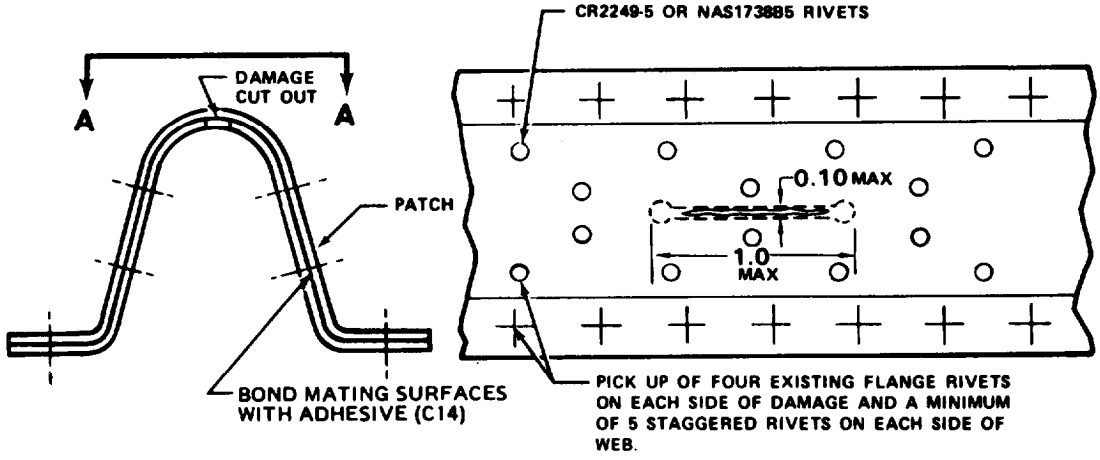
Figure 2-69. Longeron Damage and Repair Criteria (Sheet 1 of 3)



NOTE

All longitudinal cracks are repairable if they are located within the following limits: 0.45 inch minimum height from longeron flange, 1.04 inches maximum height from longeron flange.

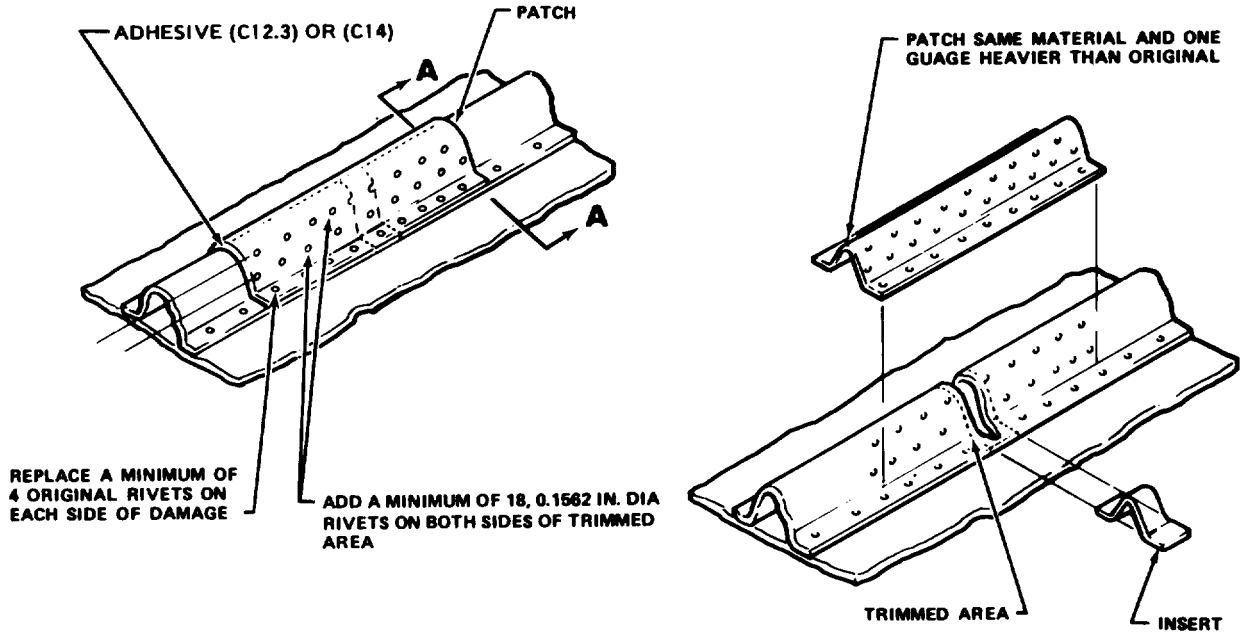
REPAIR OF LONGITUDINAL OR LATERAL CRACKS IN WEB AREA, BY PATCHING



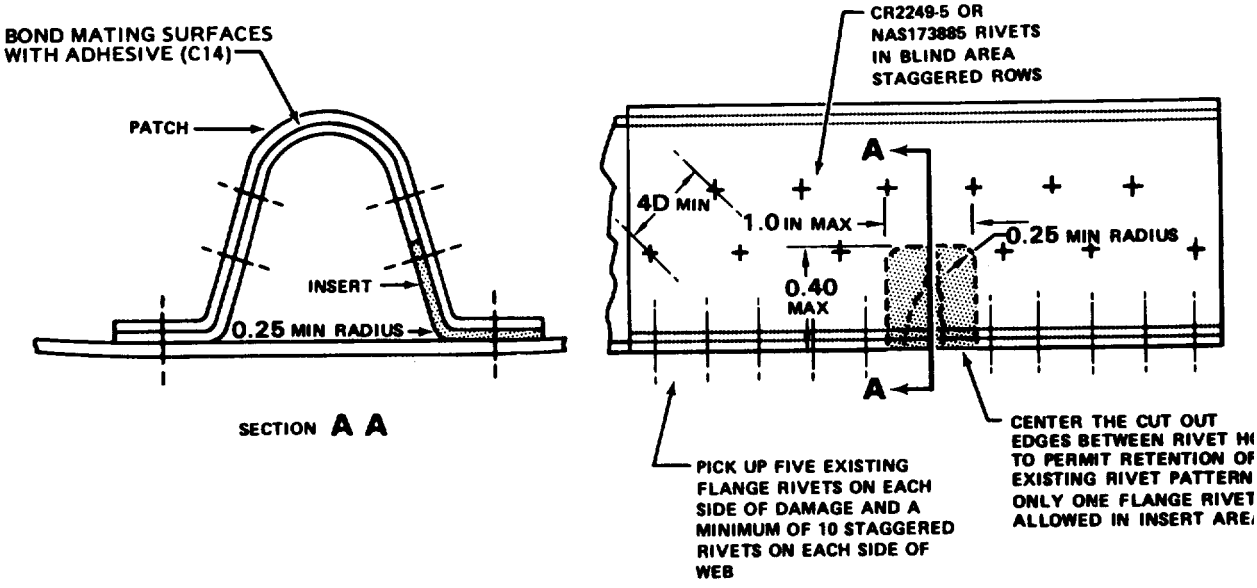
VIEW A-A

REPAIR OF LONGITUDINAL CRACKS IN CRITICAL AREA, BY PATCHING

Figure 2-69. Longeron Damage and Repair Criteria (Sheet 2 of 3)



FULL INSERTION REPAIR



REPAIR OF CRACKS BY INSERTION

Figure 2-69. Longeron Damage and Repair Criteria (Sheet 3 of 3)

NOTE

Only one repair may be made on each longeron in any tailboom bay. No repair allowed in forward bay. Refer to table 2-7 for repair limits and areas.

NOTE

All splice areas or any bonded area should be repaired only with qualified engineering authority.

(1) Polish out acceptable nicks, notches and scratches with No. 400 grit abrasive paper (C233).

NOTE

When removing corrosion, be sure to check pockets and hidden areas for indications.

(2) Refer to paragraph 2-14 for cleaning and treatment of corroded parts.

(3) Polish scratches on longeron web surfaces and acceptable scratches in critical area to a maximum length of 0.75 inch, maximum width of 0.04 inch and no deepter than 10 percent of material thickness with No. 400 grit abrasive paper (C185.2).

(4) Polish nicks and notches on flanged edges of longerons to a maximum length of 0.80 inch, maximum width of 0.04 inch and to a depth not to exceed 10 percent of material thickness with No. 400 grit abrasive paper (C233).

(5) Longitudinal cracks in the critical and web areas may be repaired by patching provided the cleanup area does not exceed 1.0 inch long and 0.10 inch wide. Lateral cracks in web areas may be repaired by patching provided the cleanup area does not exceed 0.40 inch long and 0.10 inch wide. Lateral cracks in flange and web areas may be repaired by insertion within limits shown on Sheet 2 and 3, figure 2-68.

(6) Smooth, contoured, non-sharp dents no deeper than 0.050 inch, not exceeding 0.500 inch wide and 1.0 inch long require repair by patching.

(7) Procedure for the repair of longeron cracks and dents by patching is as follows (Sheet 1 and 2, figure 2-69.):

NOTE

A patch shall not overlap or come any closer than 1.0 inch from a splice member or fitting.

NOTE

Longerons shall not be repaired by patching or insertion at any bulkhead when the patch extends into or beyond the bulkhead flanges,

(a) Check for loose, missing, sheared or damaged rivets, elongated rivet holes, and damage to skin.

(b) Stop drill ends of crack with a minimum stop drill diameter of 0.094 inch. Clean up damaged area taking care not to cut away more material than necessary.

(c) Procure a patch of same material, shape and one gage heavier than the longeron being repaired. Patch to be of sufficient size to pick up the specified number of rivets called out on figure 2-69.

(d) Drill out existing flange rivets that will interfere with placement of patch.

(e) Secure patch in position and drill rivet holes of the required size and pitch as shown on figure 2-69. Back drill existing flange rivet holes to pickup patch flange holes. Remove patch and deburr all holes.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(f) Clean paint and dirt from mating surfaces of damaged area by wiping mating surfaces with a clean cloth moistened with naphtha (C178). The paint shall be removed in the mating area by sanding lightly with No. 400 grit abrasive paper (C233). Remove the. sanding residue with a clean cloth moistened with naphtha. The mating surface shall be wiped dry with a clean dry cloth before the naphtha evaporates.

NOTE

Do not prime patch or longeron in area to be bonded.

(g) Apply a smooth coat of adhesive (C29) to patch and longeron mating surfaces. Adhesive may be applied by spatula, notched trowel, wood applicator or by flowing into place.

(h) Secure patch in position and rivet in place while adhesive is still tacky.

(i) Wipe off excess adhesive and coat repaired area with epoxy primer (C110). Allow adhesive to cure for **24 TO 48** hours at room temperature.

(8) Procedure for the repair of longeron damage by insertion is as follows (Sheet 3, figure 2-69.)

NOTE

A patch shall not overlap or come any closer than 1.0 inch from a splice member or fitting.

NOTE

Longerons shall not be repaired by patching or insertion at any bulkhead when the patch extends into or beyond the bulkhead flanges.

(a) Inspect longeron splice areas for separation of splice and longeron, cracks and breaks, missing or damaged rivets, and other damage. Such damage is not repairable. Twisted, misaligned or deformed longerons are not repairable. If crack in the longeron is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

(b) Check for loose, missing, sheared or damaged rivets, torn or elongated rivet holes, and damage to skin.

(c) Cut out damaged material to remove all ragged edges and stretched metal. Center trimmed edges of cutout in such a manner as to permit retention of existing rivet pattern. Do not remove more material than necessary.

(d) Procure a patch of same material, shape and one gage heavier than the longeron being repaired. Patch to be of sufficient size to allow replacement of required number of flange rivets and placement of correct number of rivets on each side of insert.

(e) Procure an insert of same material, gage and shape as original part. Insert shall be of size to completely fill cutout area.

(f) Drill out existing flange rivets as necessary.

(g) Position insert and patch and drill required rivet holes in suitable pattern, maintaining proper spacing and edge distance. Deburr as necessary.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(h) Clean paint and dirt from mating surfaces of damaged area by wiping mating surfaces with a clean cloth moistened with naphtha (C178). The paint shall be removed in the mating area by sanding lightly with 400 grit abrasive paper (C233). Remove the sanding residue with a clean cloth moistened with naphtha. The mating surface shall be wiped dry with a clean dry cloth before the naphtha evaporates.

NOTE

Do not prime patch or longeron in area to be bonded.

(i) Apply a smooth coat of adhesive (C29) to patch, insert and longeron mating surfaces. Adhesive may be applied by spatula, notched trowel, wood applicator or by flowing into place.

(j) Secure patch and insert in position and rivet in place while adhesive is still tacky.

(k) Wipe off excess adhesive and coat repaired area with epoxy primer (C110). Allow adhesive to cure for **24 TO 48** hours at room temperature.

c. Chafing (bumper) pad installation on tailboom.

NOTE

Chafing damage to tailboom skin caused by tail rotor driveshaft doors may be prevented by installation of chafing (bumper) pads.

(1) Cut six bumper pads to dimensions shown on figure 2-70 from nylatron (C181).

(2) Install bumper pads on tailboom at stations 39.43, 81.44, 121.33, 144.28, 165.23 and 195.3 in position shown in figure 2-69. Bond bumper pads to tailboom with sealing compound (C244). Install two rivets outboard of tail rotor driveshaft cover as shown on figure 2-70.

d. Repair tail rotor driveshaft cover support angles and hinges. Repair angles and hinges in accordance with instructions in figure 2-71.

e. Repair tail rotor driveshaft access cover.

(1) Replace unserviceable hinges and fasteners.

(2) Repair skin using standard repair methods.

f. Repair damaged formers on forward bulkhead. Refer to repair procedures in figure 2-72.

g. Repair of bulkhead web damage.

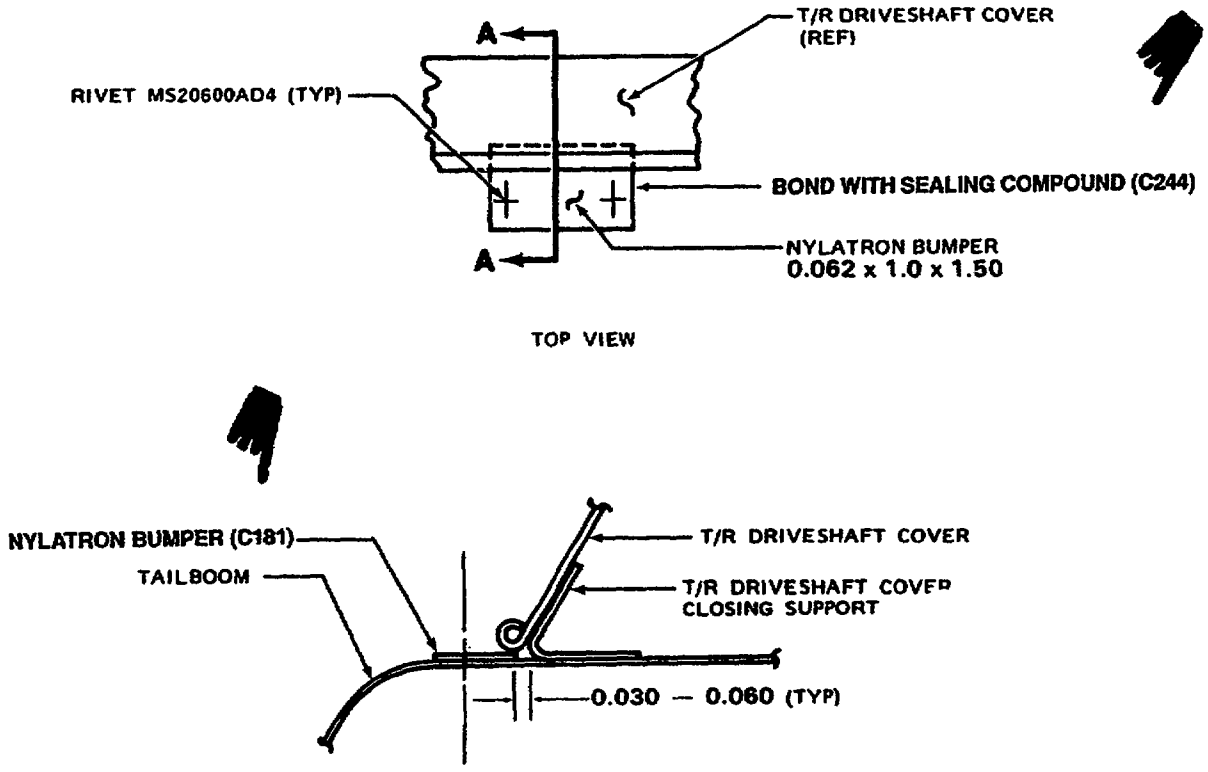


Figure 2-70. Tailboom Chafing Pad Installation

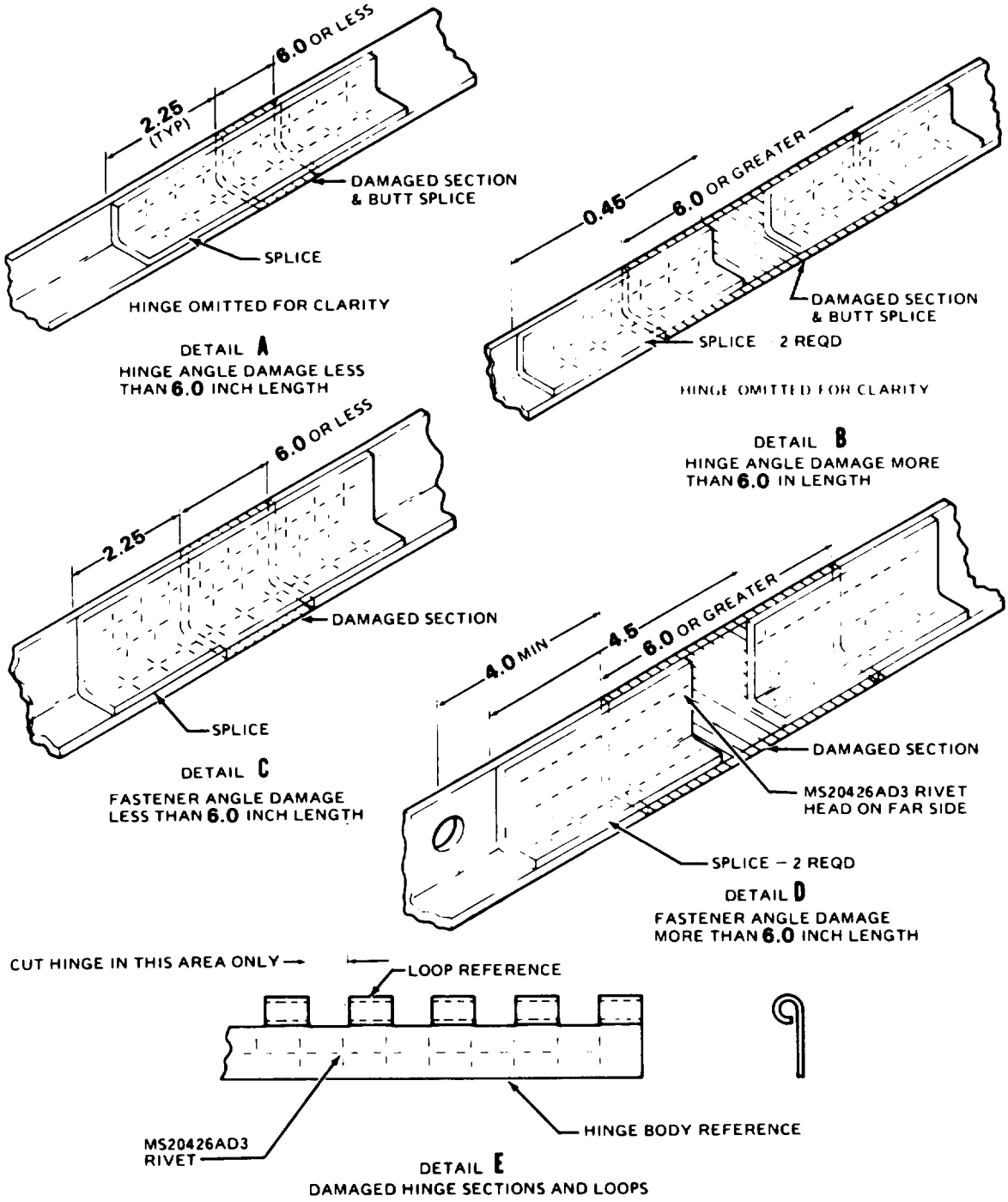


Figure 2-71. Repair of Driveshaft Cover Support Angles and Hinges (Sheet 1 of 3)

APPLICATION A:

For damaged hinge angles with damage less than 6.0 inches in length.

PARTS REQUIRED A:

● (1) Like butt section same as removed section.
(2) Nesting like section splice angle long enough to overlap existing angle 2.25 inches each end.

PROCEDURE A:

● (1] Cut out and remove damaged section of angle. Replace with the like butt section.
(2) Install the nesting splice angle. Pick up all existing rivets.
(3) Add additional 0.0937 rivets through hinge and vertical flange centered between existing rivets.

APPLICATION B:

For damaged hinge angles with damage more than 6.0 inches in length.

PARTS REQUIRED B:

● (1) Like butt section same as removed section.
● (2) Nesting like section splice angle 4.5 inches long for each butt joint.

PROCEDURE B:

● (1) Cut out and remove damaged section of angle. Replace with the like butt section.
(2) Install the nesting splice angle centered over each butt joint. Pick up all existing rivets.
(3) Add three additional 0.0937 rivets in each splice through hinge and vertical flange centered between existing rivets.

APPLICATION C:

For damaged fastener angles with damage less than 6.0 inches in length.

PARTS REQUIRED C:

● (1) Like butt section same as removed section,
(2) Nesting like section splice angle long enough to overlap existing angle 2.25 inches at each end.

PROCEDURE C:

(1) Cut out and remove damaged section of angle, Do not cut within 4.0 inches of fastener centerline, Replace removed section with the like butt section.
(2) Install the nesting splice angle. Pick up all existing rivets.
(3) Add a double row staggered rivet pattern of 0.0937 flush rivets in the vertical flange maintaining 0.25 inch E. D. and approximately 0.85 inch spacing.

APPLICATION D:

For damaged fastener angles with damage more than 6.0 inches long,

PARTS REQUIRED D:

● (1) Like butt section same as removed section.
● (2) Nesting like section splice angle 4.5 inches long for each butt joint.

Figure 2-71. Repair of Driveshaft Cover Support Angles and Hinges (Sheet 2 of 3)

PROCEDURE D:

(10) Cut out and remove damaged section of angle. Do not cut angle within 4.0 of fastener centerline. Replace removed section with the like butt section.
(2) Install the nesting like section centered over each joint. Pick up all existing rivets.
(3) Add a double row staggered rivet pattern of 0.0937 flush rivets in the vertical flange overlap areas maintaining 0.25 edge distance and approximately 0.85 spacing.

APPLICATION E:

For bent hinge sections and hinge loops.

PROCEDURE E:

Hand form and check for cracks. If cracked, repair per application "F" or "G"

APPLICATION F:

For damaged hinge half section.

PARTS REQUIRED F:

Like butt section same as removed section.

PROCEDURE F:

(1) Cut out and remove damaged section. Replace with the like butt section.
(2) Pick up existing rivets and add additional 0.0937 rivets centered between existing rivets.

APPLICATION G:

For cracked and/or worn through hinge loops.

PROCEDURE G:

(1) Cut off hinge loop flush with hinge body.
(2) Radius edges and refinish.

LIMITATIONS G:

No more than one loop may be removed in any 8.0 length. If exceeded repair per application "F".

- **2024-T42 Al Aly, 0.040 Thick**

204030-1003-3

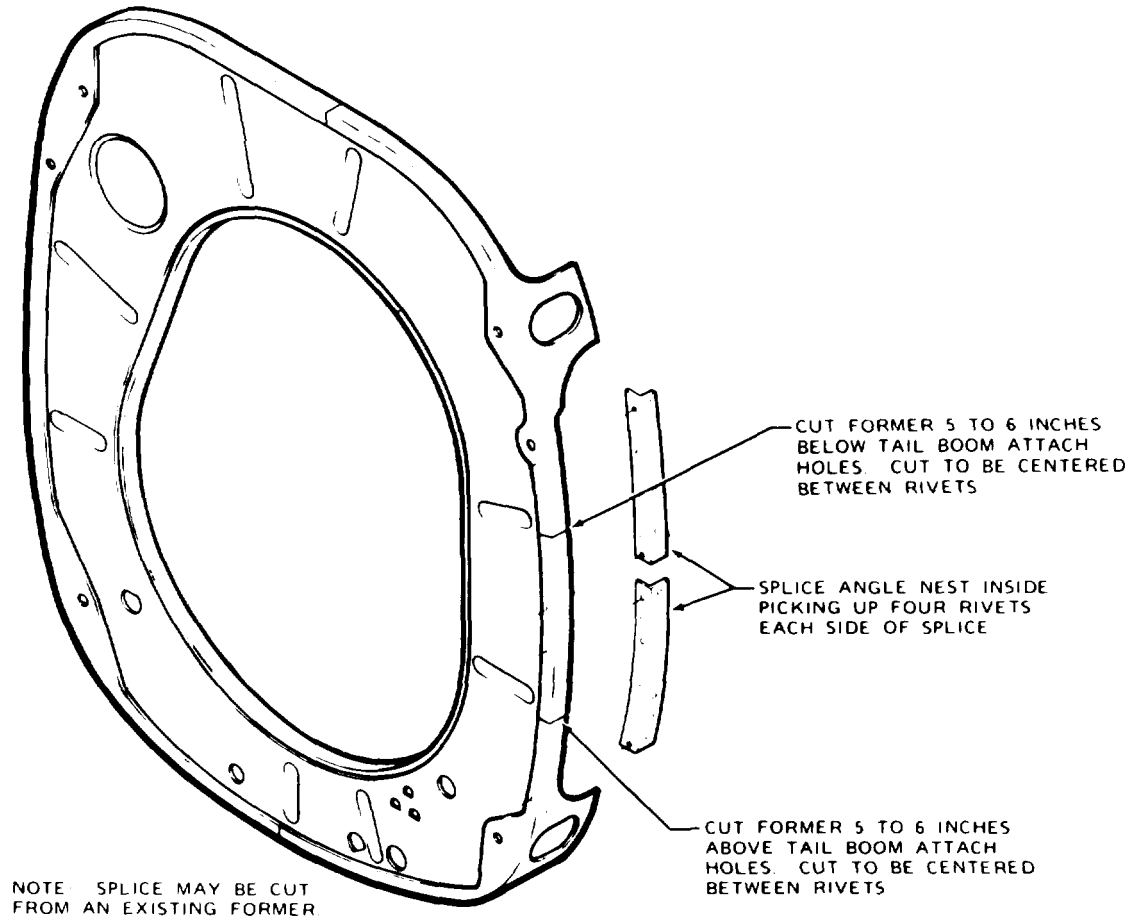
Figure 2-71. Repair of Driveshaft Cover Support Angles and Hinges (Sheet 3 of 3]

(1) Nicks, scratches and dents classified as negligible, may be polished out with pads (C11) or 400 grit abrasive paper (C233).

NOTE

When removing corrosion be sure to check pockets and hidden areas for indications. Refer to paragraph 2-14 for cleaning and treatment of corroded parts. Allow only one splice repair on each repairable bulkhead.

(2) Repair cracked lightening holes and web damage that can be repaired by a single patch and insert (figure 2-73, sheet 2),



REPAIR FOR DAMAGED TAILBOOM FRONT BULKHEAD FORMER

APPLICATION:

Repair of cracked former on forward bulkhead.

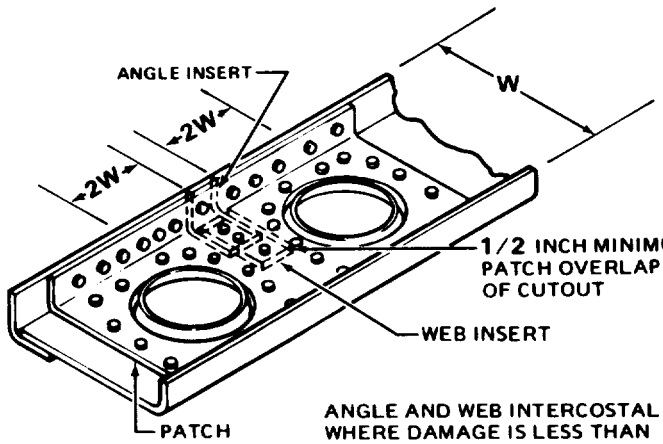
PARTS REQUIRED:

(1) Like section of portion of former which is being replaced.
(2) Nesting like section splice angle long enough to pick up four rivets on each side of butt joint in former.
(3) Original type rivets.

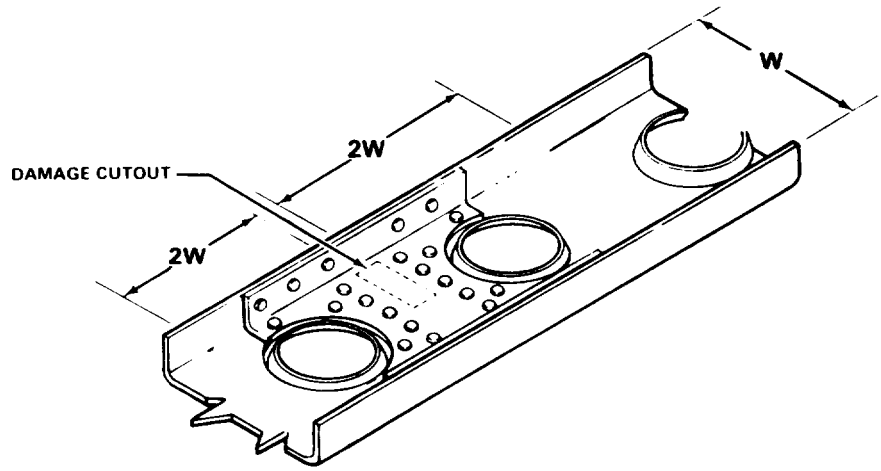
PROCEDURE:

(1) Remove the required number of rivets to allow the former to be cut as shown in illustration.
(2) Remove discrepant portion of former.
(3) Install new like section of former and splice angle as shown in illustration using existing type rivets and location. Bond splice angle with adhesive (C29).

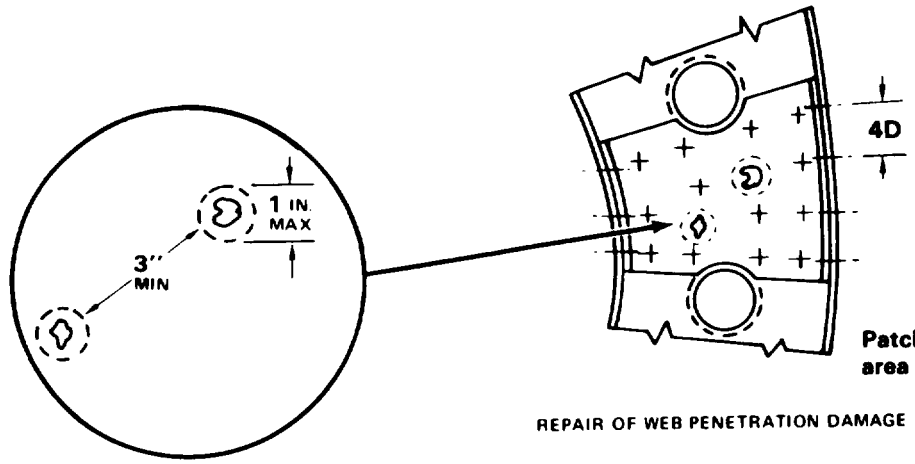
Figure 2-72. Repair of Damaged Tailboom Forward Bulkhead Former



ANGLE AND WEB INTERCOSTAL DAMAGE
WHERE DAMAGE IS LESS THAN
ONE HALF OF CROSS SECTION



FLANGED INTERCOSTAL DAMAGE
WHERE DAMAGE IS ONE HALF OR
GREATER OF CROSS SECTION



NOTE

Patch should overlap cleanup area a minimum of 1.0 inch.

REPAIR OF WEB PENETRATION DAMAGE

Figure 2-73. Bulkhead, Web Damage and Repair Criteria (Sheet 1 of 3)

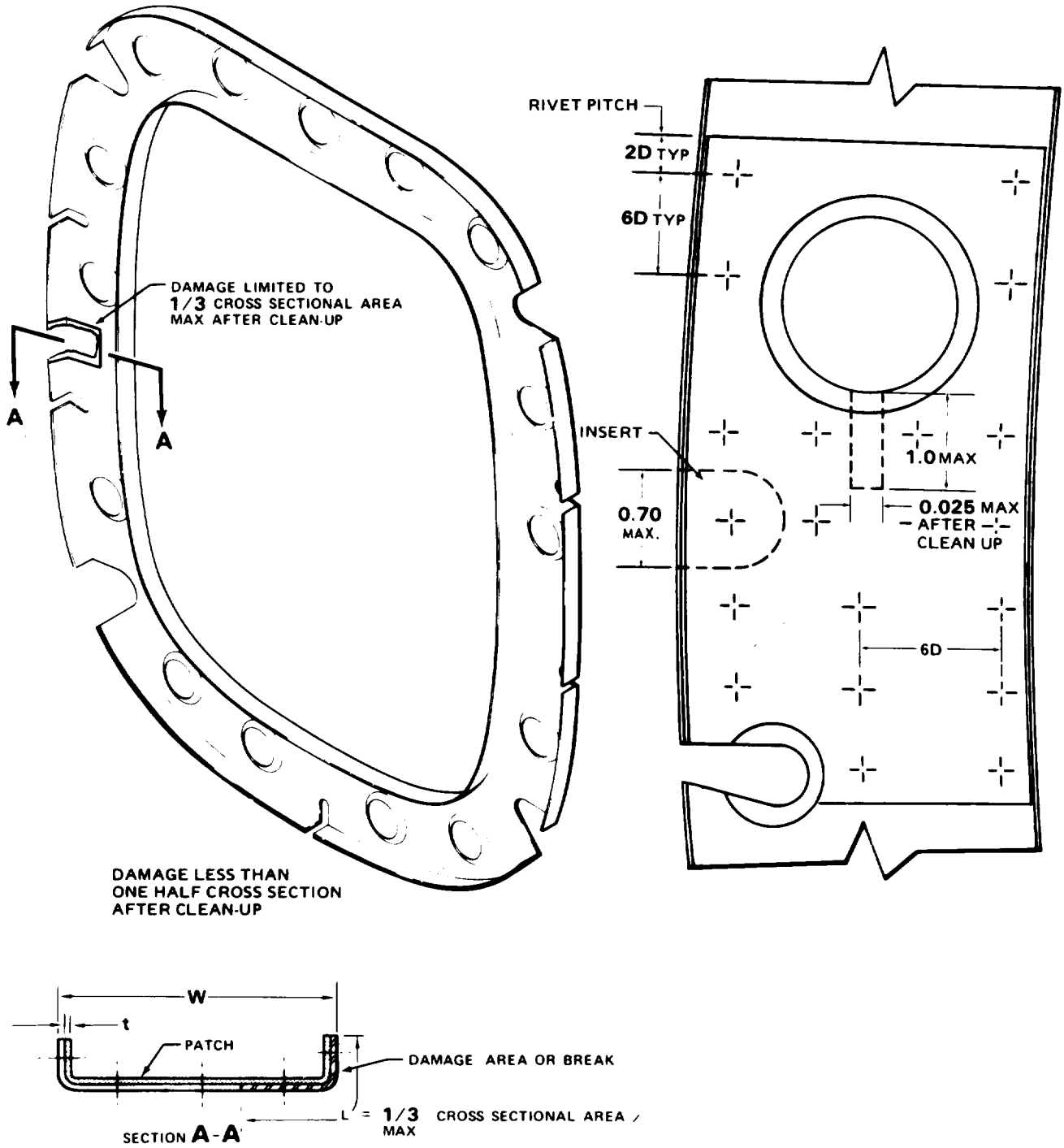


Figure 2-73. Bulkhead, Web Damage and Repair Criteria (Sheet 2 of 3)

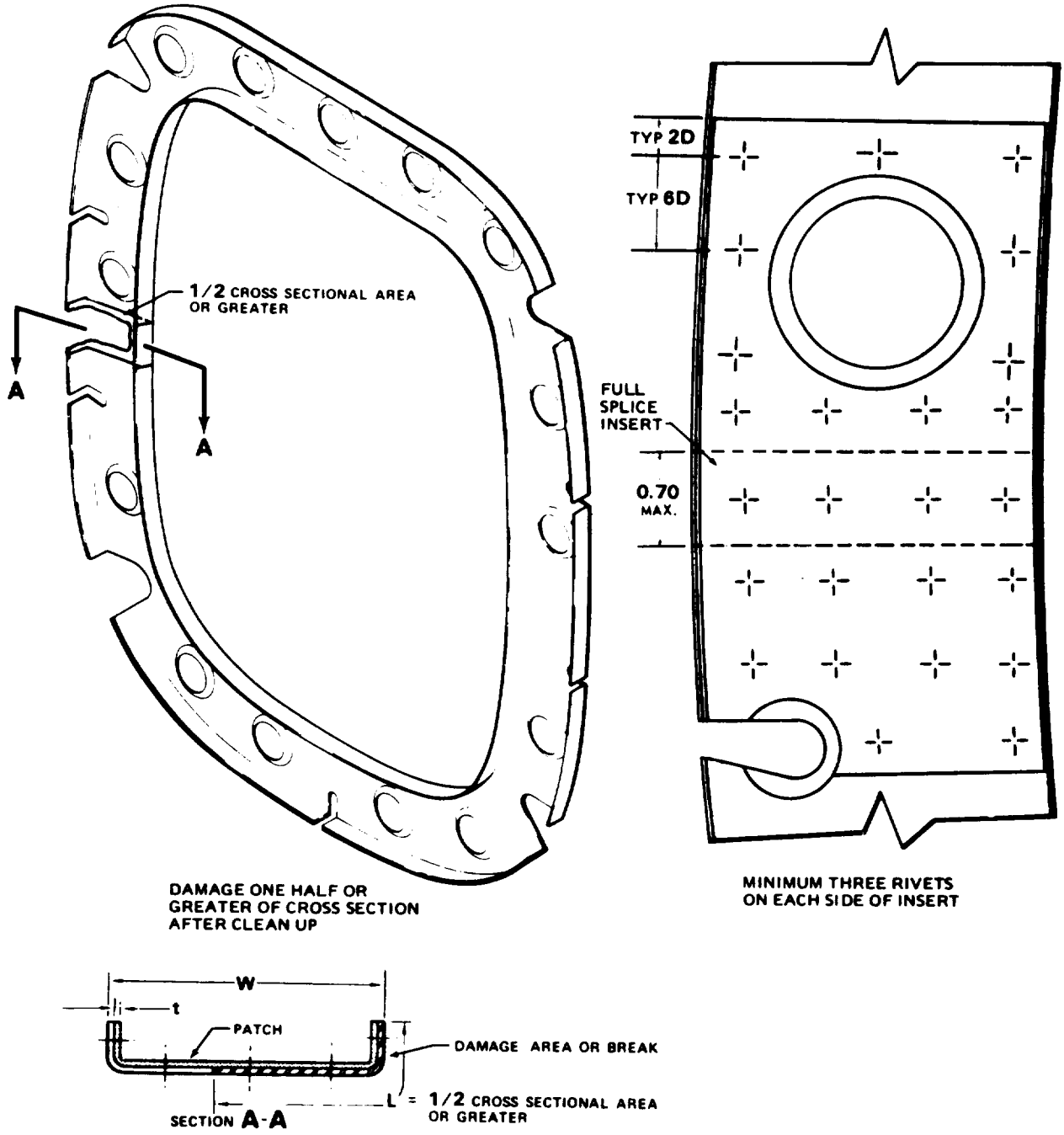


Figure 2-73. Bulkhead, Web Damage and Repair Criteria (Sheet 3 of 3)

(a) Stop drill cracks which extend less than 1.0 inch between lightening holes or hole and flange angle.

(b) Prepare and install patch in accordance with step (5) below.

(3) Cracks between two lightening holes, or which extend at least one-half the distance between lightening holes or lightening hole and flange angle, shall be repaired as follows:

(a) Cut out damaged area to include all ragged edges and stretched metal.

(b) Fabricate patch of same material and gage as that of part being repaired. Patch shall be of sufficient size to extend at least one-half the diameter of both lightening holes in damage area and full flange width.

(c) Secure patch over damaged area, as shown on sheet 1, figure 2-73, and drill suitable rivet pattern, maintaining proper spacing and edge distance. Deburr rivet holes,

(d) Clean all paint and dirt from around damaged area and both sides of patch.

(e) Apply coat of zinc chromate primer (C312) to damaged area and to both sides of patch. Allow primer to dry.

(f) Secure patch in position and rivet in place.

(g) Apply coat of zinc chromate primer (C312) to repair area.

(4) Repair of web penetration damage is as follows (sheet 1, figure 2-73).

(a) Cut round or elongated hole according to shape of puncture or tear in order to clean up ragged edges and stretched metal. Allow generous radii at all corners.

(b) Cut and form a patch of same material and thickness as damaged web and flange.

(c) Remove paint and dirt from damaged area.

(d) Secure patch in position and drill rivet holes of same size and pitch as surrounding area (sheet 1, figure 2-73). Deburr all holes

(e) Apply a coat of zinc chromate primer (C312) to both sides of patch and damaged area. Allow to dry,

(f) Secure patch in position and rivet in place.

(g) Apply a coat of zinc chromate primer (C312) to repaired area.

(5) Insert or splice repair of bulkhead, Intercostal and rib webs is as follows (sheets 2 and 3, figure 2-73)

(a) Cut out damaged area to include all ragged edges and stretched metal. Allow generous radii at all corners. Deburr.

(b) Fabricate a patch of same material and gage as original part. Patch shall be of size sufficient to cover damage and provide edge distance in both members, If repair requires the use of an insert, fabricate insert of same material and gage as original part. Inserts shall be of size to completely fill cut out area. Patches and inserts shall include cut outs for lightenting holes as necessary.

(c) Drill out existing rivets which would interfere with repair.

(d) Position patch, and insert if used, and drill suitable rivet holes, maintaining proper spacing and edge distance as outlined on figure 2-73. Deburr as necessary.

(e) Clean paint and dirt from patch, insert and damaged area.

(f) Apply a coat of primer (C312) to both sides of patch, insert and damaged area. Allow primer to dry.

(g) Secure patch and insert in position and rivet in place.

(h) Apply a coat of primer (C312) to repaired area.

h. Repair damaged or worn tail rotor gear box support fitting. See figure 2-63 for damage limits.

(1) Repair chafed areas as follows:

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(a) Clean chafed area with methyl-ethyl-ketone (C177).

(b) Abrade chafed area with 400 grit paper (C233).

(c) Clean chafed area with methyl-ethyl-ketone (C177), and wipe dry with clean cloth.

(d) Immediately coat area with adhesive (C29) or equivalent. Build up area in excess of original surface by approximately **1/16** inch. Cure at room temperature for **24** hours.

(e) File, sand or machine the affected area to meet the original contour of the support fitting.

NOTE

Above repair procedures shall be utilized only if casting remains on tailboom.

(2) Repair support fitting with gearbox stud holes which are elongated or corroded beyond tolerance shown in figure 2-63. If corrosion is still present after reaming hole, corrosion limits in figure 2-62.1 apply.

(a) Ream out existing hole to a maximum diameter of **0.3594** plus **0.000**, minus **0.001**. Maintain hole relationship as shown on figure 2-74.

(b) Clean in accordance with TM 1-1500-344-23.

(c) Fabricate a bushing (Part No. UH-1S0054-1). Heat support fitting in bushing replacement area with a heat gun for approximately **1/2** hour (maximum temperature **275** degrees F). Chill bushing in dry ice and alcohol for minimum of **1/2** hour. Remove bushing from dry ice and install in magnesium casting using wet primer (C312).

(d) Ream bushing to final tolerance indicated in step (c) above.

(3) Repair support fittings with gearbox hold down stud holes which fail the mechanical damage and corrosion limits of figure 2-63.

(a) Corrosion/damage of the stud holes beyond the limits of figure 2-63 is allowed as shown in figure 2-62.1 but not within **.156** inch from each end of the hole. The depth of the allowable repair is dependent on the hole diameter.

(b) Using the graph of figure 2-63.1, determine the hole diameter in inches. Move vertically up from that diameter to intersect the diagonal line. At that intersection, move horizontally across and read the maximum repair depth in inches. For example, if the diameter of a hole is **.317** inch the maximum allowable repair is .**087** inch.

(c) Clean up corrosion/damage to the depth allowed and treat reworked area per TM 1-1500-344-23.

(d) Corrosion damage of the stud holes beyond the allowable limits of figure 2-63.1 may be repaired by bushing the hole per paragraph 2-296.h.(2) (a) thru (d). If corrosion/damage is still evident after reaming, an additional .**066** inch maximum cleanup is allowed. See figure 2-63.2. Note that no corrosion damage or cleanup is allowed on the hole surface within .**180** inch from the gearbox mating surface and **156** inch from the opposite end of the hole. Treat reworked area per TM 1-1500-344-23.

2-296.1. Repair - Vertical Fin (AVIM).

a. Remove tailboom from aircraft. Open vertical fin driveshaft cover and remove vertical fin driveshaft, tail rotor hub and blade assembly and 90° gearbox.

b. Inspect 90° gearbox support casting (4, figure 2-73.1) for corrosion damage in the gearbox attachment holes.

c. Carefully remove the twenty-one (21) rivets attaching the UH upper skin, P/N 205-030-899-7, to the 90° gearbox support fitting. Do not score or damage support fitting. Remove additional rivets securing the UH upper skin to the vertical fin from Fin Sta 5.08 to approximately Fin Sta 22.37 to provide access to crack area.

CAUTION

Do not remove any additional rivets securing the L/H lower skin, P/N 205-030-899-3, to the vertical fin. Do not remove rivets below Fin Sta 22.37.

d. Peel back UH upper skin, P/N 205-030-899-7, covering crack area. Do not crimp, bend, deform or otherwise damage skin. If additional access is required, notify ATCOM Engineering for direction.

e. Dye penetrant check crack area and locate end of crack. Stop drill crack using a No. 40 drill. Care should be exercised so as not to damage the vertical fin forward spar (3, Figure 2-73.1). Dye penetrant check crack are after stop drilling to be assured that no portion of the crack extends beyond the stop drill hole. If crack in the vertical fin is suspected, refer to TM 1-1520-256-23 AVUM/AVIM NDI procedures for UH-1 helicopter series.

f. Treat the stop drilled hole and crack area with primer (C219).

g. Remove the existing doubler (2, figure 2-73.1) located between Fin Sta 5.08 and Fin Sta 10.08 and beneath the vertical fin L/H upper skin. Following Figure 2-73.1 and using item 2 as a partial template, fabricate a repair doubler from .**032** inch thick, 7075-T6 aluminum alloy. The repair doubler is to be fabricated such that the overall length ("L") will: 1. Overlap the crack in the driveshaft cover attachment channel by **4.0** inches if the crack is lower than the top dzus fastener or, **2**. Overlap the top dzus fastener by **4.0** inches if the crack is above the top dzus fastener. See sheet 2, section B-B for a typical cross sectional view of the repair doubler below the 90° gearbox support casting.

h. Using the vertical fin support structure and item 2, pick up the rivet pattern on the repair doubler for all existing fasteners. Existing fasteners removed in step 3 were 1/8 inch diameter except those through the 90° gearbox support casting which were **5/32** inch diameter.

i. Fabricate the filler shown in figure 2-73.1, Sheet 2 from **.040** inch thick, 2024-T3 aluminum alloy to be inserted between the repair doubler and the driveshaft cover attachment channel from Fin Sta 10.08 to the edge of the repair doubler. Shape one edge of filler to fit the radius of vertical fin forward spar at the 90° gearbox support fitting as shown in figure 2-73.1, Sheet 2.

j. Temporarily install filler and repair doubler on the vertical fin. Using a No. 30 drill expand the existing rivet pattern to provide two rows of rivets in a transverse pattern shown in Figure 2-73.1 through the repair doubler and filler and into the vertical fin driveshaft cover attachment channel. Utilize standard sheet metal riveting practices with minimum spacings of 2D edge and 4D pitch distance.

k. Temporarily reinstall the L/H upper skin (peeled back in Step 4) over the repair doubler. Using a No. 30 drill, drill the six holes through the L/H upper skin at the lower end of the repair doubler parallel to Fin Sta 10.08 as shown in Figure 2-73.1, Sheet 1, to secure doubler to skin.

l. Peel back skin and remove the repair doubler and filler. Clean and deburr all holes and treat all affected surfaces with primer (C219).

m. Reinstall repair doubler and filler on vertical fin and overlay UH upper skin. Install fasteners in existing rivet pattern according to figure 2-73.1. Install NAS1738B4 rivets in the holes drilled in step 11. Install MS20426AD4 rivets flush to the outside in the expanded rivet pattern through the vertical fin driveshaft cover attachment channel. Seal gaps between the vertical fin forward spar and 90° gearbox support fitting with sealant (C244).

n. Due to the increased material thickness on the vertical fin driveshaft cover attachment channel, the topmost turnlock fastener stud on the vertical fin driveshaft cover may be changed from an A5T27 stud to an A5T37 stud if required.

o. Finish paint all exposed surfaces. Reinstall all items removed in Step a.

2-297. Painting - Tailboom Structures (TM 55-1500-345-23).

2-298. TAIL SKID.

2-299. Description - Tail Skid. A tubular steel tail skid is attached on lower aft section of tailboom.

2-300. Removal - Tail Skid.

a. Remove screws attaching two covers to lower tailboom fin, at aft end of tailboom. Remove covers (figure 2-75).

b. Remove nut, washer, and screw attaching forward end of skid tube to tailboom structural member. Pull out through support block.

2-301. Inspection - Tail Skid.

a. Inspect tail skid for deflection beyond maximum limit due to tail low landings of other causes. The painted stripes illustrated in figure 2-75 may be applied at aft end of tailboom for quick reference to determine whether tail skid is bent beyond limits.

b. Inspect for minor nicks, scratches, and dents; cracks or permanent buckles. Maximum allowable deflection of tail skid is approximately four inches vertical.

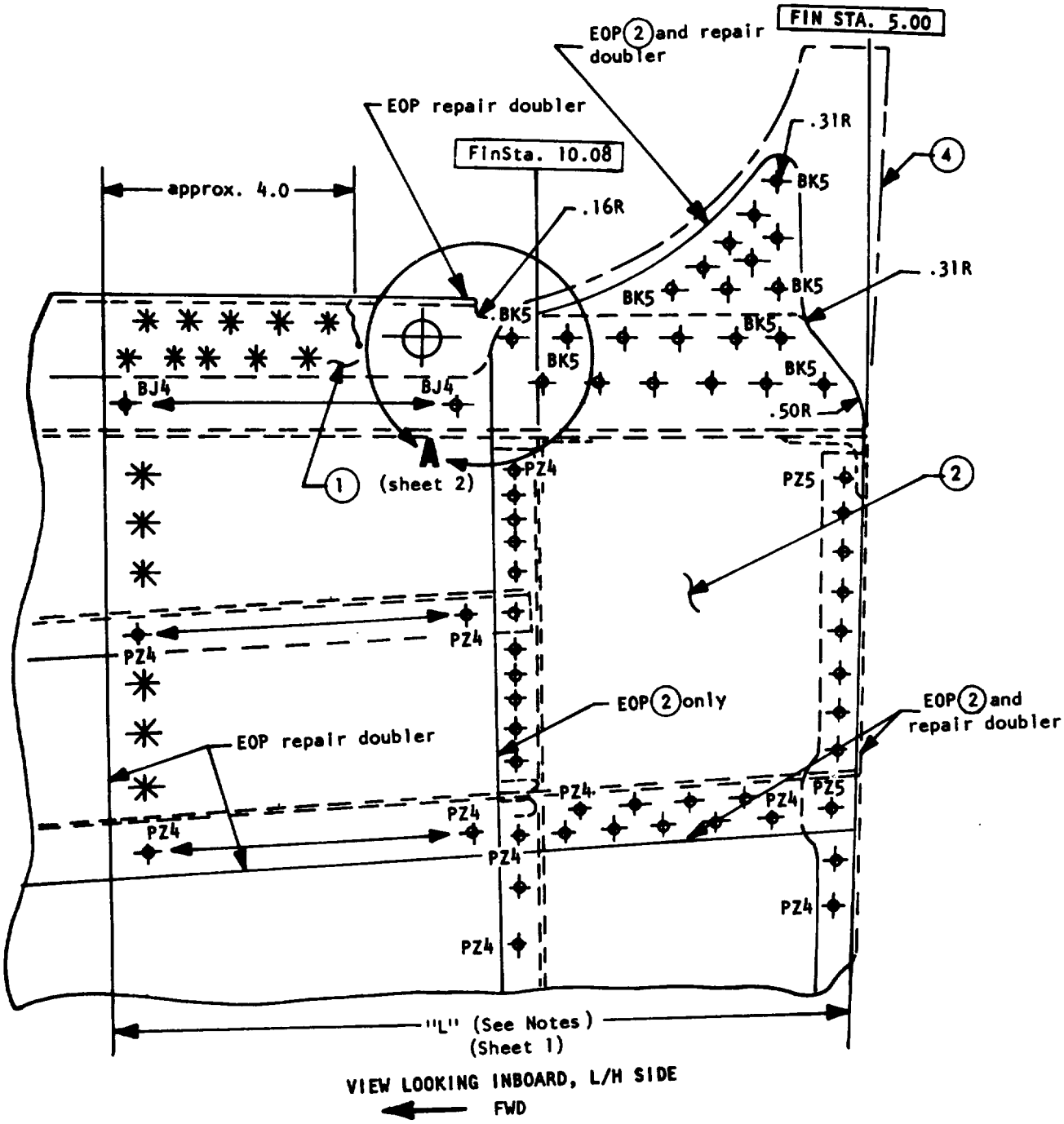
2-302. Repair or Replacement - Tail Skid.

a. Repair minor nicks, scratches or dents by polishing out.

b. Replace cracked or permanently buckled tail skid.

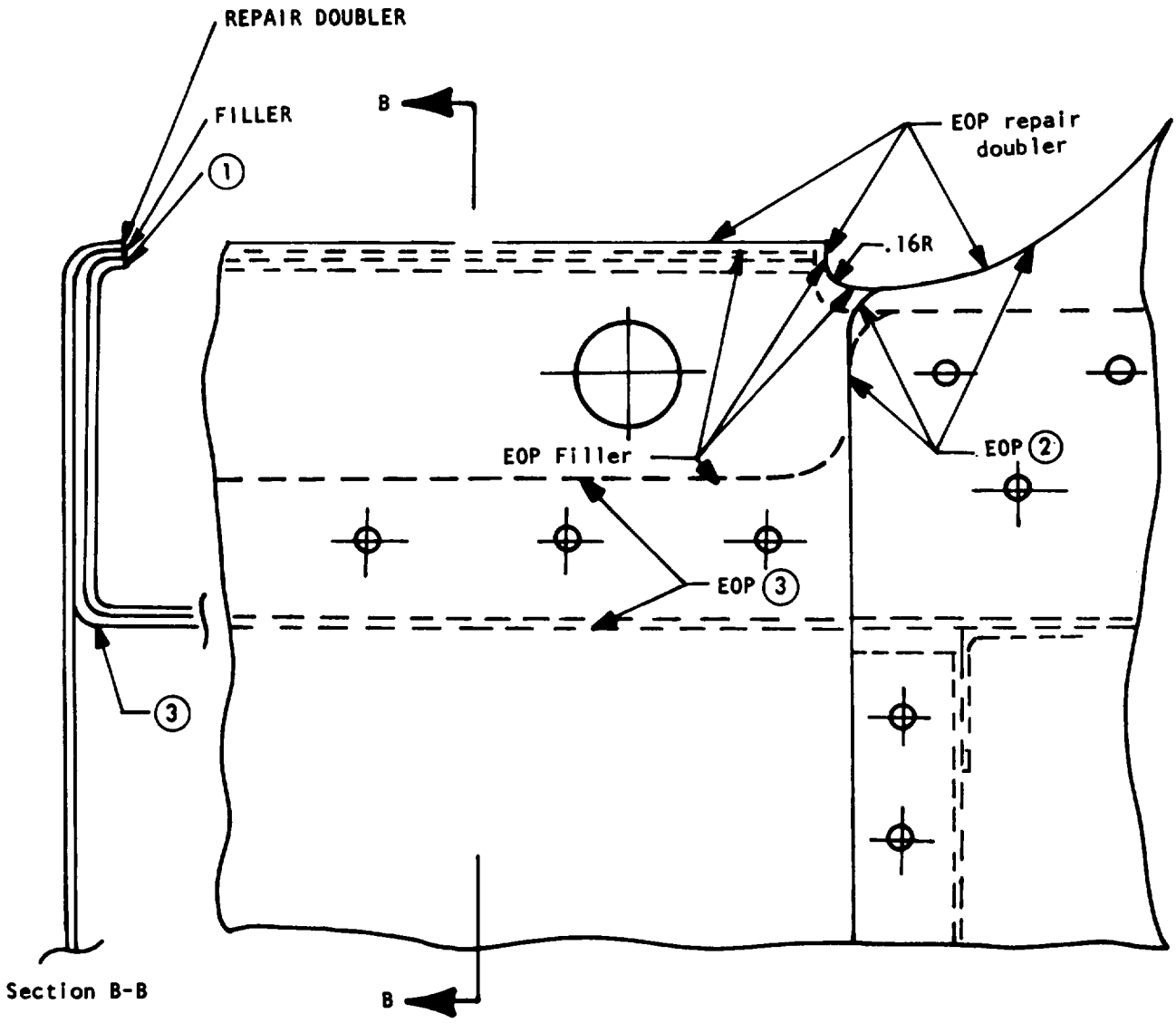
2-303. Installation - Tail Skid.

a. Insert tail skid tube (7, figure 2-76) through support block (5). Align holes in forward end of tail skid with holes in tailboom structural member, shim as required between skid and inner surfaces of support with AN960C10L washers to eliminate excessive clearance. Install attaching screw (11), washers (12), and nut (13).



NOTES:
1. L/H upper skin P/N 205-030-899-7 omitted For clarity purposes.
2. "L" determined by Location of Crack See paragraph B in instructions.
3. Install rivets in expanded rivet pattern (*) Flush to the outside.

Figure 2-73.1. Vertical Fin Repair (Sheet 1 of 2)



DETAIL A

LEGEND

CODE	DESCRIPTION
*	Expanded rivet pattern
⊕	Existing rivet pattern
PZ4	NAS1738B4 rivets
BJ4	MS20410AD4 rivets
BK5	MS20470B5 rivets

(1) Vertical Fin Driveshaft Cover Attachment Channel, P/N 205-030-846-4
(2) Doubler P/N 205-030-899-41
(3) Vertical Fin Forward Spar P/N 205-030-846-47
(4) 900 G/B Support Casting, P/N 204-030-828

Figure 2-73.1. Vertical Fin Repair (Sheet 2 of 2)

b. Position side covers on lower tailboom fin, at aft end of tailboom. Install attaching screws.

WARNING

Maximum of 50 pounds permitted on P/N 204-030-947-3.

2-304. Ballast Installation — Tail Skid. If ballast is required to keep the helicopter within CG limits, install ballast on tail skid as shown in figure 2-76.

2-305. Painting. Tail skid, refer to TM 55-1500-345-23.

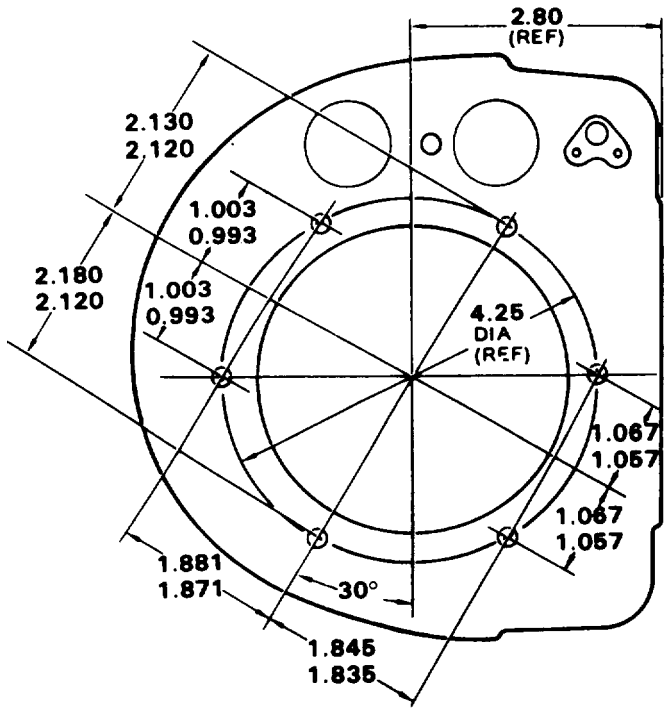


Figure 2-74. Tail Rotor Gearbox Support Fitting Hole Relationship

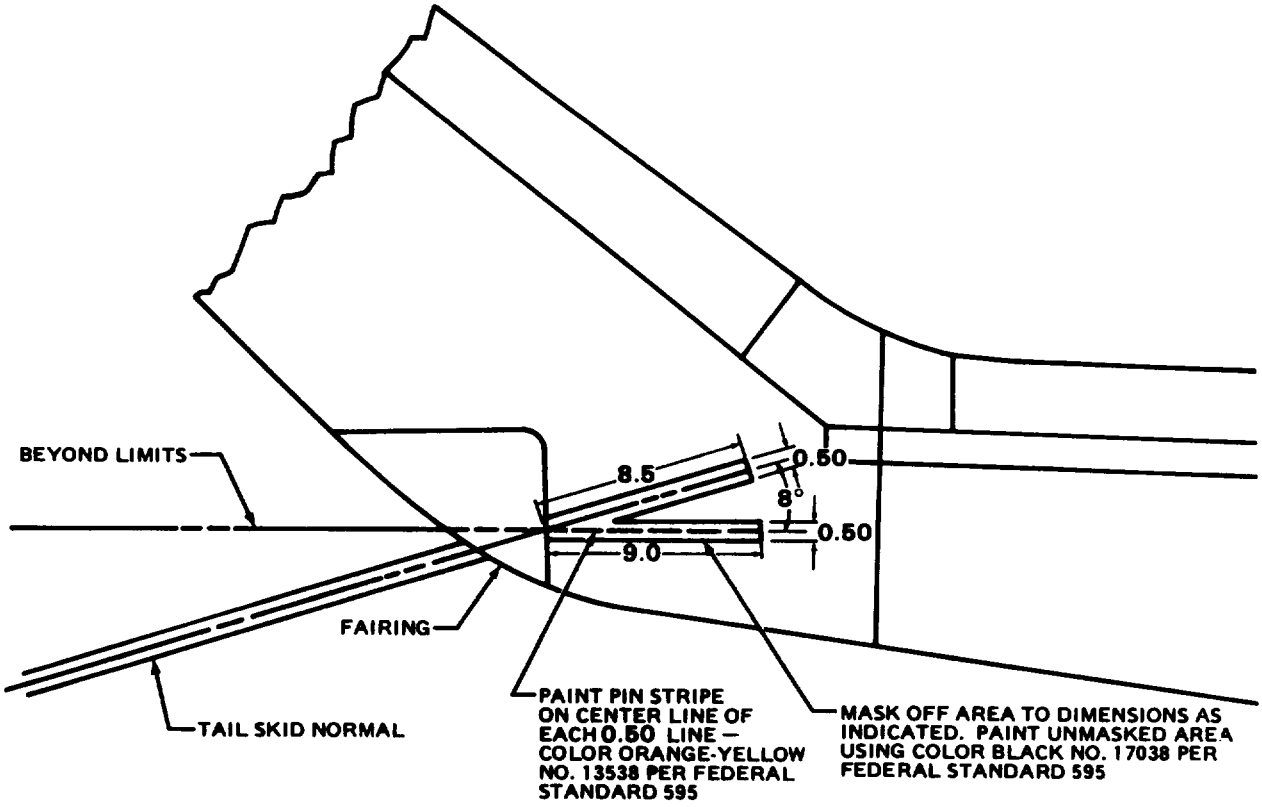
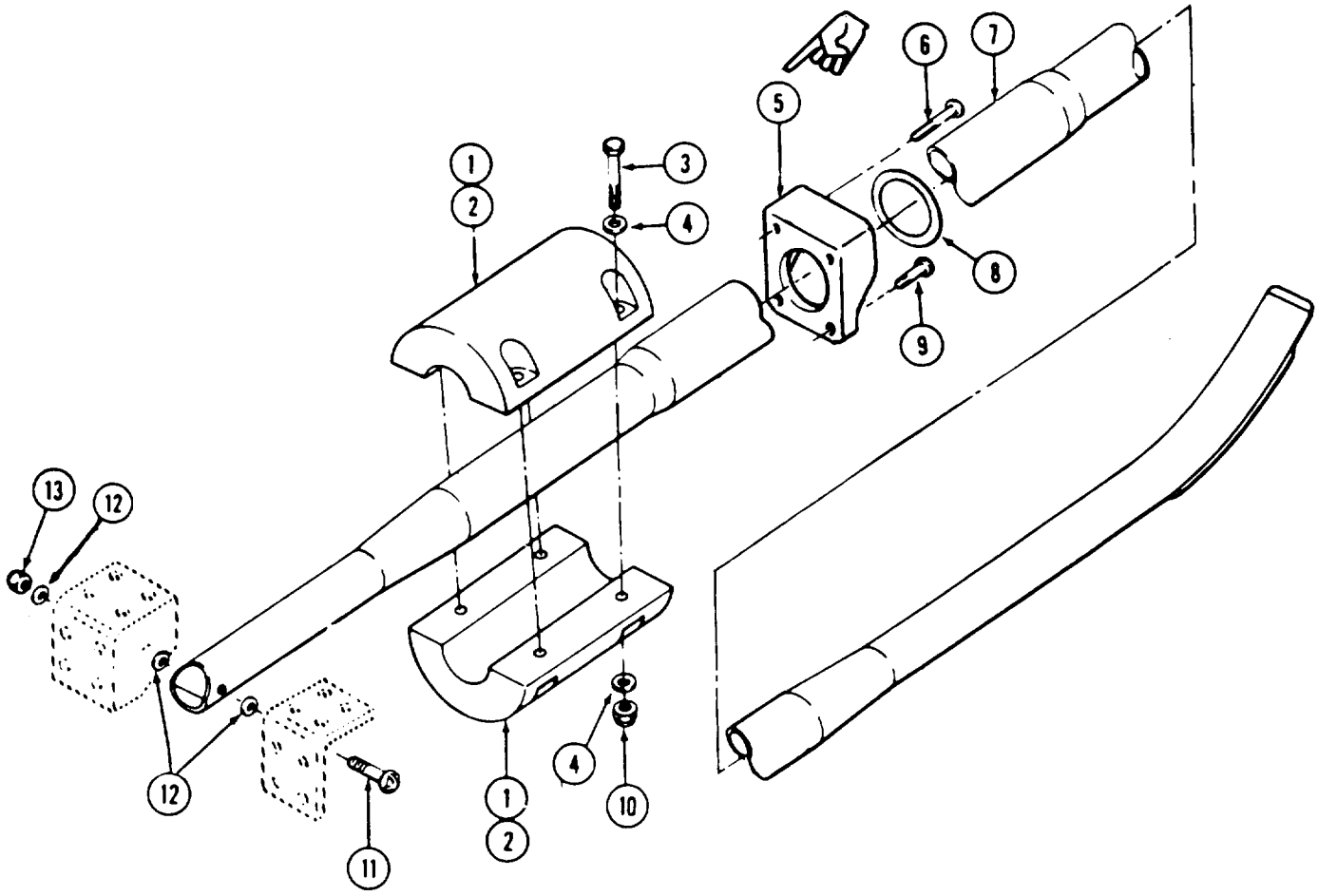


Figure 2-75. Tail Skid



1. 156OUH-1-347-3 weight, ballast 35.0 pounds
2. 156OUH-1-347-5 weight, ballast 50.0 pounds
3. Bolt
4. Washer
5. Support block
6. Screw
7. Skid tube
8. Pecking
9. Screw
10. Nut
11. Screw
12. Washers
13. Nut

Figure 2-76. Ballast Installation - Tail Skid

SECTION III WIRE STRIKE PROTECTION SYSTEM

2-306. WIRE STRIKE PROTECTION SYSTEM

2-307. Description—Wire Strike Protection System. The wire strike protection system (figure 2-77) protects against frontal impacts from horizontally strung wire and power transmission cables. The basic system consists of an upper cutter, a lower cutter, a central deflector to protect the windshield, and two side deflectors to protect the windshield wiper driveshafts.

a. Upper and Lower Cutters. Sawblades are used in the upper and lower cutters to abrade wires and deflect them into the primary wire cutting blades at the double wedge cutters. To prevent wires or cables from hanging up on the sawblades, the blades are installed with the teeth slanted toward the double wedge cutters. A cutter tip is attached to the lower cutter with shear rivets. The sheat rivets allow the tip to break away before helicopter structural damage occurs. Struts provide lateral support to the cutters during an off center strike.

b. Deflectors. A windshield deflector protects the windshield, deflects wires into the upper cutter, and provides additional structural support for the upper cutter assembly. A windshield wiper deflector mounted at each side of the windshield protects the windshield wiper driveshafts.

2-308. General information. Before performing operations that require drilling, cutting, grinding, or filing, mask, or otherwise protect, windshields, windows, air intake scoops, instrument panels, and pedestal consoles as necessary. In the following procedures, the holes in certain new parts may not be predrilled. In these instances, it will be necessary to position the part carefully, mark the location of the holes, then remove, drill, and deburr the part before final installation. Some parts may also require hand fitting for proper installation.

2-309. SAWBLADES.

2-310. inspection—Sawblades.

a. Inspect the sawblades (3 and 49, figure 2-78) for impact damage and peeling of the rubber coating. Sawblades with one or more missing or damaged teeth shall be replaced without repair. Repair or replace rubber coating on sawblade with sealant (C237).

b. If impact damage has occurred, inspect the cutter installation (paragraph 2-316 or 2-323).

2-311. Replacement—Sawblades.

a. Remove rivets (10 or 56, figure 2-78) and remove sawblade (3 or 49).

b. Clean sealant from cutter assemblies (2 or 48). (TM 43-0105.)

c. Position new sawblade (3 or 49) in cutter assembly (2 or 48) with the teeth slanted toward the cutter throat, and secure with rivets (10 or 56).

d. Mask the cutter assembly (2 or 48) on each side of the sawblade (3 or 49), and coat the sawblade with a thin application of sealant (C237). Allow the sealant to set and remove the masking.

2-312. CUTTER BLADES. The cutter blades provide the main cutting effort and consist of three cutter blades (4, 6, 7, and 50, 52, 53, figure 2-78) located in each cutter assembly (2 and 48). The blades are angled to minimize air frame impact load as the wires are being cut.

2-313. Inspection—Cutter Blades.

a. Inspect the cutting blades (4, 6, 7, 50, 52, and 53, figure 2-78) for impact damage and peeling of the rubber coating. Blades with nicks or abrasions on the cutting edge shall be replaced without repair. Repair or replace rubber coating on blades with sealant (C237).

b. If impact damage has occurred, inspect the cutter installation (paragraph 2-316 or 2-323).

2-314. Replacement—Cutter Blades.

NOTE

Removal of cutter throat blades (4, 7, 50, or 52, figure 2-78) may require removal of entry guide blades (6 or 53).

a. Remove nuts (13 or 59), washers (12 or 58), capscrews (11 or 57), and remove cutter blades (4, 6, and 7, or 50,52, and 53) noting the position of shims (5, 8, and 9, or 51, 54, and 55) if used.

b. Clean the sealant (TM 43-O 105) from cutter assemblies (2 or 48) and shims (5, 8, and 9, or 51, 54, and 55).

NOTE

Shims must be installed on the same side of the blades noted during removal.

c. Apply sealant (C237) to cutter blades (4, 6, and 7, or 50, 52, and 53) and shims (5, 8, and 9, or 51, 54, and 55), and position them in the cutter assembly (2 or 48).

d. Install capscrews (11 or 57), washers (12 or 58), and nuts (13 or 59).

e. Check the gap at the aft end of the cutter throat blades (4 and 7 or 50 and 52). The maximum allowable gap is 0.020 inch.

f. Clean off excess sealant (TM 43-0105), and prime and paint as required, TM 55-1500-345-23.

2-315. UPPER CUTTER INSTALLATION.

2-316. Inspection—Upper Cutter Installation,

a. Inspect the upper cutter assembly (2, figure 2-78) for loose fasteners, impact damage, scratches, nicks, gouges, corrosion, and paint deterioration. Replace assembly if scratches, nicks, or gouges exceed a depth of 0.010 inch, if impact damage has caused permanent bending, or corrosion exceeds negligible limits (table 2-3). Replace loose fasteners as necessary.

b. Inspect the sawblade (paragraph 2-310).

c. Inspect the cutter blades (paragraph 2-313).

d. Inspect strut assemblies (14 and 15) as follows:

(1) Inspect for paint deterioration, paint scratches, and corrosion. Corrosion shall not exceed negligible limits (table 2-3).

(2) Inspect for cracks, particularly in the welded area and the formed tab ends. Replace cracked strut assemblies.

(3) Inspect the tubes for bowing. The maximum allowable bow over the strut length is 0.060 inch. Replace strut assemblies that exceed this maximum.

(4) Inspect for loose fasteners and replace as necessary.

e. Inspect the deflector (16) as follows:

(1) Inspect for paint deterioration, scratches, corrosion, nicks, and gouges. Corrosion shall not exceed negligible limits (table 2-3). Scratches, nicks, or gouges to a depth of 0.010 inch in the deflector only may be repaired.

(2) Inspect the deflector (16) and clips (19 and 20) for impact damage and cracks. Replace the deflector or clips for cracks or permanent deformation.

(3) Inspect for loose fasteners, particularly at the clips (19 and 20), and for gaps between the clips and the windshield base. Gaps are not permitted; trim or replace as necessary.

f. Inspect the stiffeners (33 and 34) for cracks and permanent deformation. Replace stiffeners that are cracked or permanently deformed. Inspect for loose fasteners and replace as necessary.

g. Doubler. The doubler (32) provides additional structural support by distributing the wire cutting load to the canopy frame members; inspect as follows:

(1) Inspect for paint deterioration, scratches, and corrosion. Corrosion shall not exceed negligible limits (table 2-3). Scratches, nicks, or gouges to depth of 0.006 inch may be repaired.

(2) Inspect for cracks and permanent deformation. Replace the doubler if it is cracked or permanently deformed.

(3) Inspect for loose fasteners and replace as necessary.

2-317. Removal—Upper Cutter Installation.

a. Remove upper cutter assembly (2, figure 2-78) as follows:

(1) Remove nut (27), washer (26), and bolt (29) securing upper end of struts (14 and 15) to cutter assembly (2).

(2) Remove nuts (23), washers (31), capscrews (30), and remove cutter assembly (2). Note position of shims (37), if installed, and remove. Retain filler (18) with deflector assembly (16).

(3) Remove sawblade (paragraph 2-311).

(4) Remove cutter blades (paragraph 2-314).

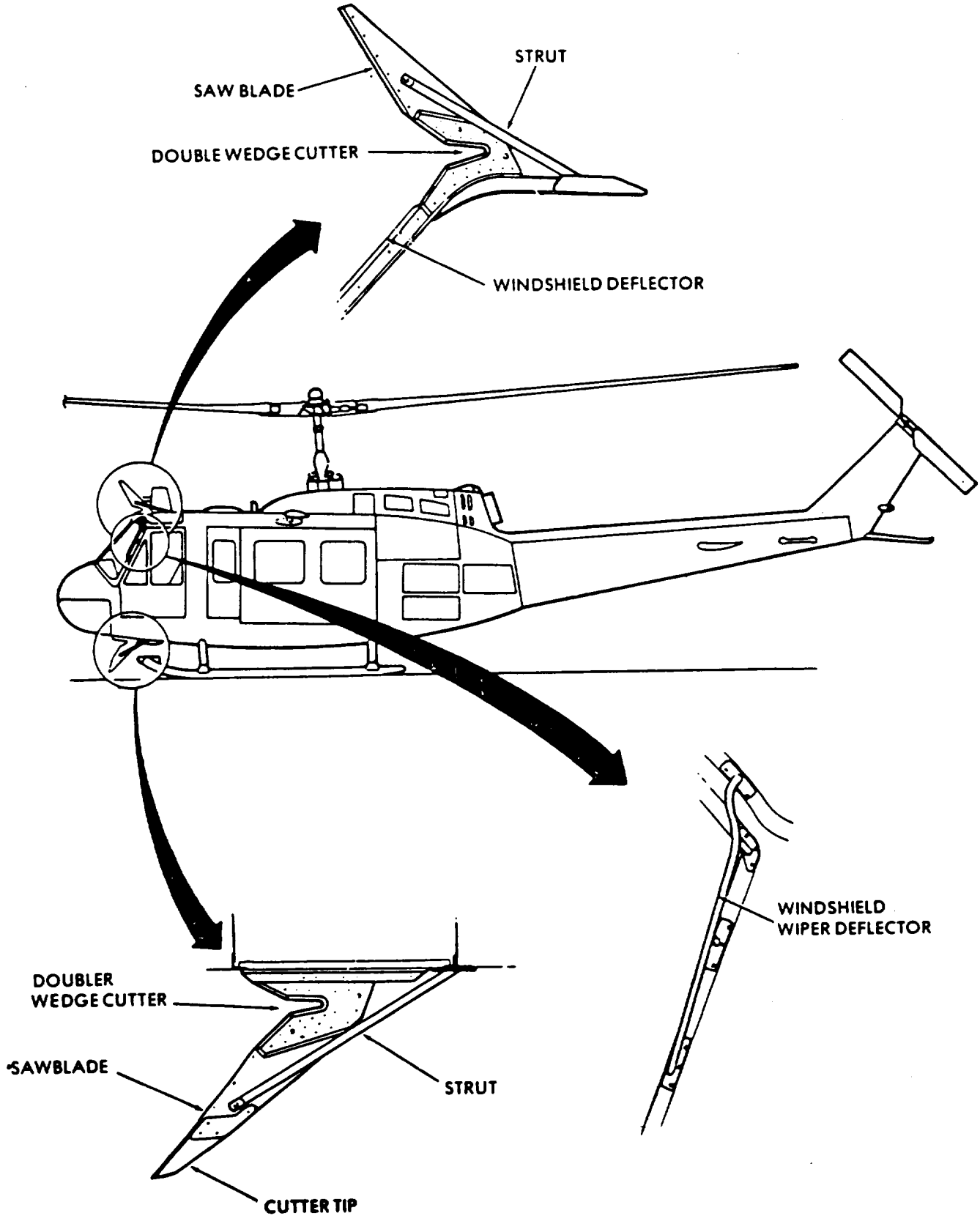


Figure 2-77. Wire Strike Protection System

b. Remove screws (44), washers (26), and strut assemblies (14 and 15).

c. Remove deflector assembly (16) as follows:

(1) Lower overhead circuit breaker panels.

(2) Remove windshield centermost cover plate, pull wire bundle from channel, and remove channel (paragraph 2-136 a and b).

(3) Remove nuts (27), washers (26), and screws (25 and 28) securing deflector (1 6).

(4) Remove nuts (23), washers (22), and screws (21) securing clips (19 and 20), and remove deflector assembly (16).

(6) Remove rivets (24) and remove clips (19 and 20) from deflector assembly (16).

d. Remove stiffeners (33 and 34) as follows:

(1) Lower overhead terminal board TB2, but do not disconnect wiring.

(2) Remove rivets (40 and 41) and remove stiffeners (33 and 34). Do not remove shims (35 and 36) from aircraft unless damaged.

CAUTION

To avoid damage to electrical wiring, use care when drilling out rivets.

e. Remove doubler (32) as follows:

(1) Remove pitot-static tube assembly (paragraph 8-169).

(2) If installed, disconnect proximity warning system upper antenna (TM 11-1520-210-20).

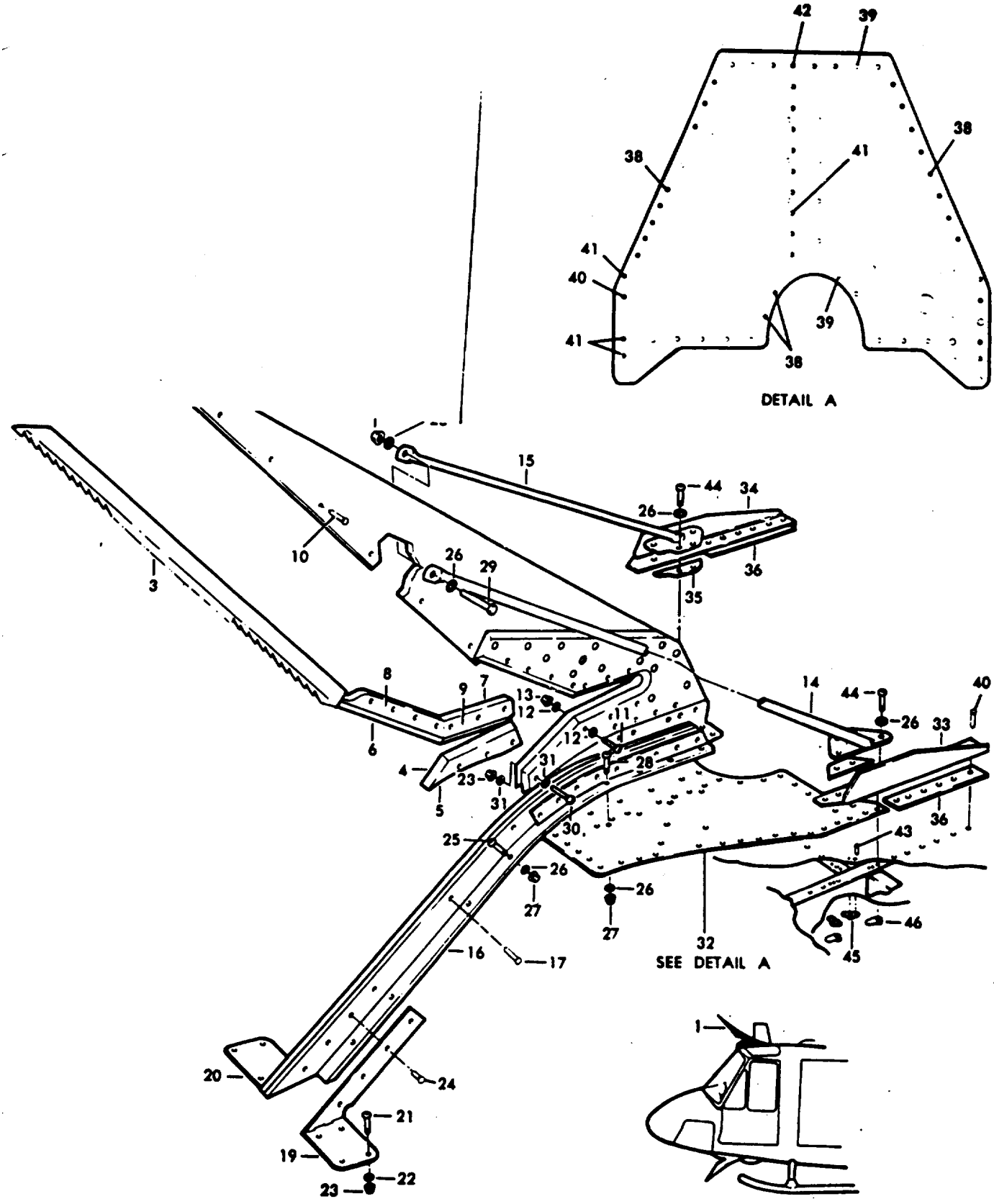


Figure 2-78. Cutter Installation (Sheet 1 of 4)

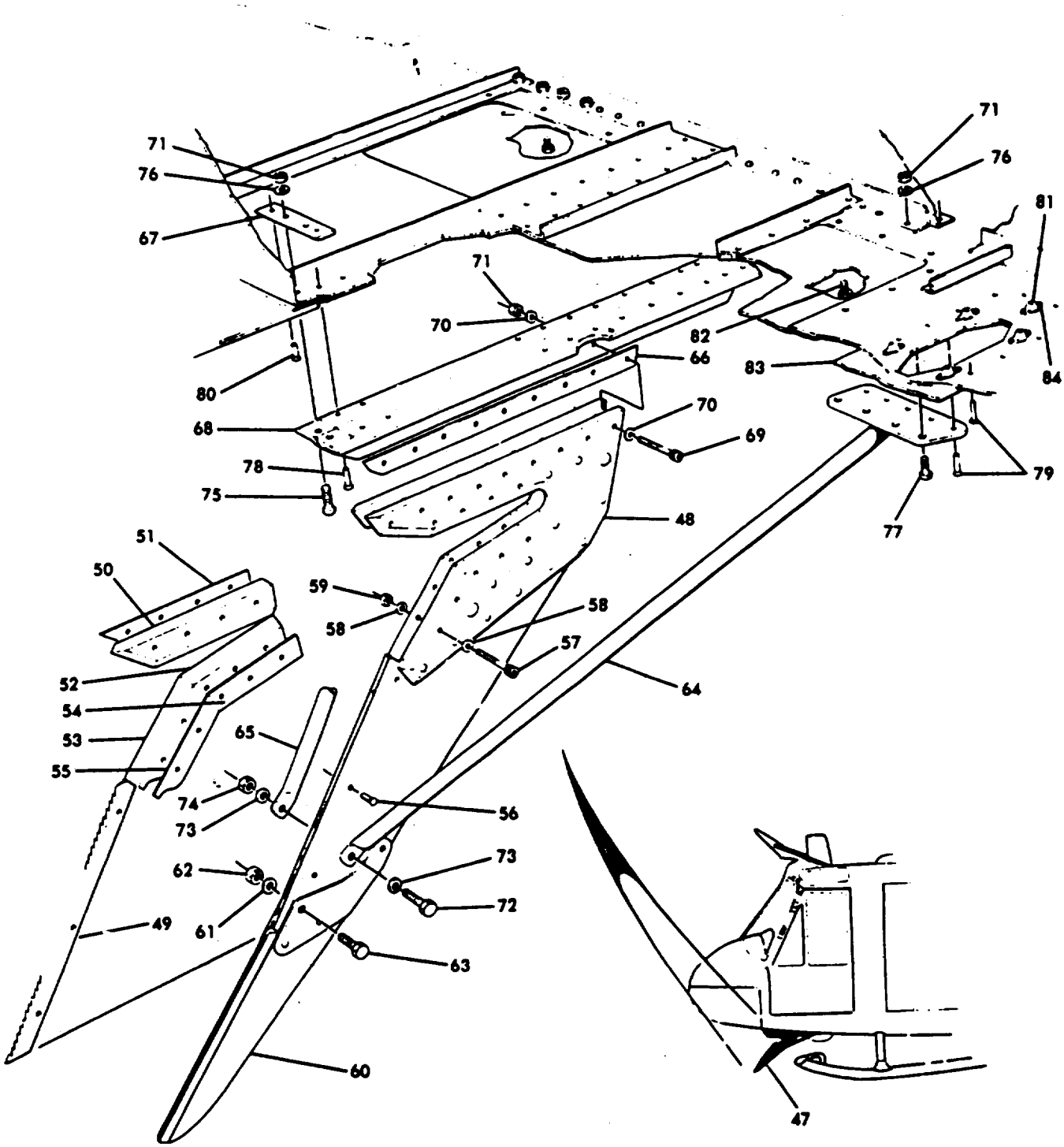


Figure 2-78. **Cutter Installation (Sheet 2 of 4)**

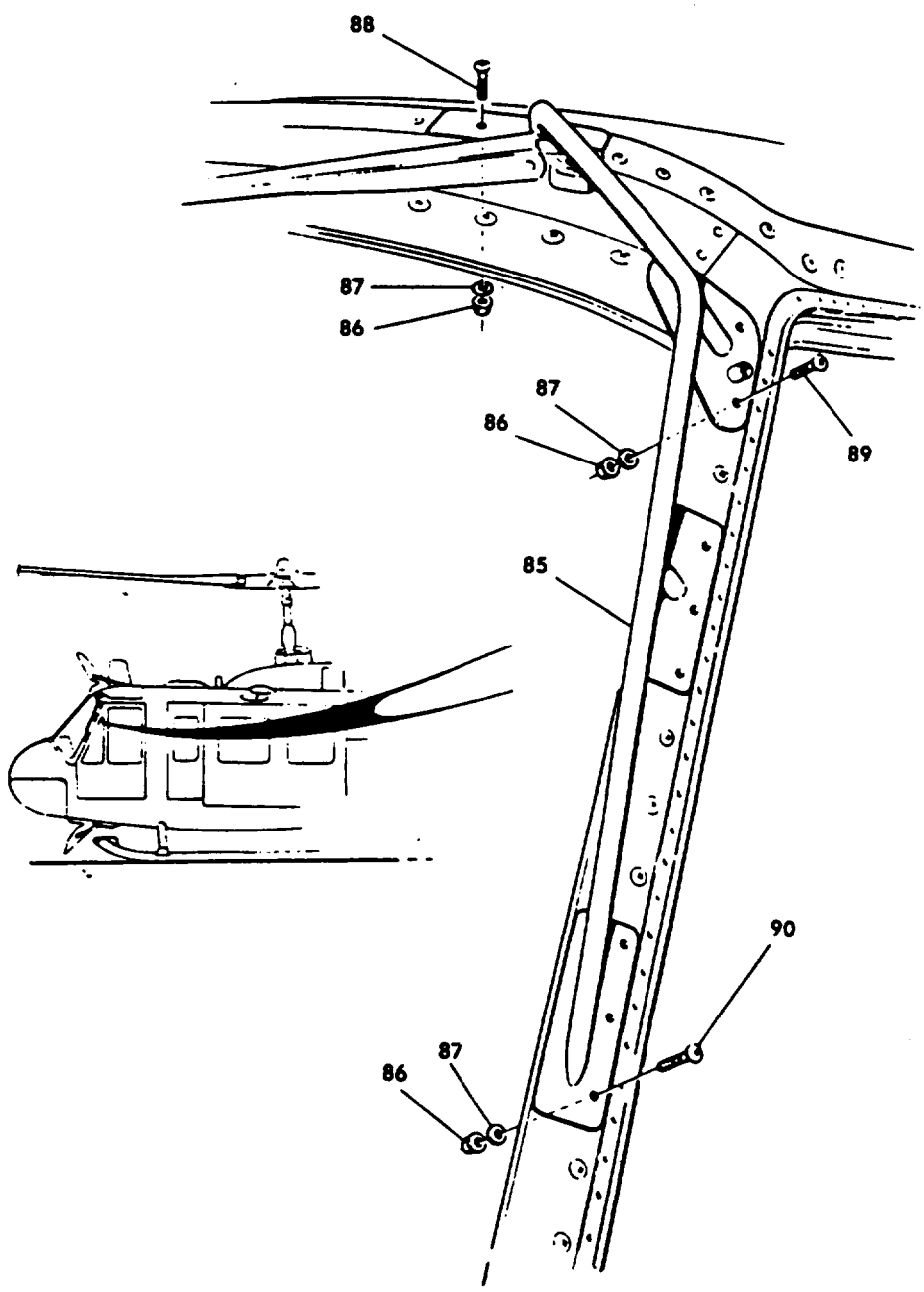


Figure 2-78. Cutter Installation (Sheet 3 of 4)

1. Upper cutter installation
2. Upper cutter assembly
3. Sawblade
4. Blade
5. Shim
6. Blade
7. Blade
8. Shim
9. Shim
10. Rivet
11. Capscrew
12. Washer
13. Nut
14. Strut assembly
15. Strut assembly
16. Deflector assembly
17. Rivet
18. Filler
19. Clip
20. Clip
21. Screw
22. Washer
23. Nut
24. Rivet
25. Screw
26. Washer
27. Nut
28. Screw
29. Bolt
30. Capscrew
31. Washer
32. Doubler
33. Stiffener
34. Stiffener
35. Shim
36. Shim
37. Shim
38. Rivet
39. Rivet
40. Rivet
41. Rivet
42. Rivet
43. Rivet
44. Screw
45. Nutplate
46. Nutplate
47. Lower cutter installation
48. Lower cutter assembly
49. Sawblade
50. Blade
51. Shim
52. Blade
53. Blade
54. Shim
55. Shim
56. Rivet
57. Capscrew
58. Washer
59. Nut
60. Tip assembly
61. Washer
62. Nut
63. Bolt
64. Strut assembly
65. Strut assembly
66. Shim
67. Bearing plate
68. Angle assembly
69. Screw
70. Washer
71. Nut
72. Bolt
73. Washer
74. Nut
75. Screw
76. Washer
77. Screw
78. Rivet
79. Rivet
80. Rivet
81. Nutplate
82. Bolt
83. Doubler
84. Rivet
85. Deflector assembly
86. Nut
87. Washer
88. Screw
89. Screw
90. Screw

Figure 2-78. Cutter Installation (Sheet 4 of 4)

To avoid damage to electrical wiring, use care when drilling out rivets.

(3) Remove rivets (38, 39, 40, and 42) and remove doubler (32).

2-318. Cleaning — Upper Cutter Installation. Clean sealant from aircraft and disassembled parts (TM 55-1500-344-23).

2-319. Inspection — Upper Cutter installation. a. Inspect the disassembled parts using the criteria given in paragraph 2-316.

b. Inspect the helicopter support structure and repair or replace as necessary.

2-320. Repair or Replacement — Upper Cutter Installation. a. Repair or replace cutter assembly (2, figure 2-78) as follows:

(1) Clean and repair negligible corrosion (TM 55-1500-344-23); replace parts exceeding negligible corrosion limits (table 2-3).

(2) Using sandpaper (C233), remove scratches, nicks, and gouges not exceeding a depth of 0.010 inch.

(3) Repair or replace sawblade as necessary (paragraph 2-309).

(4) Repair or replace cutter blades as necessary (paragraph 2-312).

(5) Prime and paint as necessary (TM 55-1500-345-23).

b. Repair or replace the strut assemblies (14 and 15) as follows:

(1) Clean and repair negligible corrosion (TM 43-0105); replace struts if corrosion exceeds negligible limits (table 2-3).

(2) Prime and paint as necessary (TM 55-1500-345-23).

c. Repair or replace deflector assembly (16) as follows:

(1) Clean and repair negligible corrosion (TM 55-1500-344-23); replace deflector assembly if corrosion exceeds negligible limits (table 2-3).

(2) In the deflector area only, use sandpaper (C233) to remove scratches, nicks, and gouges not exceeding 0.010 inch in depth.

(3) Prime and paint as necessary (TM 55-1500-345-23).

d. Replace defective stiffeners (33 and 34); no repair is authorized.

e. Repair or replace the doubler (32) as follows:

(1) Clean and repair negligible corrosion (TM 55-1500-344-23); replace doubler if corrosion exceeds negligible limits (table 2-3).

(2) Using sandpaper (C233), remove scratches, nicks, and gouges not exceeding a depth of 0.006 inch.

(3) Prime and paint as necessary (TM 55-1500-345-23).

2-321. Installation — Upper Cutter Installation. a. Install doubler (32, figure 2-78) as follows:

(1) Apply sealant (C237) to the mating surface of the doubler (32).

NOTE

Do not install rivets (41) in holes where stiffeners (33 and 34) will be located.

(2) Cleco doubler (32) in position, and secure with rivets (38, 39, 40, 41, and 42).

NOTE

If the stiffeners (33 and 34) are not predrilled, position the stiffener so that the front hole will be located 0.38 inch from the front edge of the stiffener. Maintain 0.60 inch from the holes to the outboard edge of the stiffeners.

b. Install the stiffeners (33 and 34) as follows:

(1) Apply sealant (C237) to mating surfaces of shims (35 and 36) and stiffeners (33 and 34).

(2) Position shims (35 and 36), if removed, and stiffeners (33 and 34) and secure with rivets (40 and 41).

c. Install the deflector assembly (16) as follows:

(1) Using clecos, temporarily install the deflector assembly (16) and clips (19 and 20).

(2) Check for gaps between clips (19 and 20) and the fuselage, and ensure that deflector assembly (16) is positioned tightly against the windshield-to-roof radius. Trim and fit as required to eliminate gaps.

(3) Apply sealant (C237) to mating surface of deflector assembly (16), and install using screws (25 and 28), washers (26), and nuts (27). Reinstall wire bundle restraining hardware.

(4) Apply sealant (C237) to base of clips (19 and 20), and install using rivets (24), screws (21), washers (22), and nuts (23).

d. Install the cutter assembly (2) as follows:

(1) Install cutter blades (paragraph 2-315).

(2) Install sawblades (paragraph 2-311).

(3) Ensure that filler (18) is in place and position cutter assembly (2) on deflector (16). Ensure that the aft end of the cutter assembly is flush with the aft end of the deflector, and the front end of the cutter assembly is pushed down against the angles.

(4) Check the gap between the mating parts, and adjust with shims (37) as required; the maximum gap shall be 0.016 inch. Ensure that the cutter assembly (2) is positioned perpendicular to the airframe.

(5) Secure the cutter assembly (2) to the deflector assembly (16) with capscrews (30), washers (31), and nuts (23). Torque to 30 TO 35 inch-pounds.

e. Install the strut assemblies (14 and 15) as follows:

(1) Apply sealant (C237) to the strut feet, position strut assemblies (14 and 15) on stiffeners (33 and 34), and install washers (26) and screws (44) finger tight.

(2) Align the holes in the upper end of strut assemblies (14 and 15) and cutter assembly (2), and secure with bolt (29), washers (26), and nut (27).

(3) Tighten screws (44).

f. Reconnect proximity warning system upper antenna (TM 11-1520-210-20).

g. Install pitot-static tube assembly (paragraph 8-171).

h. Raise and secure overhead terminal board T B2.

i. Raise and secure overhead circuit breaker panels.

j. Reinstall channel, wire bundle, and windshield centermost cover plate (paragraph 2-139 q and r).

k. Clean off excess sealant (TM 55-1500-344-23) and prime and paint as necessary (TM 55-1500-345-23).

2-322. LOWER CUTTER INSTALLATION.

2-323. Inspection — Lower Cutter Installation. a. Inspect the lower cutter assembly (48, figure 2-78) for loose fasteners, impact damage, scratches, nicks, gouges, corrosion, and paint deterioration. Replace assembly if scratches, nicks, or gouges exceed a depth of 0.010 inch, or if impact damage has caused permanent bending. Corrosion shall not exceed negligible limits (table 2-3).

Replace loose fasteners as necessary.

a. Inspect the sawblade (paragraph 2-310).

b. Inspect the cutter blades (paragraph 2-313).

c. Inspect the tip assembly (60) as follows:

(1) Inspect for paint deterioration, scratches, corrosion, nicks, and gouges. Corrosion shall not exceed negligible limits (table 2-3). Replace assembly if scratches, nicks, or gouges exceed a depth 0.006 inch.

(2) Inspect for security of attachment, paying particular attention to the rivets. If the rivets are loose or deformed, replace the tip assembly.

e. Inspect strut assemblies (64 and 65) as follows:

(1) Inspect for paint deterioriation, paint scratches, and corrosion. Corrosion shall not exceed negligible limits (table 2-3).

(2) Inspect for cracks, particularly in the welded area and the formed tab ends. Replace cracked strut assemblies.

(3) Inspect the tubes for bowing. The maximum allowable bow over the strut length is 0.060 inch. Replace strut assemblies that exceed this maximum.

(4) Inspect for loose fasteners and replace as necessary.

f. Inspect the angle assembly (68) as follows:

(1) Inspect for paint deterioration, scratches, nicks, gouges, and corrosion. Corrosion shall not exceed negligible limits (table 2-3). Replace assembly if scratches, nicks, or gouges exceed a depth of 0.010 inch.

(2) Inspect for loose fasteners and replace as necessary.

(3) Inspect for gaps between the angle assembly and the aircraft skin; gaps are not permitted. Trim and fit, or replace as necessary.

(4) Inspect for impact damage, and replace if cracked or permanently deformed.

2-324. Removal — Lower Cutter Installation. a. Remove the lower cutter assembly (48, figure 2-78) as follows:

(1) Disconnect struts (64 and 65) from cutter assembly (48) by removing nut (74), washers (73), and bolt (72).

WARNING

To prevent personnel injury and equipment damage, support the cutter assembly to prevent it from falling as the last bolt is removed.

(2) Remove nuts (71), washers (70), screws (69), and remove cutter assembly (48) and shims (66).

(3) Remove nuts (62), washers (61), bolts (63), and remove tip assembly (60).

(4) Remove sawblade (paragraph 2-311).

(5) Remove cutter blades (paragraph 2-314).

b. Remove strut assemblies (64 and 65) as follows:

(1) Remove floor panels over cutter installation (paragraph 2-30).

(2) Remove rivets (79).

(3) Remove nuts (71), washers (76), screws (77), and remove strut assemblies (64 and 65).

c. Remove rivets (78), nuts (71), washers (76), screws (75), and remove angle assembly (68).

d. Remove rivets (80) and bearing plates (67).

2-325. Cleaning-Lower Cutter Installation. Clean sealant from aircraft and disassembled parts (TM-43-0105).

2-326. Inspection-Lower Cutter Installation. a. Inspect the bearing plates (67) for cracks and permanent deformation. Replace cracked or permanently deformed bearing plates.

b. Inspect all other parts of the lower cutter installation in accordance with paragraph 2-323.

c. Inspect the helicopter support structure and repair or replace as necessary.

2-327. Repair or Replacement—Lower Cutter Installation. a. Repair or replace cutter assembly (48, figure 2-78) as follows:

(1) Clean and repair negligible corrosion (TM 43-0105); replace parts exceeding negligible corrosion limits (table 2-3).

(2) Using sandpaper (C233), remove scratches, nicks, and gouges not exceeding a depth of 0.010 inch.

(3) Repair or replace sawblade as necessary (paragraph 2-309).

(4) Repair or replace cutter blades as necessary (paragraph 2-312).

(5) Prime and paint as necessary (TM 55-1500-345-23).

b. Repair or replace the tip assembly (60) as follows:

(1) Clean and repair negligible corrosion (TM 43-0105); replace tip assembly if corrosion exceeds negligible limits (table 2-3).

(2) Using sandpaper (C233), remove scratches, nicks, and gouges not exceeding a depth of 0.006 inch.

(3) Replace tip assembly if rivets are loose or deformed.

(4) Prime and paint as necessary (TM 55-1500-345-23).

c. Repair or replace the strut assemblies (64 and 65) as follows:

(1) Clean and repair negligible corrosion (TM 43-0105); replace strut assemblies that exceed negligible corrosion limits (table 2-3).

(2) Prime and paint as necessary (TM 55-1500-345-23).

d. Repair or replace angle assembly (68) as follows:

(1) Clean and rapair negligible corrosion (TM 43-0105); replace angle assembly if corrosion exceeds negligible limits (table 2-3).

(2) Using sandpaper (C233) remove scratches, nicks, and gouges not exceeding 0.010 inch in depth.

(3) Prime and paint as necessary (TM 55-1500-345-23).

e. Replace defective bearing plates (67); no repair is authorized.

2-328. Installation—Lower Cutter Installation.

a. Ensure that the beveled edge of each bearing plate (67) is in contact with the radius of the bulkhead, and install using rivets (80).

b. Apply sealant (C237) to mating surface of angle assembly (68) and install using screws (75), washers (76), nuts (71), and rivets (78).

c. Install the cutter assembly (48) as follows:

(1) Install cutter blades (paragraph 2-315).

(2) Install sawblade (paragraph 2-311).

(3) Install tip assembly (60) and secure with bolts (63), washers (61), and nuts (62).

(4) Position cutter assembly (48) on angle assembly (68) and measure the gap between the mating parts; the maximum allowable gap is 0.016 inch.

(5) Use shims (66) to reduce gap as required, and install cutter assembly (4) using screws (69), washers (70), and nuts (71). Torque 30 TO 35 inch-pounds.

d. Install strut assemblies (64 and 65) as follows:

(1) Position strut assemblies (64 and 65) on fuselage and install screws (77), washers (76), and nuts (71) finger tight.

(2) Align the holes in the lower end of the strut assemblies (64 and 65) and cutter assembly (48), and secure with bolt (72), washers (73), and nut (74).

(3) Install rivets (79) in strut feet and tighten screws and nuts (77 and 71).

e. Install floor panels (paragraph 2-33).

f. Clean off excess sealant (TM 55-1500-344-23) and prime and paint as necessary (TM 55-1500-345-23).

2-329. DEFLECTOR ASSEMBLIES (WINDSHIELD WIPERS)

2-330. Inspection-Deflector Assemblies. e. Inspect deflectors (85, figure 2-78) for deterioration of the dry film lubricant, scratches, and corrosion. Corrosion shall not exceed negligible limits (table 2-3).

b. Inspect the deflector assemblies (85) for cracks, paying particular attention to the welded areas. Replace cracked deflectors.

c. Inspect deflector assemblies (85) for deformation at the foot pad areas. Replace permanently deformed deflectors.

d. Inspect for loose fasteners and replace as necessary.

2-331. Removal-Deflector Assemblies. a. Remove wiper motor head guards and air scoop drain tubes.

b. Remove nuts (86), washers (87), screws (88, 89, and 90), and remove deflectors (85).

2-332. Cleaning-Deflector Assemblies. Clean sealant from aircraft and disassembled parts (TM 55-1500-344-23).

2-333. Repair or Replacement-Deflector Assemblies. a. Clean and repair negligible corrosion (TM 55-1500-344-23). Replace deflector assemblies that exceed negligible corrosion limits (table 2-3).

b. Prime and paint as necessary (TM 55-1500-345-23).

2-334. Installation-Deflector Assemblies. a. Position deflectors (85, figure 2-78) on the aircraft, check that the pads conform to the airframe, and ensure that the outboard edges of the lower and middle pads are aligned with the edge of the windshield. With the wiper arms in the parked position, check that the clearance between the wiper arm and deflector is at least 0.38 inch. Trim and fit as necessary.

b. After fitting the deflectors (85), apply sealant (C237) to the mating surfaces of the mounting pads.

CAUTION

To avoid cracking the windshield, do not over torque the mounting screws and nuts (89 and 86).

c. Install deflectors (85) and secure with screws (88, 89, and 90), washers (87), and nuts (86).

d. Reinstall air scoop drain tubes and apply sealant (C237) around drain tubes and foot pads.

e. Reinstall wiper motor head guards.

f. Clean off excess sealant (TM 55-1500-344-23) and prime and paint as necessary (TM 55-1500-345-23).

CHAPTER 3

ALIGHTING GEAR

SECTION I. LANDING GEAR

3-1. LANDING GEAR ASSEMBLY.

3-2. Description - Landing Gear Assembly. The landing gear assembly consists of two skid tubes attached on ends of two arched crosstubes which are secured to fuselage structure by four padded caps. Each skid tube assembly is fitted with a forward end step, tow ring fitting, two saddles with sockets for forward and aft crosstubes, a two piece replaceable shoe along bottom of skid tube, a rear end cap and two eyebolt fittings for mounting of ground handling wheels. Crosstubes are fitted with bearing straps at fuselage attachment locations (figure 3-1).

3-3. Inspection - Landing Gear Assembly - Installed. With landing gear installed, inspect landing gear for proper deflection as follows:

a. With helicopter at full gross weight of **9500** pounds, measure distance between centerline of skid tubes.

b. If distance is less than **102** inches, no further inspection is required, if distance is more than **102** inches, proceed as follows:

(1) Place helicopter on level surface.

(2) Using hydraulic jacks, raise helicopter off surface. Ensure all weight is removed from landing gear.

(3) Level helicopter (paragraph 1-38).

(4) Measure distance between crosstube bearing plates, divide distance to determine helicopter centerline.

(5) Suspend a plumb bob from helicopter centerline to floor surface (figure 3-2). Measure from plumb line to centerline of each skid tube.

(6) Distance should be **48 TO 50** inches from plumb line to centerline of skid tube. If distance exceeds **50** inches for either side and distance between skid tube centerlines exceeds **100** inches, replace defective crosstube (paragraph 3-13).

3-4. Removal - Landing Gear Assembly.

CAUTION

When helicopter is placed on jacks preparatory to removing landing gear skid tubes, take up slack with hoist attached to main rotor retaining nut.

a. Position helicopter on smooth surface.

b. Support helicopter using hoist and hydraulic jacks.

b.1. ☒ Remove electrical bonding components located at each retention cap (4 and 17, figure 3-1).

(1) Deleted.

(2) Deleted.

CAUTION

Helicopter is tail heavy when front crosstube is disconnected. Ensure tailboom is supported prior to disconnecting front crosstube.

c. Remove two bolts (15, figure 3-1) and two washers (16) at four locations on forward retention cap (17).

d. Remove four long bolts (14) and washers (13) at four forward locations.

NOTE

Retention caps are not interchangeable. Mark for reinstallation at original location.

e. Remove two bolts (7, figure 3-1) and two washers (8) at four locations on aft retention cap (4).

f. Remove four long bolts (6) and washers (5) at four locations on aft retention cap (4). Remove angles (12, figure 3-1.1).

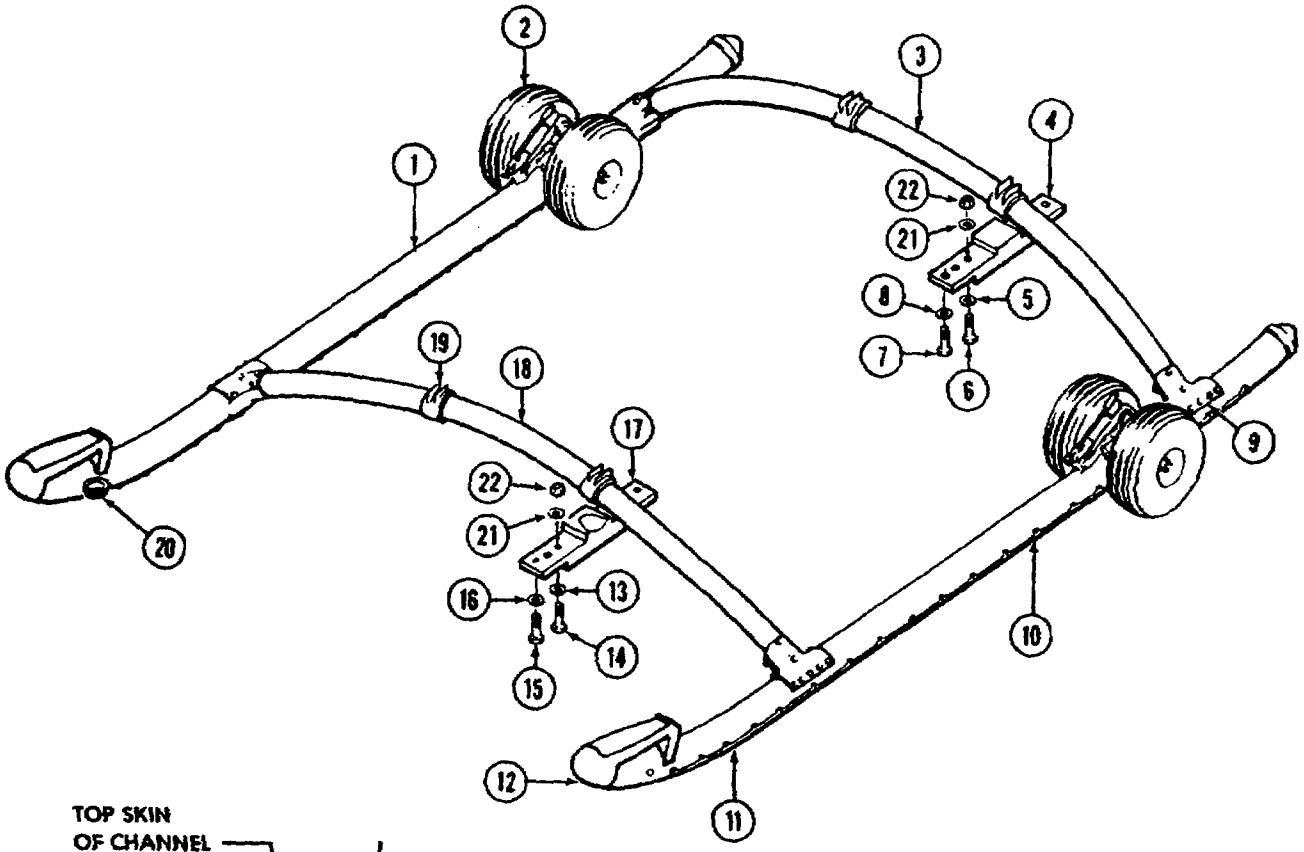
g. Using hoist and hydraulic jacks (paragraph 1-38), raise helicopter to allow removal of landing gear. Remove landing gear.

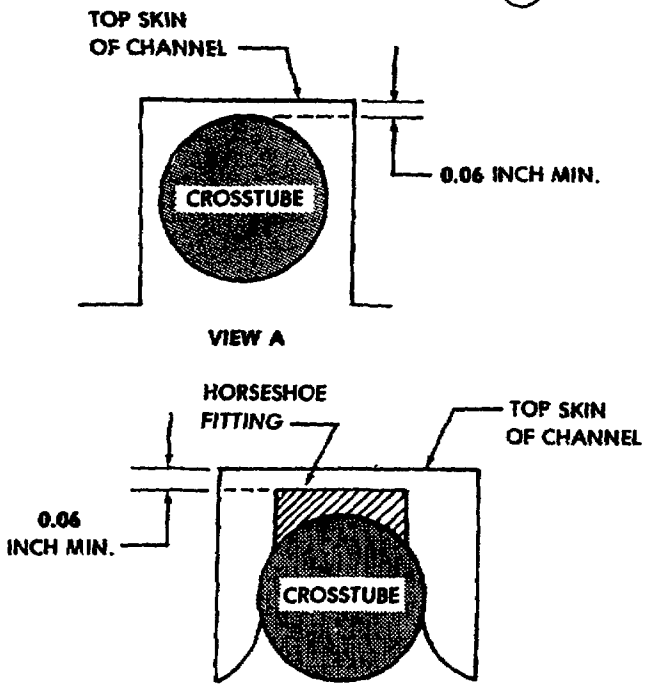
3-5. Inspection - Landing Gear Assembly - Removed.

a. Inspect skid tubes for damage (paragraph 3-17).

b. Inspect skid shoes for excessive wear.

c. Inspect for loose steps and tow rings.





1. Skid tubes
2. Ground handling wheels
3. Aft crosstube
4. Aft retention cap
5. Washer
6. Bolt
7. Bolt
8. Washer
9. Saddle
10. Aft skid shoe
11. Forward skid shoe
12. Step assembly
13. Washer
14. Bolt
15. Bolt
16. Washer
17. Forward retention cap
18. Forward crosstube
19. Bearing plate
20. Tow ring
21. Washer
22. Nut

LANDING GEAR USING HORSESHOE FITTING

Figure 3-1. Landing Gear Assembly Removal/installation

Figure 3-1.1. DELETED

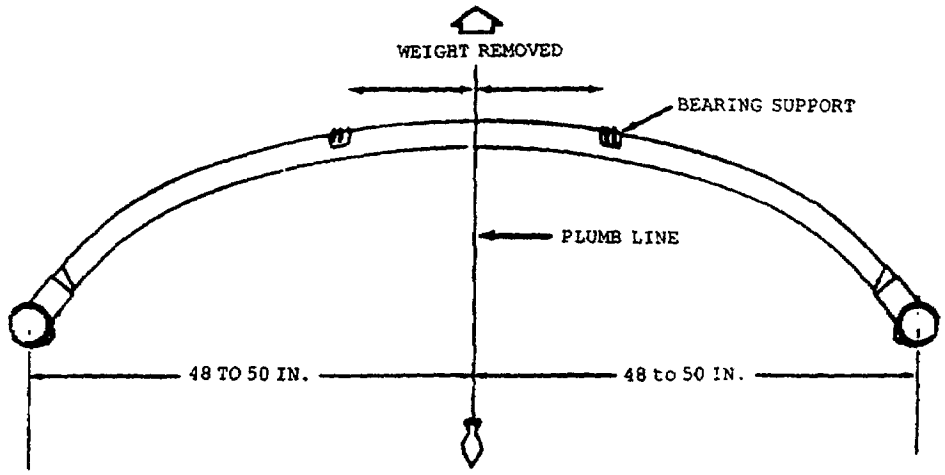


Figure 3-2. Crosstube Deflection Limits

d. Inspect for damaged ground handling wheel eyebolts.

e. Inspect for loose bolts at saddle locations.

f. Inspect crosstubes for damage (paragraph 3-11).

3-6. Repair or Replacement - Landing Gear Assembly.

a. Replace landing gear assembly if damage exceeds inspection requirements.

b. Replace defective skid shoes (paragraph 3-24).

c. Replace or repair defective skid tubes (paragraph 3-18).

3-7. Installation - Landing Gear Assembly.

CAUTION

When helicopter is placed on jacks preparatory to removing landing gear skid tubes, take up slack with hoist attached to main rotor retaining nut.

a. Using hoist or hydraulic jacks, raise helicopter to clear landing gear.

b. Position landing gear and carefully lower helicopter to seat four mounting points of structural beams on bearing straps of cross tubes. Install four cap assemblies, and secure each assembly to plate nuts in fuselage by four short and two long bolts with washers Prior to torque application, the gap between the top of the cap assembly and the bottom of the fuselage at the cross tube mounting area should be in accordance with figure 3-3. The gap shall be measured with appropriate feeler gages.

NOTE

Depending on thickness of shim required, longer bolts of same part number may be needed to install caps.

c. If gap is larger than 0.055, fabricate a shim (figure 3-4) the thickness of metal necessary to achieve recommended gap. If gap is smaller than 0.035, one of following conditions may exist:

(1) Worn rubber pad on retention cap (4, 17, figure 3-1).

(2) Worn crosstube bearing support plate (19, figure 3-1).

(3) Worn landing gear attachment point.

c.1. Replace worn parts as necessary. Tighten bolts to a snug fit while aircraft is still supported by jacks and hoist.

d. Install forward retention caps (17 figure 3-1) using eight bolts (15) and washers (16). Install four long bolts (14) on each cap, and washers (13) in holes nearest crosstube. Install washers (21) and nuts (22) on bolts (14) and snug tighten while helicopter is still on hoist or on jacks.

NOTE

Sufficient weight of helicopter needs to be on crosstubes when checking for gap in figure 3-3.

NOTE

Install aft caps with offset of hole inboard.

e. Install aft retention caps (4) using eight bolts (7) and washers (8). Install four long bolts (6) on each cap, and washers (5 figure 3-1) in holes nearest crosstube. Install washers (21) and nuts (22) on bolts (6).

f. Lower helicopter and tighten all bolts. Ensure landing gear is properly seated on crosstube supports.

g. Newly installed landing gear assemblies shall meet the following requirements.

NOTE

Previously Installed landing gear assemblies may remain in service provided they do not contact the skid channel top skin.

(1) There shall be no vertical movement of the crosstube between the horseshoe fitting and retaining straps.

(2) Clearance between crosstube channel top skin and crosstube at center of aircraft shall be 0.06 inch minimum (view A, figure 3-1).

(3) Clearance between crosstube channel top skin and top of inboard saddle lip shall be 0.06 inch minimum (view B, figure 3-1).

3-8. LANDING GEAR CROSSTUBES.

3-9. Description - Landing gear crosstubes are constructed of formed aluminum alloy. Crosstubes are attached to skid tube assemblies by means of a saddle.

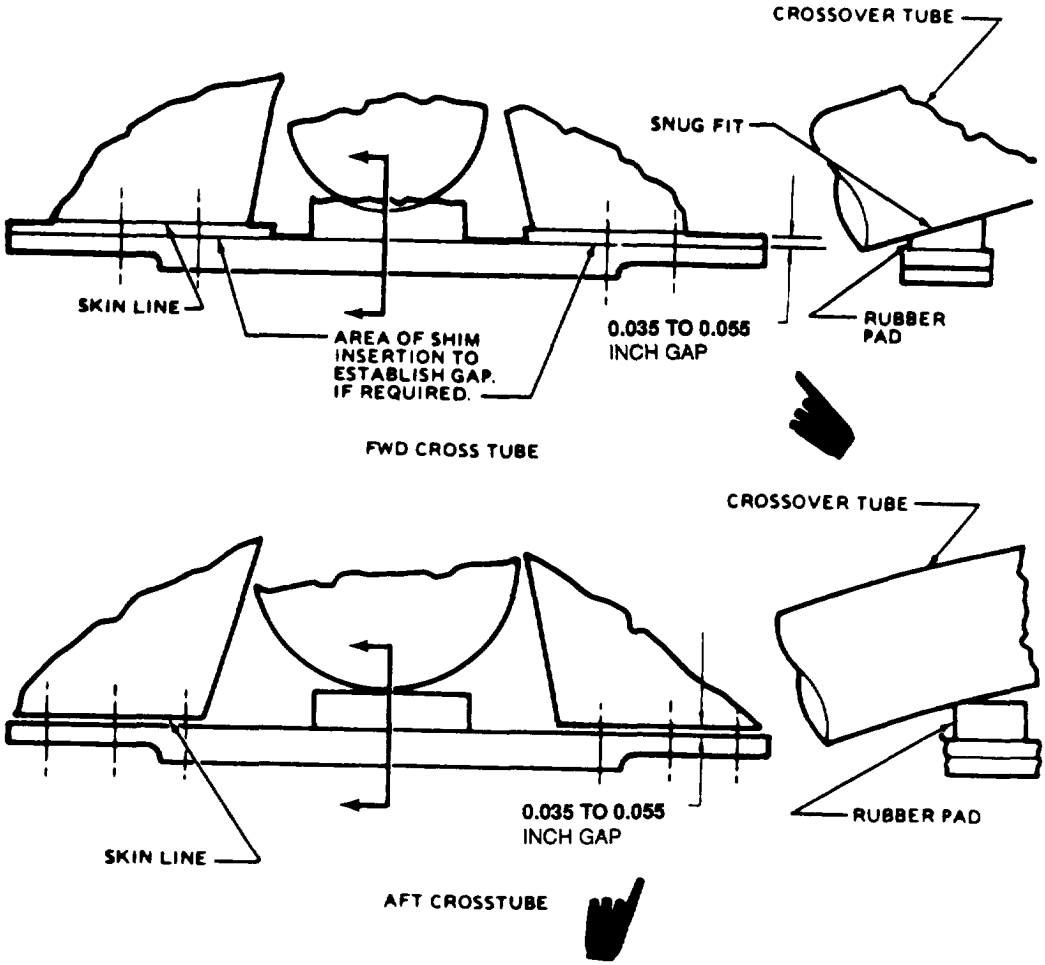


Figure 3-3. Crosstube Gap Measurement

3-10. Removal – Landing Gear Crosstubes.

a. Remove landing gear assembly from helicopter (paragraph 3-4).

b. Remove bolts (4, figure 3-5) and washers (3) attaching forward and aft crosstubes (23 and 24) to saddles (22).

c. Separate crosstubes (23 and 24) from skid tubes.

3-11. Inspection – Landing Gear Crosstubes.

a. Inspect crosstubes for scratches, nicks, and dents.

b. Inspect crosstube bearing support plate for wear and looseness.

c. Inspect crosstubes for loose, damaged, or missing nutplates.

NOTE

Critical inspection criteria of the crosstubes depends on the installed weight of nonstandard, locally fabricated, heavy duty skid shoes on each side.

d. When using skid shoes with a weight limitation of 20 pounds or less, inspect crosstubes as follows:

(1) Inspect during each phase maintenance interval.

NOTE

Do not remove paint or crosstubes from aircraft.

(2) Using a magnifying glass of at least three power, inspect the crosstube for cracks in an area approximately three inches wide around each side of the bearing support plate attachments. If crack in cross tube is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

(3) If cracks are found, replace the tube (paragraphs 3-10 and 3-13).

e. When using skid shoes weighing more than 20 pounds, inspect crosstubes as follows:

(1) Inspect at each 50 hour maintenance interval.

(2) Remove the landing gear assembly (paragraph 3-4).

NOTE

Omit steps (3), (4), and (5), below, when crack inspection is performed using ultrasonic sheer wave inspection equipment.

(3) Remove the bearing support plates from both crosstubes and retain for reuse.

(4) Strip paint from the crosstubes approximately three inches wide around each side of the bearing support plate areas.

(5) Fluorescent penetrant inspect the stripped area for cracks. If crack in cross tube is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

(6) If cracks are found, replace the crosstube (paragraphs 3-10 and 3-13).

(7) If cracks are not found, apply sealant (C244) to crosstubes and reinstall the bearing support plates using six NAS 1739MW bulbed, cherrylock rivets.

(8) Apply zinc chromate primer (C219) and refinish as necessary.

(9) Reinstall landing gear (paragraph 3-7).

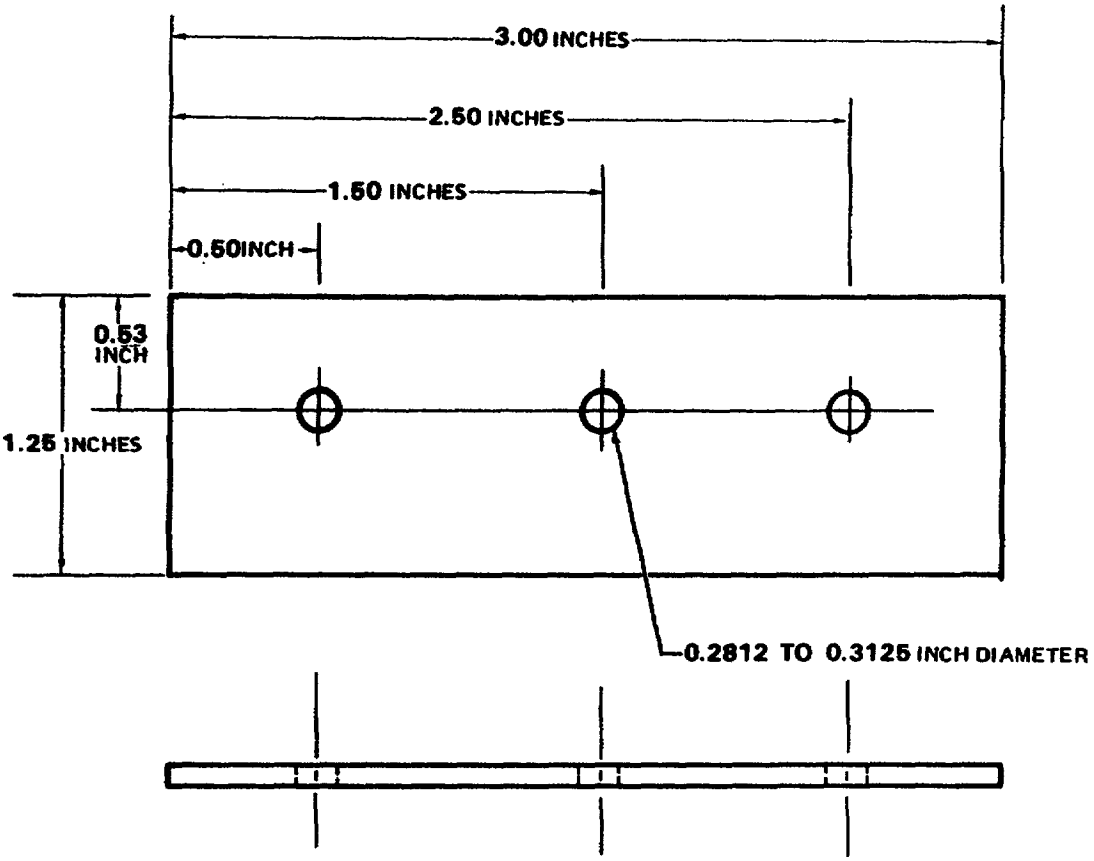
3-12. Repair/Replacement - Landing Gear Crosstubes.

a. Polish out nicks or scratches in crosstube to depth of damage, not to exceed 10 percent of crosstube wall thickness (figure 3-6). Polish in a longitudinal direction. No circumferential grind marks are allowed.

b. Replace nutplates if loose, damaged, or missing. Replace crosstube assembly if damage exceeds limits given in figure 3-6.

c. Bearing support plates wear is limited to 0.025 inch. Corrosion or mechanical damage cannot exceed 0.025 inch after clean up. Corrosion is further limited to 25% of the plate surface area. No cracks allowed.

d. For inspection and replacement criteria for the four crosstube supporters, refer to paragraph 2-65.1.



Fabricate from Aluminum Alloy 2024T3

Figure 3-4. Crosstube Shim Fabrication

3-13. Installation - Landing Gear Crosstubes.

a. Position crosstube (23 and 24, figure 3-5) in saddle.

b. Align holes and install bolts (4) with washers (3).

3-14. SKID TUBES.

3-15. Description - Skid Tubes. Skid tubes are one piece formed aluminum alloy tubes. Each skid tube has a forward end step, rear end cap, two eyebolts for mounting ground handling wheels, two saddles with sockets for crosstubes, a tow ring fitting and two piece skid shoe mounted on bottom of skid tube.

3-16. Removal - Skid Tubes.

a. Remove landing gear assembly from helicopter (paragraph 3-4).

b. Remove bolts (4, figure 3-5) with washers (3) attaching saddle (22) to cross tubes at forward and aft locations.

c. Remove skid tube with saddles attached.

3-17. Inspection - Skid Tubes.

a. Inspect skid tubes for scratches, dents and nicks.

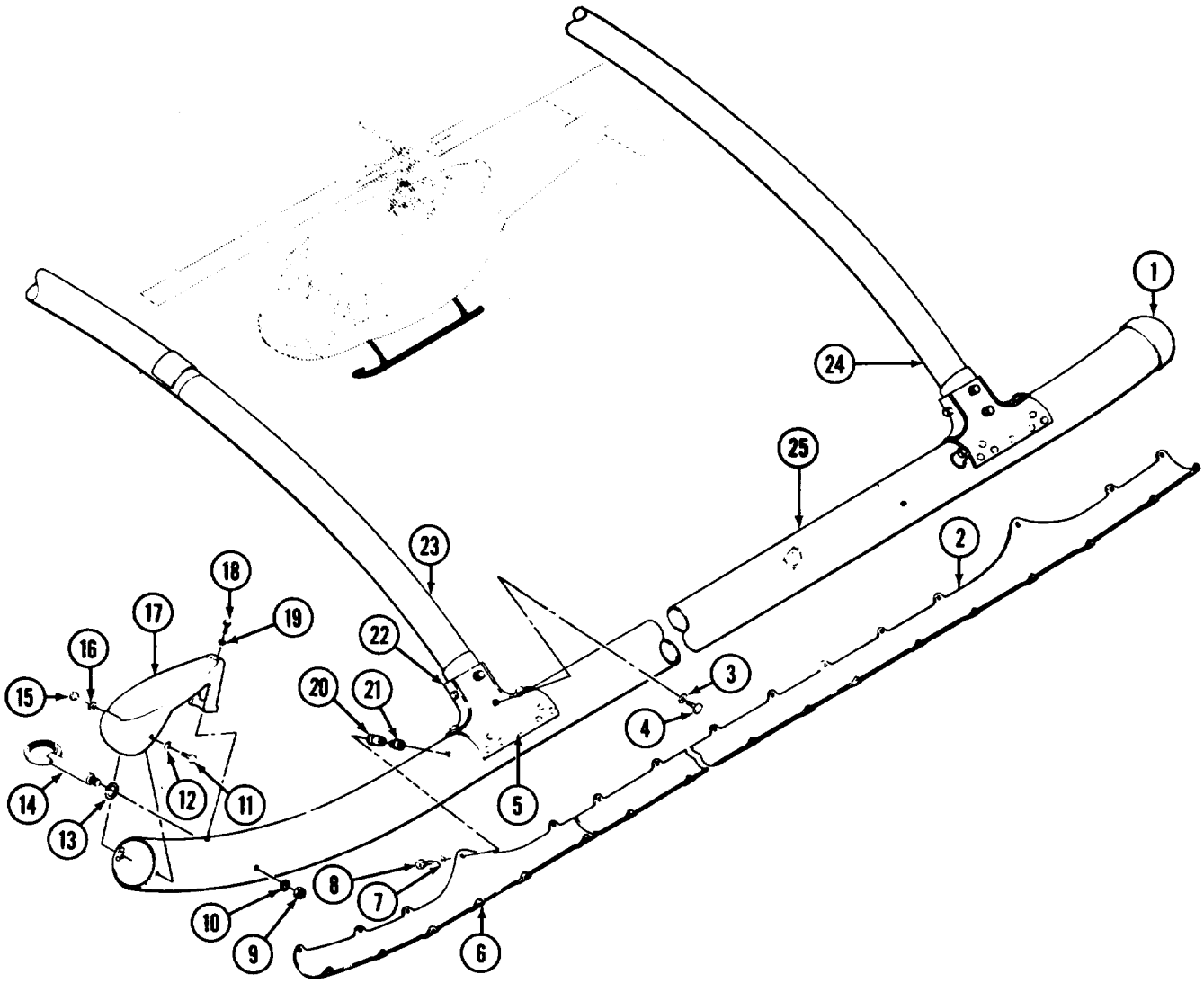
b. Inspect saddles for cracks or missing rivets. If crack in saddle is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

c. Inspect skid tubes for damaged and loose bolt inserts.

d. Inspect saddles for bolt hole elongation. Diametrical measurement shall not exceed **0.390** inch.

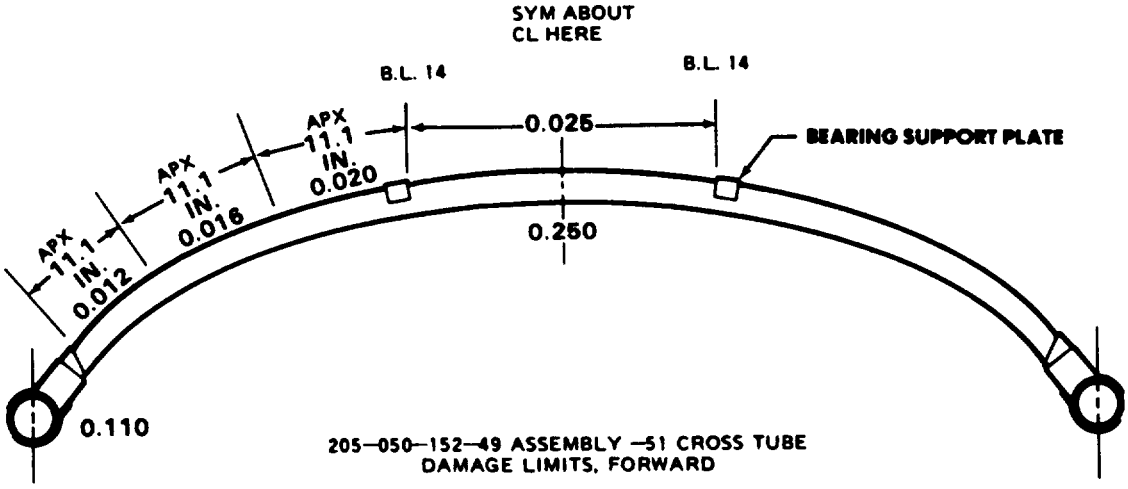
3-18. Repair - Skid Tubes.

a. The following scratch and dent damage is allowable without

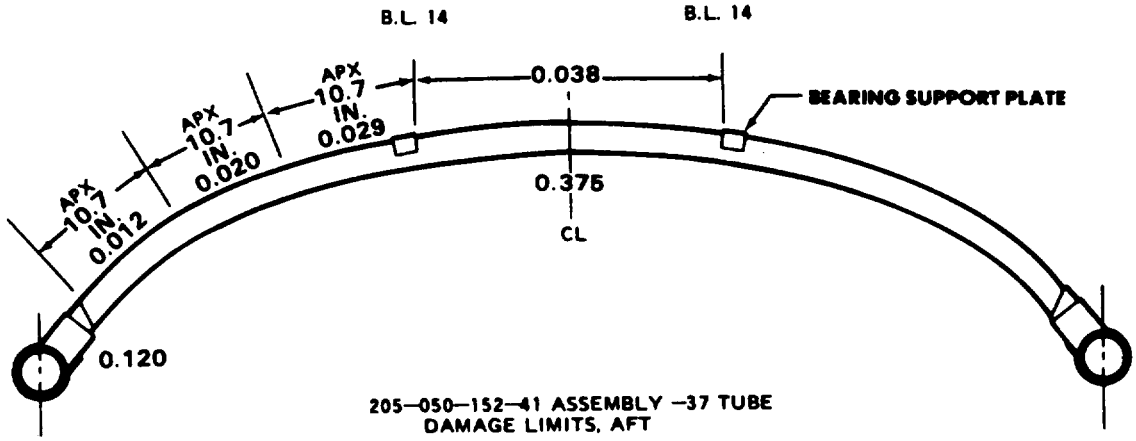


1. End cap
2. Aft skid shoe
3. Washer
4. Bolt
5. Blind rivet
6. Forward skid shoe
7. Washer
8. Bolt
9. Nut
10. Washer
11. Bolt
12. Washer
13. Washer
14. Tow ring
15. Bolt
16. Washer
17. Step
18. Bolt
19. Washer
20. Sleeve
21. Expander nut
22. Saddle
23. Forward crosstube
24. Aft crosstube
25. Skid tube

Figure 3-5. Landing Gear Assembly – Exploded View



205–050–152–49 ASSEMBLY –51 CROSS TUBE
DAMAGE LIMITS, FORWARD



205–050–152–41 ASSEMBLY –37 TUBE
DAMAGE LIMITS, AFT

NOTE

THE FORWARD CROSS TUBE WALL THICKNESS TAPER IS 0.110 TO 0.250 INCH. THE AFT CROSS TUBE WALL THICKNESS TAPER IS 0.120 TO 0.375 INCH.

Figure 3-6. Crosstube Damage Limits

extensive repair (patching), however scratches should be polished out and a coat of primer (C219) applied to affected surface.

(1) Smooth dents in skid tuba between crosstube saddles that do not exceed 0.2S5inch depth and are **1.00TO 1.20** inches in diameter.

(2) Scratches in skid tube not exceeding 0.03 inch depth and between crosstube saddles, running any direction except straight across (circumferential) top of skid tube.

(3) Surface scratches running straight across (circumferential) top of skid tube between crosstube saddles not exceeding **0.03** inch depth and **1.00TO 1.20** inches long.

(4) Minor scratches, dents, holes in the skid tube forward of forward crosstube saddle and aft of aft crosstube saddle that do not affect structural qualities of skid tube helicopter performance may be left without repair at discretion of local maintenance officer.

b. The following damage should be repaired by patching.

(1) Scratches running straight across top of skid tube exceeding **0.03** inch depth and **1.20** inches in length, but not exceeding **4.0** inches in length.

(2) Dents more than **0.25** inch depth and **1.20** inches in length, but not exceeding **4.0** inches in length.

(3) Holes up to **4.00** inches in diameter through one surface of tube only.

(4) Patch repairs for the above listed damage are limited to top side of skid tube and restricted to area shown in figure 3-7.

c. Patch repair procedure for the above listed damages.

(1) If damage is a hole, trim rough edges and remove all burrs, if damage is a scratch or dent, remove burrs using abrasive cloth (C1).

(2) Fabricate a patch from aluminum alloy, large enough to overlap damaged area as shown in figure 3-7. Trim and smooth edges of patch.

(3) Position patch in place and form to contour of skid tube.

(4) Layout rivet pattern using dimension given in figure 3-7.

(5) Clamp patch in place and drill rivet pattern using No. 10 drill. Remove patch and deburr rivet holes.

(6) Apply a coat of primer (C219) to patch and repair area.

(7) Secure patch in place using blind rivets.

(8) Apply primer (C219) followed by lacquer to match color in accordance with instructions in TM 55-1500-204-25/1 and TM 55-1500-345-23.

d. The following damage should be repaired by insertion repair.

(1) Dents on either top or bottom of skid tube which are larger than **4.00** inches.

(2) Holes on either top or bottom of skid tube which are larger than **4.00** inches.

(3) Repairs of this type are restricted to areas shown in figure 3-7. Damage of this type outside of repair area is cause for skid tube replacement.

e. Insertion repair procedure.

(1) Cut out damaged portion of skid tube.

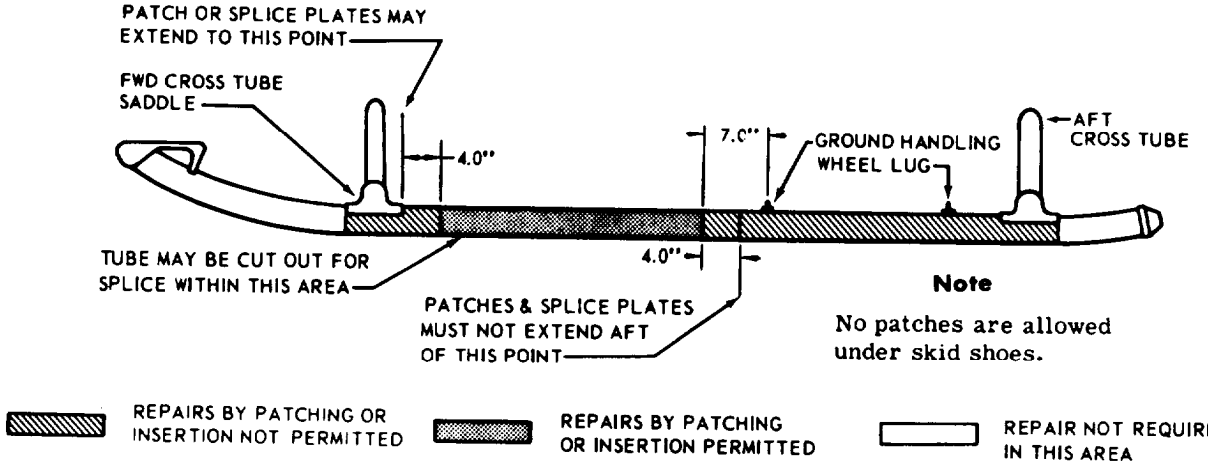
(2) Fabricate an insert of the required length from tubing of 0.095 wall thickness.

(3) Cut four plates to the required dimensions from aluminum alloy sheet or use material salvaged from scrap skid tube.

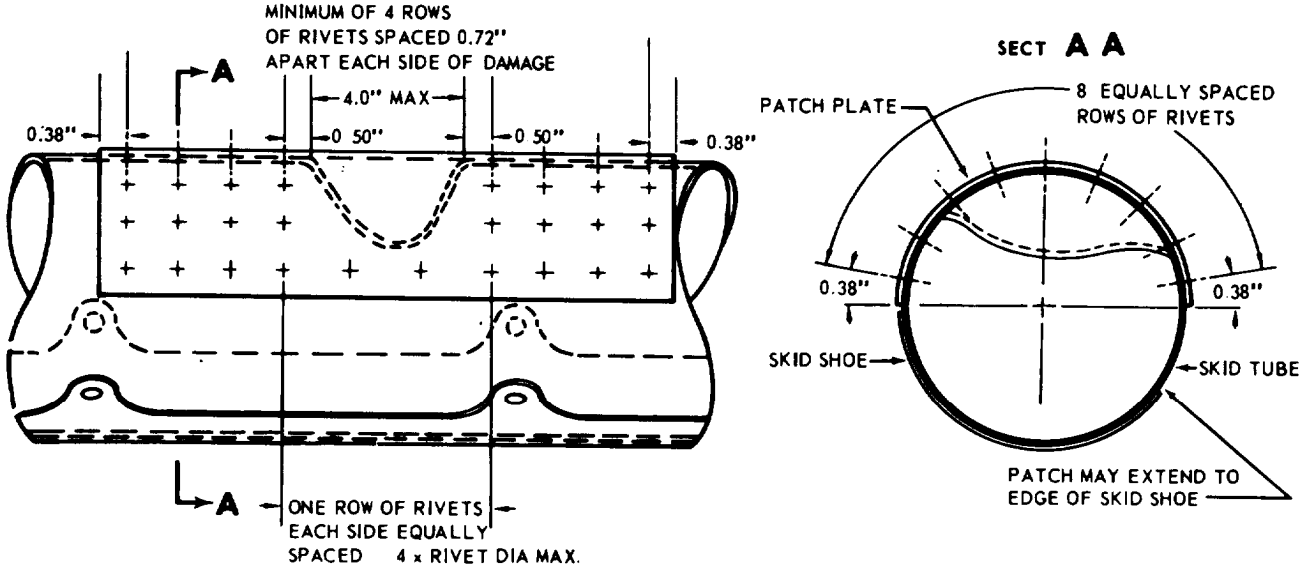
(4) Form two plates to fit the outside diameter of skid tube and two plates to fit the inside diameter of skid tube as shown in figure 3-7.

(5) Apply a coat of primer (C219) to plates and skid tube.

(6) Lay out rivet hole pattern on upper splice plates and lower sides of skid tubes as shown in figure 3-7.



SKID TUBE REPAIR LIMITS



TYPICAL PATCH REPAIR

Figure 3-7. Landing Gear Skid Tube Repair (Sheet 1 of 2)

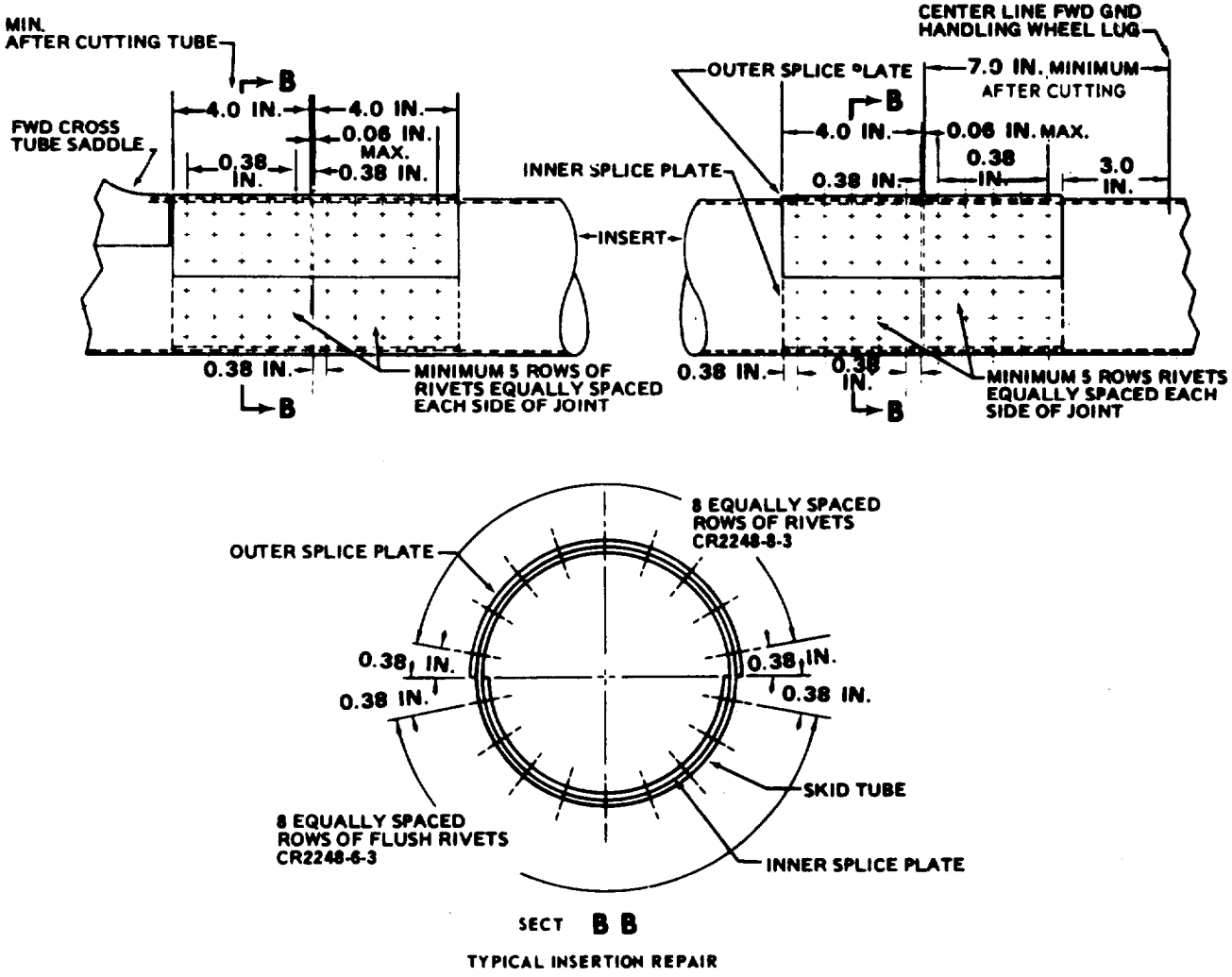


Figure 3-7. landing Gear Skid Tube Repair (Sheet 2 of 2)

(7) Maintaining proper alignment, assemble and securely clamp splice plate and tubes together.

(8) Drill rivet holes in plates and tubes with a No. 10 drill. Countersink lower holes with a 100 degree countersink. Remove plate and deburr holes. Install blind rivets in upper half and lower half of splice as shown in figure 3-7.

(9) If repair involves removal of skid shoes and bolt sleeves, mark new sleeve location using skid shoes as a template. Install new sleeves in these places (paragraph 3-24).

(10) Apply a touchup coat of primer (C219) followed by lacquer to match color in accordance with TM 55-1500-345-23

f. The following corrosion damage may be repaired by polishing.

(1) Repair is limited to the skid tube area directly beneath the four saddles.

(2) Repair depth is limited to 0.005 inch depth after polishing is completed.

g. Corrosion polish repair procedure:

(1) Clean up corroded areas with abrasive paper (C6) polishing to a smooth surface.

(2) Brush/dip areas with Alodine 1200 (C62).

(3) Apply coat of Epoxy Polyamide Primer (C206).

h. Saddle bolt holes may be enlarged to enhance fit with cross tubes. Use drill size wiper TM 55-1500-204-25/1, Table 4-9. Diametrical measurement shall not exceed 0.390 inch.

3-19. Installation – Skid Tubes. a. Install removed skid tube to landing gear, inserting forward and aft crosstubes (23 and 24) in saddles of skid tube (25).

b. Install bolts (4, figure 3-5) with washers (3) at forward and aft saddle locations Tighten bolts.

c. Reinstall landing gear assembly to helicopter (paragraph 3-7)

3-20. SKID SHOES.

3-21. Description – Skid Shoes. Two replaceable type steel skid shoes (2 and 6) are Installed on lower surface of each skid tube (25). The skid shoes are attached to skid tubes with bolts (8) and washers (7) The skid shoes prevent abrasion and damage to skid tubes

3-22. Inspection – Skid Shoes – Installed.

a. Inspect skid shoes for excessive wear.

b. Inspect skid shoes for looseness and damage.

3-23. Removal — Skid Shoes.

CAUTION

When helicopter is placed on Jacks, preparatory to removing landing gear skid tubes, take up slack with hoist attached to main rotor retaining nut.

a. Jack or hoist helicopter clear of the ground (paragraphs 1-37,1-38, and 1-49).

b. Remove bolts (8, figure 3-5) and washers (7) attaching skid shoes (2 and 6) to skid tube (25).

c. Remove skid shoe from skid tube.

NOTE

Helicopter may be jacked on one aide high enough to allow replacement of skid shoe, provided all safety precautions (paragraph 1-38) are met end jacked evenly.

3-24, Repair or Replacement – Skid Shoes.

a. Replace skid shoes that are worn excessively.

b. Repair loose or damaged inserts in skid tube prior to installation of skid shoe, as follows:

(1) Carefully drill the damaged or loose expander nut and sleeve blind nut using a 1/4 inch drill.

(2) Carefully drill off the countersunk portion of sleeve head from skid tuba. Do not damage the original drilled hole in-the skid tube.

(3) Remove the remaining portion of expander nut and sleeve blind nut using a 5/16 inch or smaller punch

(4) Remove damaged expander nuts and sleeves from skid tube.

c. Install new expander nut and sleeve blind nut in skid tube as follows

(1) Apply a light coat of primer (C219) to hole in skid tube. Using installation tool (T4), install new expander nut (21, figure 3-5) and new sleeve (20) in skid tube.

CAUTION

Overtorquing the nut installation tool (14) may result in cracking sleeve.

(2) Torque nut installation tool (T4) **215 TO 240** inch-pounds.

(3) Remove nut installation tool (T4) from completed installation.

3-24.1. Skid Shoes - Nonstandard, Heavy Duty (Locally Fabricated).

a. Description. Nonstandard, heavy duty skid shoes are standard skid shoes that have been locally altered by the application of weld beads or metal wear strips of any form.

NOTE

The use of nonstandard, locally fabricated heavy duty skid shoes requires a critical inspection of the landing gear crosstubes (paragraph 3-11) at each phase maintenance interval.

b. Inspection. Refer to paragraph 3-22.

c. Removal. Refer to paragraph 3-23.

NOTE

Nonstandard, heavy duty skid shoes may be repaired of refabricated as often as necessary provided the weight limitations are not exceeded.

d. Repair or Replacement. Refer to paragraph 3-24.

3-24.2. Skid shoes - Standard Heavy Duty (Surfacite) (Non-Locally Fabricated).

a. Description. Standard heavy duty skid shoes are heavy duty skid shoes manufactured with a special surfacite treated steel bottom plate, anti-slip brackets and stainless steel attaching clamps. These skid shoes have extended wear life and weight **19.6** pounds per shoe, **39.2** pounds per set. (figure 3-7.1).

3-24.3 Installation - Standard Heavy Duty (Surfacite) Skid shoes.

a. Remove Bell factory skid shoes. Refer to paragraph 3-23.

b. Ensure skid tube is free of dirt and debris.

(1) Screw holes used to attach Bell Factory skid shoes will not be reused. Seal holes with sealing compound (C242)

NOTE

On some aircraft crosstube to saddle retaining bolts are one long bolt rather than two separate opposing bolts.

(2) Remove lower inboard and two outboard crosstube to saddle retaining bolts on all four saddles (figure 3-7.1).

(3) Install and loosely clamp skid shoe on skid tube. Install skid shoe with clamp T-bolt nut inboard side of skid tube. Do not fully tighten clamps at this time. Approximately **55** inch-pounds is sufficient at this stage of the installation.

NOTE

A flat washer may be required under head of crosstube to saddle bolts to cover edges of oblong holes on anti-slip brackets.

NOTE

It is very important that the long, flat surfacite wear surface on the bottom of the shoes is resting flat on the ground when the full weight of the helicopter is resting on the shoes prior to final tightening of the skid shoe clamps.

(4) Position skid shoes on skid tubes so oblong holes in anti-slip brackets are aligned over crosstube to saddle retaining bolt holes. Reinstall crosstube to saddle retaining bolts and tighten fully.

NOTE

For standard heavy duty skid shoes, the 90 inch-pounds torque requirement be applied.

(5) Lower helicopter and torque all clamps to **90** inch-pounds using the following sequence: (FWD clamp is number 1 and aft clamp is number 9) tighten clamp 5 first, clamp 4 second, clamp 6 third, clamp 3 fourth, clamp 7 fifth, clamp 2 sixth, clamp 8 seventh, clamp 1 eighth, and clamp 9 last.

3-24.4 Inspection - Standard Heavy Duty Skid Shoes (Surfacite).

a. Inspect attaching clamps for looseness.

b. Inspect anti-slip bracket bolts for looseness.

c. Inspect skid shoe bottom plate for excessive wear. The last 18 inches of shoes receive the most wear.

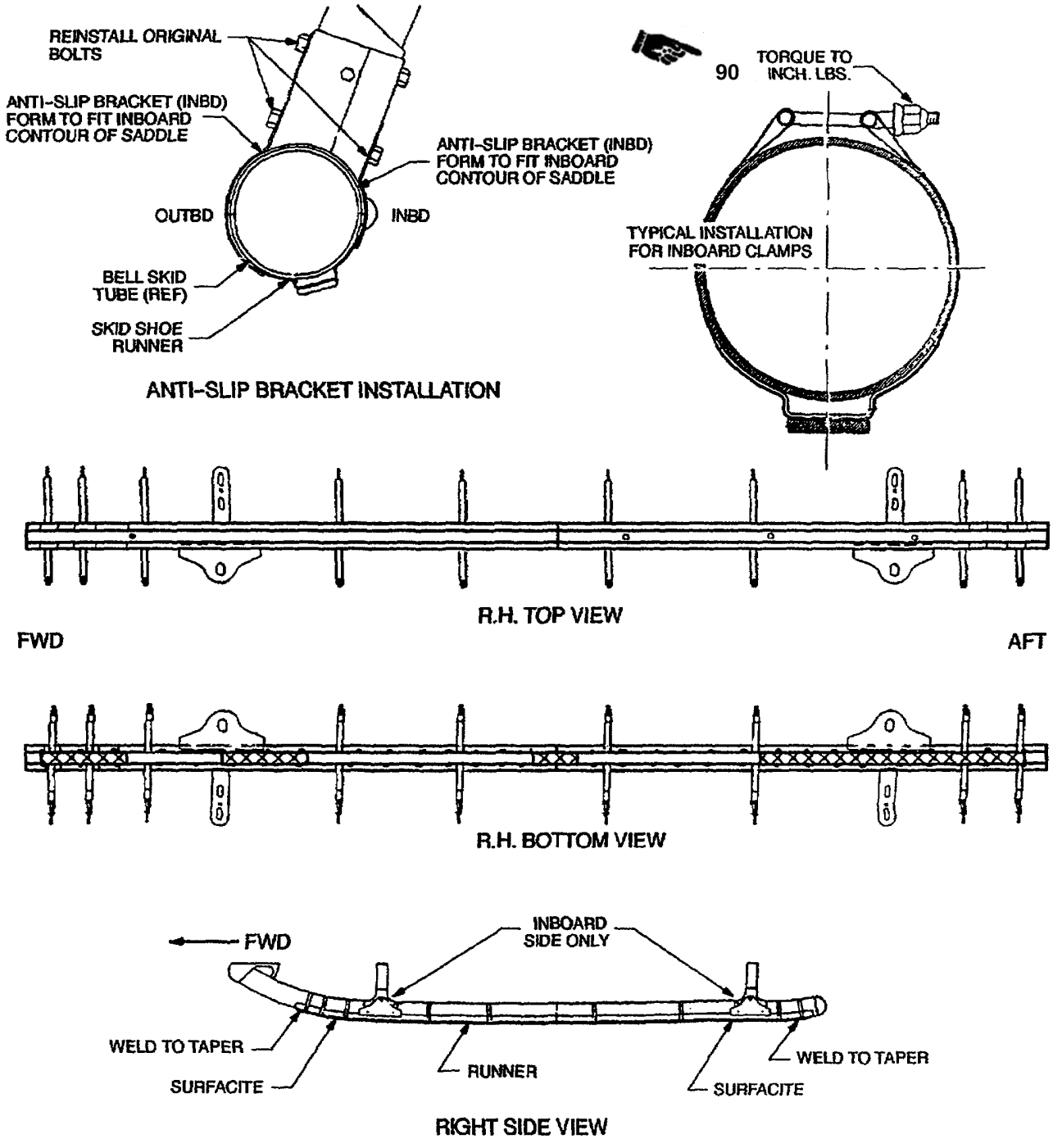


Figure 3-7.1. Skid Shoes - Standard, Heavy Duty

3-24.5. Replacement or Repair - Standard Heavy Duty Skid Shoes (Surfacite).

a. Replacement - Replace excessively worn skid shoes.

b. Repair-

(1) 45 degree ramps at front and rear of skid shoe can be repaired by re-welding and regrinding the 45 degree angle. (figure 3-7.1)

(2) Anti-slip brackets that are bent or distorted can be reworked by carefully bending to original shape. (figure 3-7.1)

3-24.6. Removal - Standard Heavy Duty Skid Shoe (Surfacite).

a. Jack or hoist helicopter clear of ground (paragraph 1-37, 1-38, and 1-49).

b. Loosen 9 mounting clamps on skid shoe.

c. Remove lower inboard and two outboard crosstube to saddle retaining bolts. (figure 3-7.1)

d. Remove skid shoe.

NOTE

Standard and standard heavy duty skid shoes should not be intermixed on aircraft.

3-25. Installation of Drilled Skid Shoes.

a. Position skid shoes (2 and 6) in place and secure to skid tube (25) using bolts (8, figure 3-5) and washers (7).

b. Installation Procedures for the replacement of undrilled skid shoes:

(1) Remove the skid tube which is to receive the replacement shoes.

(2) Remove defective shoes.

(3) Mark the vertical and horizontal center lines with extended lines for each attaching hole. Or, use a hole finder if available.

(4) Place the replacement shoe on the skid tube and locate so that each ear of the shoe is above a mounting hole. Mark each ear with the horizontal and vertical center lines which were previously marked on the tube.

(5) Remove the shoe and drill 1/4 inch attaching holes where the center lines cross.

(6) Install shoes on the tube.

(7) Reinstall skid tube assembly on aircraft.

3-26. SKID SADDLES.

3-27. Description - Skid Saddles. Skid saddles are installed on each skid tube, forward and aft, to hold ends of crosstube. Saddles are manufactured of formed aluminum alloy material and contoured to shape of skid tube. Saddle assembly consists of two parts, inboard and outboard, which are riveted together. Landing gear assembly requires four saddle assemblies, two on each skid tube. Saddle assemblies are secured to skid tube with blind rivets.

3-28. Inspection - Skid Saddles Installed.

a. Inspect skid saddles (22) for cracks, corrosion and damage. If crack in saddle is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

b. Ensure that skid saddle rivets are tight, fill the hole, and the head of the rivet is tangent to the shank. Material adjacent to the rivet shall not be cracked or deformed. Loose or missing rivets are not allowed. Replace rivets that do not meet the above criteria.

3-29. Removal - Skid Saddles.

a. Remove landing gear assembly from helicopter (paragraph 3-4).

b. Remove applicable skid tube from landing gear assembly (paragraph 3-16).

c. Drill out existing rivets (5, figure 3-5) attaching saddle (22) to skid tube (25).

d. Stand tube vertically to clear chips and rivet collars from inside tube.

3-30. Repair or Replacement - Skid Saddles. Replace skid saddles if cracked, damaged or corroded.

b. Repair gouges and scratches to a depth of **0.015** using fine India stone (C264), finish using crocus cloth (C68), zinc chromate (C219) and paint to color scheme of aircraft.

3-31. Installation - Skid Saddles.

a. Position skid saddle at original location.

b. If skid saddle is a replacement, use a hole finder and back drill smaller holes in saddle.

c. Securely clamp replacement saddle and enlarge holes to original hole size.

d. Deburr holes and apply a coat of primer (C219) to saddle and skid tube.

NOTE

As a preventive maintenance measure apply sealing compound (C244 or C79) to fasteners securing saddle to skid tube and saddle to crosstube prior to reinstallation of saddle fitting. This action will provide a tighter rivet to material installation and reduce the non-interference fit between the hole and fastener.

e. Install blind rivets (5, figure 3-5) to secure saddle (22) to skid tube (25).

3-32. Painting - Skid Saddles. Refer to TM 55-1500-345-23.

3-33. TRUCK, GROUND HANDLING (GROUND HANDLING GEAR).

3-34. Description - Ground Handling Gear. Two ground handling gear assemblies are provided to allow moving helicopter on the ground. Each assembly consists of two wheels (16, figure 3-8) on an offset axle (19), a supporting cradle assembly (5), and a hand-operated hydraulic pump (1) with two hydraulic rams (7) which actuate axle (19) to extend or retract wheels. The cradle assembly (5) is mounted to eyebolts on landing gear skid by means of a fixed rear pin and a spring-loaded front pin.

NOTE

To prevent possible damage to handling wheels, the forward portion of the skids should be raised by pulling the tail skid down while extending the wheels. To further prevent damage to ground handling gear equipment, release pressure slowly allowing the helicopter to be lowered slowly.

3-35. Removal - Ground Handling Gear. If support rods (18) are engaged, release hydraulic pressure and raise wheels (16) to detach rods from skids and stow in clips. Press release pin (30) on front of cradle assembly (5) to withdraw support pin (29) from eyebolt. Lift off handling gear assembly.

3-36. Disassembly - Ground Handling Gear.

Premaintenance requirements for ground handling gear

Conditions	Requirements
Model	UH-1/H/v/EH-1
Part No. or Serial No.	All
Special Tools	(T98) (T99)
Test Equipment	
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C61) (C68) (C62) (C261)(C264)
Special Environmental Conditions	Dust Free

a . Remove bell-lock pin (17, figure 3-8) and remove support rod (18) from axle (19).

WARNING

Deflate tire before removing wheel assembly

b. Remove wheel (16) with tire and tube asssmbled (paragraph 3-43).

c. Disconnect and remove hose(8) from (6) on hydraulic pump (1) and hydraulic ram (7).

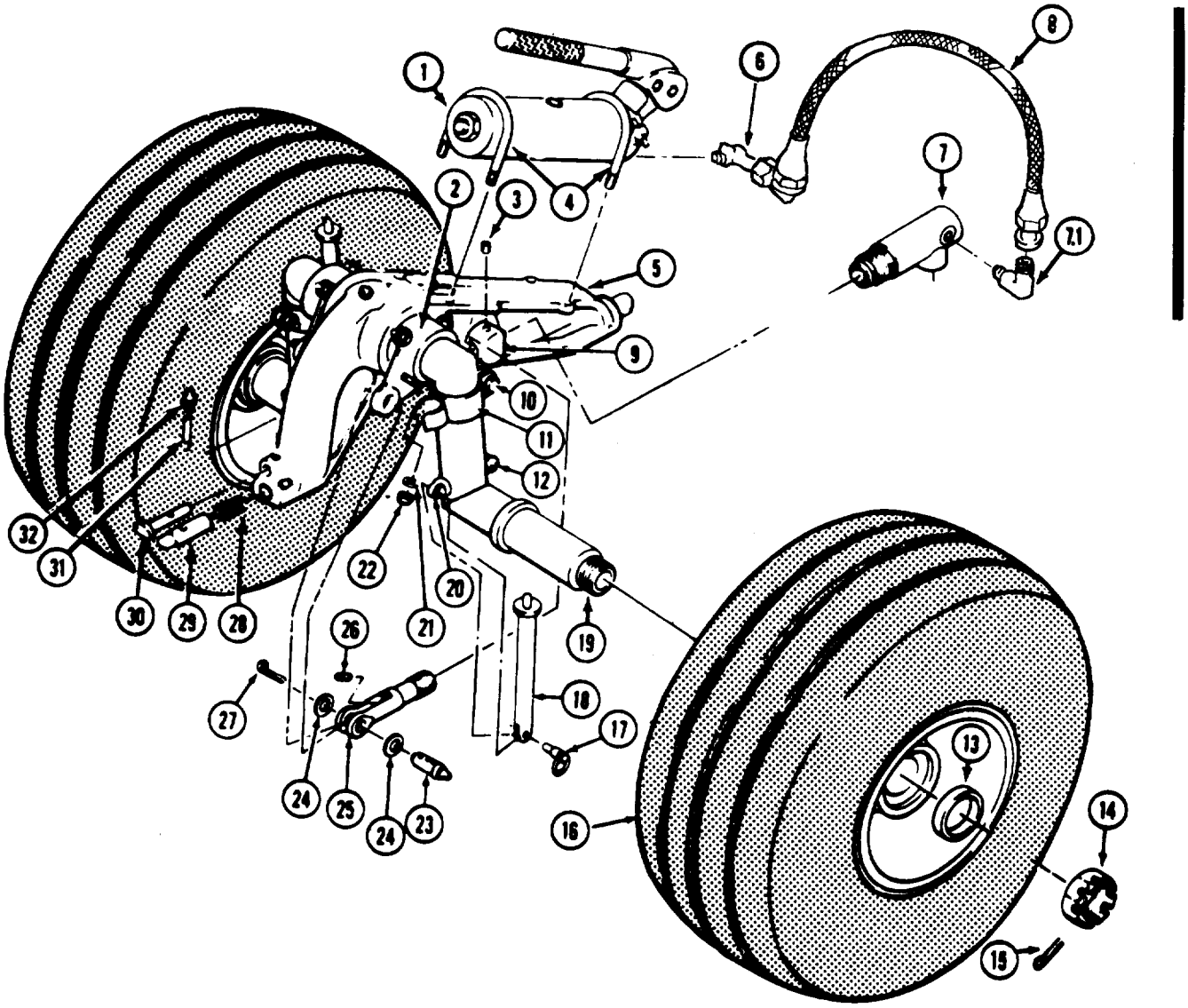
d. Remove nuts (22) and washers (21) end lift U-bolts (4) attaching hydraulic pump (1) to cradle assembly (5), Remove hydraulic pump (1).

e. Remove cotter pin (27), washer (24), and lubrication pin (23), attaching ram arm (2) to clevis (25) of hydraulic ram (7).

f. Back out set screw (3) and remove hydraulic ram (7) from trunnion (9). Using clevis (25) as handle, hold ram housing or cylinder and separate ram piston from cylinder.

g. Remove lubrication fitting (32), unscrew connecting pin (31), and remove release pin (30), support pin (29), and spring (28).

h. Remove trunnion (9) from cradles (5).



1. Hydraulic pump
2. Ram arm
3. Setscrew
4. U-bolt
5. Cradle assembly
6. Tee
7. Hydraulic ram
7.1 90° Elbow fitting
8. Hose
9. Trunnion
10. Bolt
11. Clip
12. Nut
13. Retainer
14. Nut
15. Cotter pin
16. Wheel assembly
17. Ball lock pin
18. Support rod
19. Axle
20. Eyebolt
21. Washer
22. Nut
23. Lubrication pin
24. Washer
25. Clevis
26. Setscrew
27. Cotter pin
28. Spring
29. Support pin
30. Release pin
31. Connecting pin
32. Lubrication fitting

Figure 3-8. Ground Handling Gear

3-37. Inspection — Ground Handling Gear. **a.** Inspect ball-lock pin (17, figure 3-8) for cracks, corrosion, wear, and distortion.

b. Inspect lubrication pin (23) for damage, wear, and distortion.

c. Inspect internal threads of trunnion (9) for damage and set screw (3) and its internal threads in trunnion for damage.

d. Inspect lubrication fitting (32), connecting pin (31), support pin (29), and spring (28) for damage or distortion.

e. Inspect flexible hoses (8) for leaks and damage.

f. Inspect axle (19), cradle assembly (5), and sleeve for wear and cracks.

g. Inspect hydraulic ram assembly (7) for leaks or damage.

h. Inspect hydraulic pump (1) for leaks and damage.

i. Inspect all parts of hydraulic pump for wear or damage.

j. Inspect screens of hydraulic pump (1) for damage.

k. Inspect balls in hydraulic pump (1) for pitting, damage, and corrosion.

l. Inspect hole in rod (26, figure 3-9) for clearance and no obstructions.

m. Visually inspect wheels for cracks.

3-38. Repair or Replacement — Ground Handling Gear. **a.** Replace ball-lock pin (17, figure 3-8) if unserviceable.

b. Replace lubrication pin (23) if worn or distorted.

c. Replace trunnion (9) if the internal threads are damaged.

d. Replace lubrication fitting (32) if damaged.

e. Replace connecting pin (31) and support pin (29) and spring (28) if damaged.

f. Replace flexible hose (8) if leaking or damaged.

g. Replace axle (19) or cradle assembly (5) if cracked or damaged.

NOTE

For hydraulic pump P/N HP9902-41-10, refer to paragraph 3-38.1

h. Repair hydraulic pump (P/N BU0953B) if leaking. Use service parts kit (Part No. JS953) (T-6).

(1) Replace the following parts in hydraulic pump:

(a) Replace clip (5, figure 3-9) rubber and leather packings (9 and 10).

(b) Replace filter screen (27), discharge valve spring (29), 5/16 inch ball (30), suction valve spring (31), and 3/16 inch ball (32).

(c) Replace release valve spring (38), washer (39), packing (40), and 5/16 inch ball (41).

(d) Replace packing and seal (25 and 13), screw (19), and screen (20).

(2) Remove hydraulic pump from ground handling gear.

(a) Release hydaulic pressure by turning T-handle valve on pump (1, figure 3-8) to open position.

(b) Place suitable vessel to catch fluid. Disconnect hydraulic hose from tee fitting on pump. Cap the hoses. Remove fitting (6) from pump (1) and install plug.

(c) Remove four nuts (22) and washers (21) from U-bolts (4) to detach hydraulic pump (1) from cradle assembly (5). Keep the U-bolts with pump.

(3) Disassemble hydraulic pump as follows:

(a) Remove retaining rings (1, figure 3-9) fulcrum pins (2) and separate handle assembly (3) from pump body (12):

(b) Remove filler screw (21) and drain oil from tank.

(c) Pull out piston (6) and remove clip (5) by spreading clip slightly. Unscrew gland nut (7) using adjustable spanner wrench and remove support (8), leather packings (9) and rubber packing (10) and spreader (11).

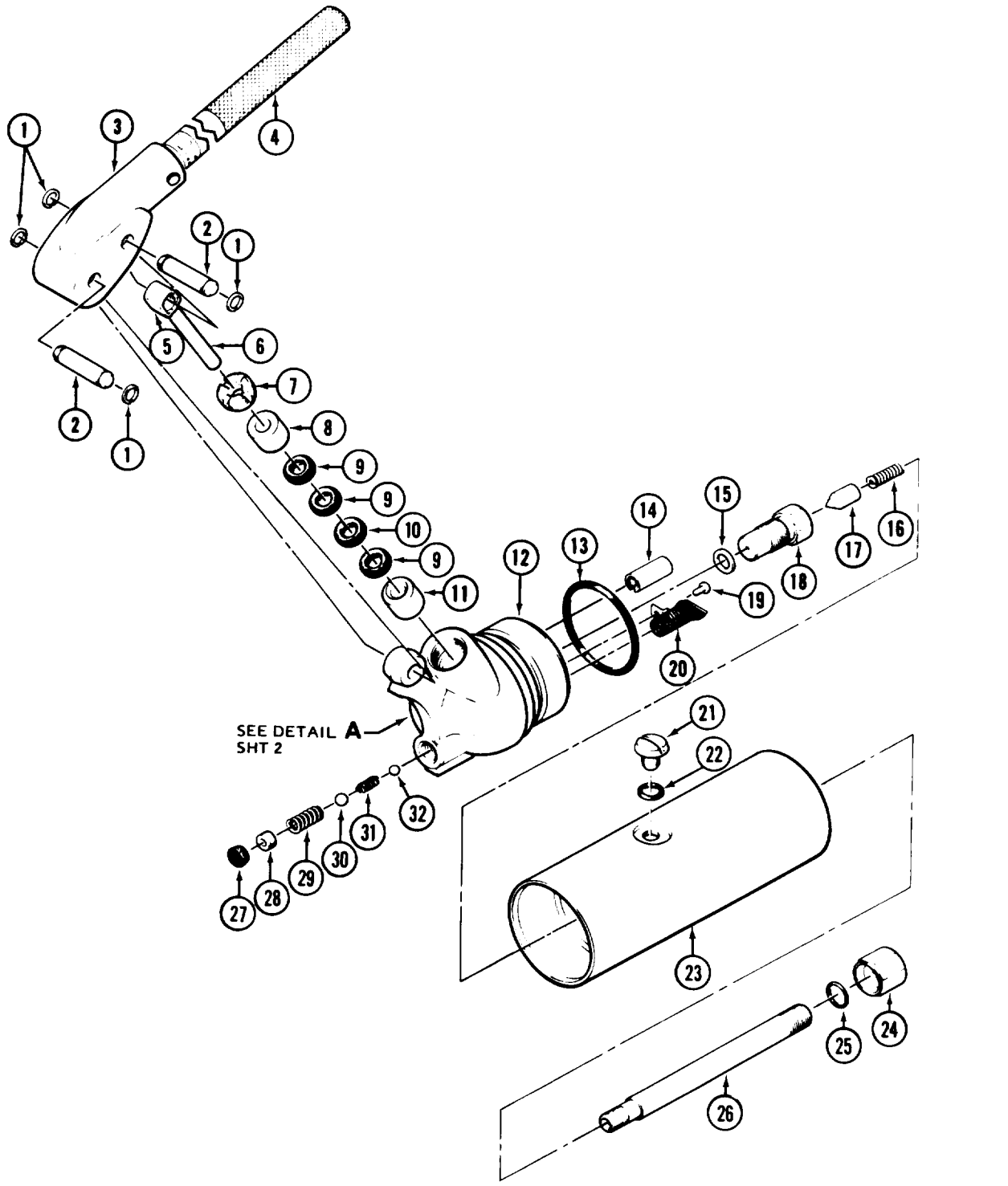
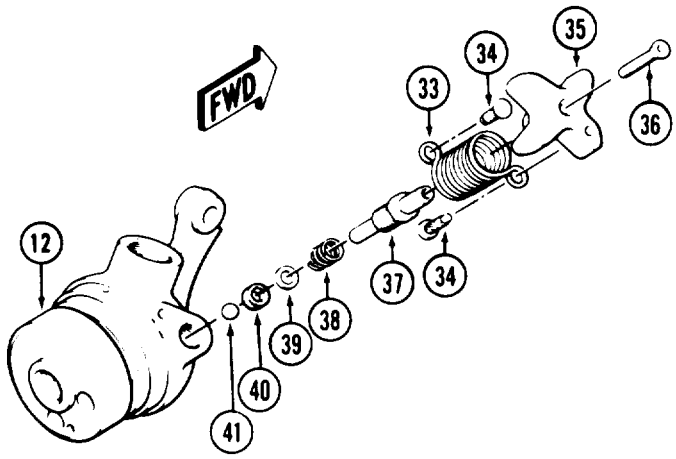


Figure 3-9. Ground Handling Gear Pump Assembly PN BU0953B (Sheet 1 of 2)



1. Retaining ring	15. Gasket	29. Spring
2. Pin	16. Spring	30. Ball (5/16" dia.)
3. Handle assembly	17. Plunger	31. Spring
4. Handle	18. Valve body	32. Ball (3/16" dia.)
5. Clip	19. Screw	33. Spring
6. Piston	20. Screen	34. Pin
7. Gland nut	21. Screw	35. Knob
8. Support	22. Packing	36. Screw
9. Leather packings	23. Tank	37. Valve stem
10. Rubber packing	24. Nut	38. Spring
11. Spreader	25. Preformed packing	39. Washer
12. Pump body	26. Tie rod	40. Packing
13. Seal	27. Screen	41. Ball (5/16" dia.)
14. Magnet	28. Screw	

Figure 3-9. Ground Handling Gear Pump Assembly PN BU0953B (Sheet 2 of 2)

(d) Remove filter screen (27). Remove screw (28), spring (29), ball (30), spring (31), and ball (32).

(e) Remove screw (36). Grasp knob (35) and detach from valve stem (37). Unhook loop of spring from pin on pump body. Slip knob (35) onto valve stem (37). Remove spring (38), steel washer (39), packing (40), and ball (41).

(f) Remove nut (24) and packing (25). Twist tank (23) off pump body (12). Remove seal (13).

(g) Remove screw (19) and screen (20). Discard screen.

(h) Remove overload valve body (18) from tie rod (26). Remove spring (16) and plunger (17) from body (18).

(4) Cleaning.

(a) Clean all foreign particles from magnet assembly (14, figure 3-9) using clean cheese cloth.

(b) Thoroughly clean recessed hole into which screen (20) fits, using solvent (C261).

(c) Thoroughly clean inside of valve body (18) using solvent (C261).

(d) Clean rod (26) using solvent (C261) to assure clear passage through hole in end of rod.

(5) Reassemble hydraulic pump.

(a) Insert trunnion (9, figure 3-8) in cradle (5) with threaded openings aft.

(b) Insert spreader (11, figure 3-9) in pump body (12), flat side down.

(c) Slide support (8) onto piston (6).

NOTE

The "V" must face away from groove on piston.

(d) Dip two leather packings (9), one rubber packing (10), and third leather packing (9) in hydraulic fluid (C130), and assemble in the order shown in figure 3-9.

NOTE

The "V" on packing must rest on brass spreader.

(e) Using bushing tool (T98), insert piston (6) and assembled packings (9 and 10) into pump body (12).

(f) Drive piston (6) with packing down solid, using medium weight hammer on seating tool (T99).

(g) Remove bushing tool (T98) and seating tool (T99).

(h) Install and tighten nut (7) using an adjustable spanner wrench.

(i) Install clip (5).

(j) Insert ball (32), spring (31), ball (30), and spring (29). Install screw (28).

(k) Install filter screen (27) in hose hole.

(l) Insert ball (41), packing (40), washer (39) and spring (38) into pump body (12).

CAUTION

To avoid damage to ball (41) and seat, do not overtighten knob (35).

(m) Install valve stem (37) in pump body (12) down against ball (41) by slipping knob (35) onto stem and tightening. Remove knob (35) from stem (37).

(n) Position spring (33) over knob {35) and hook one eye of spring onto pin (34). Place knob and spring over valve stem (37) and hook eye of spring onto pin (34) in pump body (12).

(o) Hold pump body (12) and valve stem (37) firmly and twist knob (35) to the left two faces of the hex. Push knob onto hex of valve stem at this position. Insert flat head socket screw (36) and tighten. Try knob action to see if closing is positive. If action is not positive, move knob to the left another face on hex and recheck closing action.

CAUTION

An Improperly operating valve means improper assembly and an inoperative pump.

NOTE

Knob and valve stem should work free and valve should close firmly when opened and reloaded.

(p) Install screen (20) in pump body (12) and secure with screw (19).

(q) Install plunger (17) and spring (16) in valve body (18). Screw rod (26) into valve body (18), and position in tank (23).

(r) Install gasket (15) and seal (13) and assemble tank (23) to body (12).

(s) Install packing (25) and nut (24) and tighten nut lightly. Rotate tank so that filler hole is on top and in line with pump handle. Tighten nut (24).

(t) Replace tank filler hole screw (21).

(u) Position handle assembly (3) to body (12) and secure with pins (2) and retaining rings (1).

(5.1) Bleeding - hydraulic pump.

(a) Fill hydraulic cylinder with hydraulic fluid.

(b) Operate pump handle for several strokes to build up pressure,

(c) Crack (loosen) hose coupling at tee on pump.

(d) Operate pump handle until air bubbles no longer show at loose hose coupling l nd fluid runs smoothly.

(e) Refill hydraulic pump and repeat previous steps to be sure all air is expelled from system.

(f) Tighten hoes coupling to pump and refill cylinder.

(6) Testing — ground handling pump.

(a) Fill the oil tank to proper level with hydraulic fluid (C 130), (paragraph 3-39).

(b) Connect a 10,000 psi pressure gage to out let hole.

(c) Operate pump until pressure builds up and overload valve unloads. Proper setting is 8300 to 8800 psi. If pressure goes too high, turn tie rod (26) counterclockwise using a screwdriver. If pressure is too low, turn rod clockwise. Test and readjust as required until proper setting is obtained.

NOTE

Hold tie rod in position using screwdriver in slot to prevent rod turning with the nut.

(d) When proper setting is obtained, tighten nut (24).

NOTE

For hydraulic ram P/N CB-1 003-38-02, refer to paragraph 3-38.6.

i. Repair hydraulic ram (BU0954B)

(1) Remove hydraulic ram as follows:

(a) Remove cotter pin (27), washer (24), and pin (23, figure 3-8) attaching arm (2) to clevis (25) of hydraulic ram (7).

(b) Back out set screw (3) and remove hydraulic ram (7) from trunnion (9). Using clevis (25) as handle, hold ram housing or cylinder, Separate ram piston from cylinder.

(c) Remove lubrication fitting (32), unscrew and remove connecting pin (31) and release pin (30). When connecting pin (31) is removed, support pin (29) can be released and spring (28) will slide from cradle.

(d) Remove trunnion (9) from cradle (5)

(2) Repair — hydraulic ram. (BU 0954B).

NOTE

If hydraulic ram does not have a piston P/N 330617, which is machined for packing and back up ring, requisition now piston P/N 330617.

(a) Carefully slip new back up ring over inboard end (end opposite clevis) of piston and into packing groove.

(b) Carefully slip new packing over inboard end of piston and into packing groove.

NOTE

Make certain packing is not twisted in groove.

(c) Burnish scratches inside hydraulic ram cylinder that are less than 0.005 inch deep, using crocus cloth (C68).

(d) Replace hydraulic ram if inside of cylinder has nicks, scratches, or pits deeper than **0.005** inch.

3-38.1. Ground Handling Gear Hydraulic Pump (Power-Packer) P/N HP9902-41-10.

3-38.2. Disassembly - Hydraulic Pump.

a. Remove plunger cross pin (3) and beam pin (28). Separate handle from base.

b. Remove tank filler plug (25) and copper gasket (23). Drain oil from reservoir.

c. Pull out plunger (4). Unscrew packing nuts (5) using packing nut tool (figure 3-9.2). Remove packing (6), cup retainer (7), pump CUPS (8) and spreader (9).

d. Unscrew valve plug (33), outlet check spring (32) and balls (31) and (30).

e. Remove return spring (20). Remove screw (15) and lockwasher (14). Grasp handle (13) and detach from release spindle (12). Remove spindle (12), release packing nut (19) and release packings (18).

f. Twist reservoir assembly (24) off pump base (10). Remove reservoir shim washers (26). Remove relief valve (22) and copper gaskets (23). Remove screen (21).

3-38.3. Cloeaning - Hydraulic Pump.

a. Clean screen (21) using solvent (C261).

b. Thoroughly clean relief valve (22) using solvent (C261).

3-38.4. inspection - Hydraulic Pump.

a. Inspect packings, seals and gaskets for distortion, wear or damage.

b. Inspect washers, screws, retainers, pins and springs for damage and serviceability.

c. Inspect balls (30 and 31) for pitting, corrosion or damage.

3-38.5. Repair or Replacement - Pump. (Service Kit P/N KH9000).

a. Replace copper gaskets (23).

b. Replace packing (6), cup retainer (7), pump cups (8) and spreader (9).

c. Replace release packings (18).

d. Replace outlet check spring (32), ball (30) and ball (31).

3-38.6. Repair - Hydraulic Ram, P/N CB-1003-38-02 (Semite Kit P/M KC 1013) (Figure 3-9.3).

a. Carefully slip over the plunger and in the sequence indicated, the disc (4), V CUP (5), CUP separator (6), V cup (7), cup separator (6), V CUP (5), spreader (8) and spring washer (9).

b. Assemble retaining nut (10) onto plunger and tighten.

c. Burnish scratches inside hydraulic ram cylinder that are less than 0.005 inches deep, using crocus cloth (C68).

d. Replace hydraulic ram if inside of cylinder has nicks, scratches or pits deeper than 0.005 inches.

3-38.7. Reassembly - Hydraulic Pump.

a. Install relief valve (22, figure 3-9.1) and copper gaskets (23) into pump base (10).

b. Install screen (21).

c. Assemble reservoir (24) to pump base, using reservoir shim washers (26) and (27) as required to align filler plug on top of reservoir to top of pump ± 10°. The maximum number of shims to be used is four.

d. Assemble release spindle subassembly as follows: Dip release packings (18), release packing nut (19) and release spindle (12) in hydraulic fluid (C130). Screw release spindle (12) into release packing nut (19). Place two release packings (18) on spindle so that the non-skin sides are together.

e. Assemble release spindle subassembly into pump base. Tighten release packing nut (19) until release packings (18) bottom out in pump base. Loosen release packing nut (19) and retighten to a torque of 20 inch-pounds.

f. Install ball (30), ball (31) and outlet check spring (32). Screw in valve plug.

g. Insert spreader (9), pump cups (8), cup retainer (7) and packing (6). Screw in packing nuts using packing nut tool. Insert plunger (4).

h. Install handle into pump base. Insert beam pin (28) and plunger cross pin (3).

i. Install tank filler plug (25) and gasket (23).

3-38.8. Testing - Hydraulic Pump P/N HP-990241-10.

a. Fill the oil tank to proper level with hydraulic fluid (C 130). (For bleeding instructions, refer to paragraph 5-1)

b. Connect pump to test stand. Operate pump to check setting of relief valve (22). Relief valve should function at 8500 ± 300 psi. If pressure is not within range replace relief valve. Proper relief valve setting is to be specified when ordering valve.

c. Release pressure and pump up to 8000 psi. Observe for 15 seconds. Leakage in excess of 500 psi is cause for rejection.

3.38.9. Testing - Hydraulic Ram P/N CB1003-38-02. (Refer to para 3-39.d. for procedure for testing ram assembly).

3-39. Installation — Ground Handling Gear – Hand Pump and Hydarulic Ram. a. Prepare a new hydraulic pump (1, figure 3-8) and hydraulic ram assembly (7) for installation by removing pipe plug on each end and drain original fluid.

b. Install hydraulic ram on ground handling gear as follows:

(1) Install hydraulic ram (7) on each end of trunnion (9) to bottom out in hole. Back off until hydraulic outlet is directed outboard. Secure with set screw (3).

(2) Position hydraulic ram arm (2) on sleeve, insert axle (19) and secure with bolts. Insert sleeve through cradle assembly (5) and install hydraulic ram arm (2) and axle on opposite end. Hydraulic ram arm must be forward of wheel hub centerline 1.98 inches (figure 3-10).

c. Install hydraulic pump on ground handling gear as follows:

(1) Position hydraulic pump (1, figure 3-8) on cradle assembly (5). Install U-bolts over pump and through flange of cradle assembly and secure with washers and nuts.

(2) Clean both make and female threads of reducer, tee (6), and pump outlet to remove all traces of old antisieze compound or tape. Wrap

the male pipe threads of reducer and tee (6) with one layer of antisieze tape (C273); allow a slight overlap at joint, and wrap in a clockwise direction when viewed from the thread end of fitting. Install reducer and tee (6) in pump outlet with tee aligned horizontally.

(3) Install ram clevis (25) with hydraulic ram full, extended and adjust clevis to hold 1.48 inches dimension (figure 3-10).

(4) Insert support pin (29, figure 3-8) in aft end of cradle assembly (5), align holes and secure with spring pin.

(6) Insert release pin (30) in upper forward hole of cradle. Insert spring (28) and support pin (29) in forward hole of cradle, align holes in both pins and install connecting pin (31).

(6) Attach support rod (18) to clevis (25) and insert ball-lock pin (17).

(7) Connect hose (8) from each ram (7) to outlet tee of pump.

(8) Fill pump with hydraulic fluid (C130).

(9) Pump handle several strokes.

(10) Crack hydraulic hose at tee of pump.

(11) Pump until no air can be expelled. Tighten hydraulic hose connection.

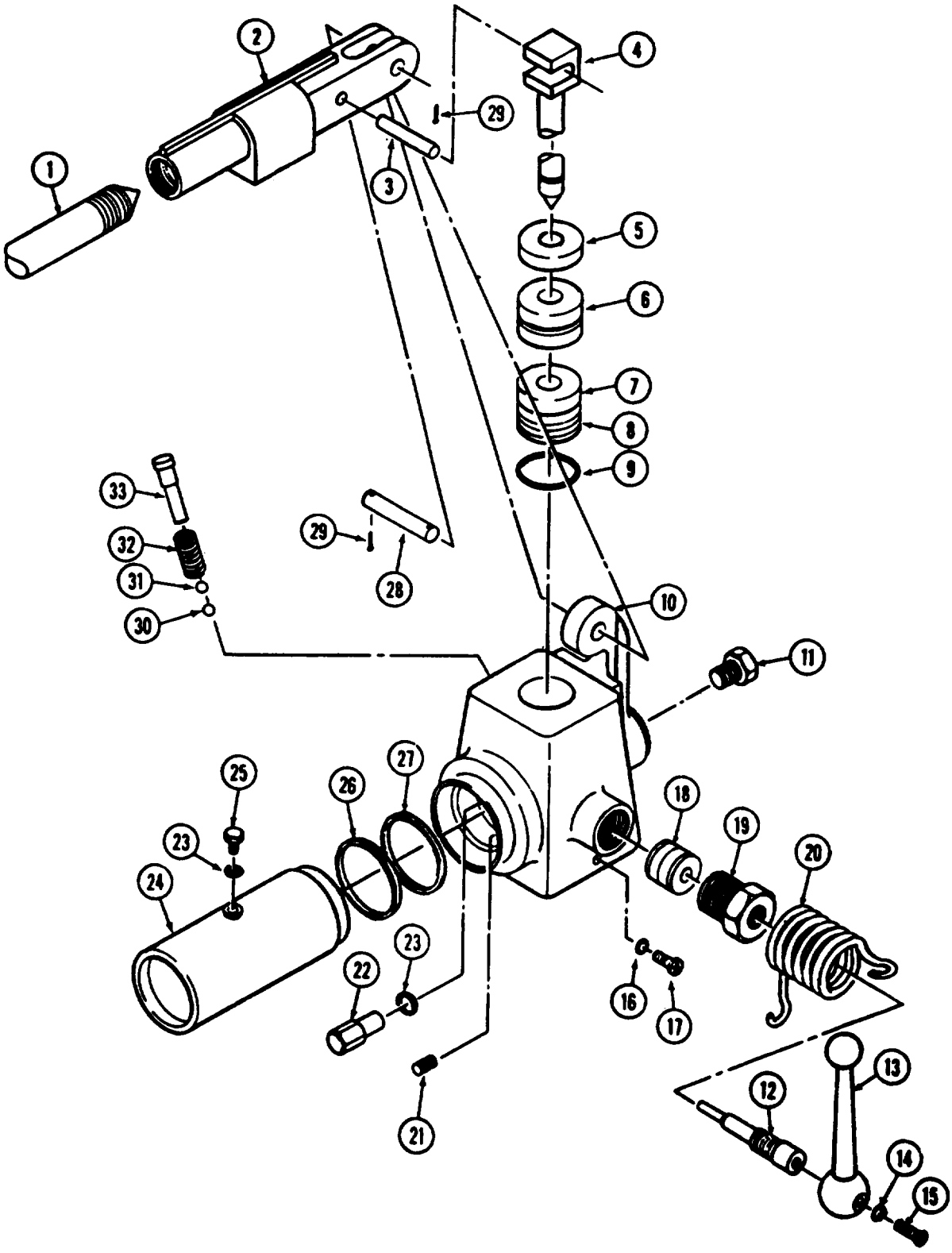


Figure 3-9.1. ground Handling Gear Pump, PN HP-9902-41-10
(Sheet 1 of 2)

1. Handle
2. Beam
3. Plunger cross pin
4. Plunger
5. Packing nut
*6. Packing
*7. Cup retainer
*8. Pump cup
*9. Spreader
10. Base
11. Reducer bushing
12. Release spindle
13. Handle
14. Lockwasher
15. Capscrew
16. Washer
17. Capscrew
*18. Release packing
19. Release packing nut
20. Return spring
21. Screen
22. Relief valve
*23. Gasket (copper)
24. Reservior
25. Filler plug
26. Reservior shim washer
27. Shim washer
28. Beam pin
29. Cotter pin
*30. Ball (0.2187 inch diameter)
*31. Ball (0.3125 inch diameter)
*32. Outlet check spring
33. Valve plug

*Components of kit KH9000

Figure 3-9.1. Ground Handling Gear Pump, PN HP-9902-41-10
(Sheet 2 of 2)

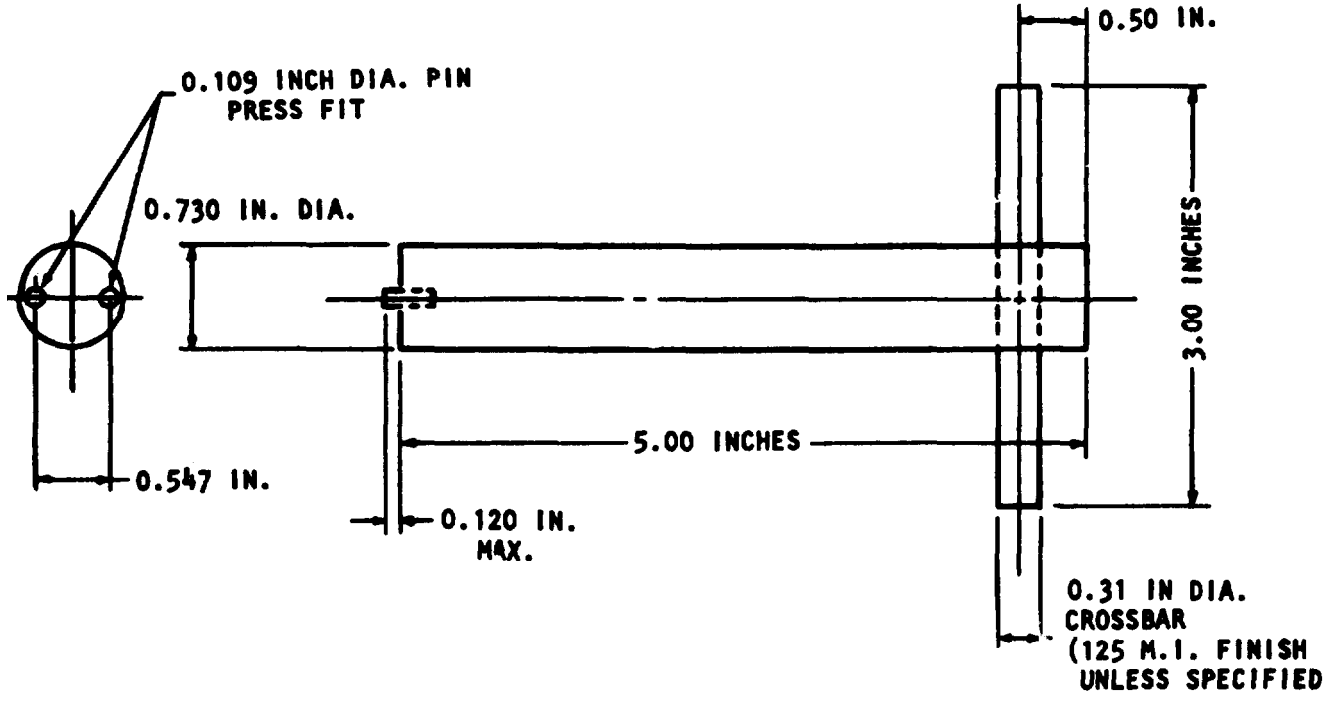
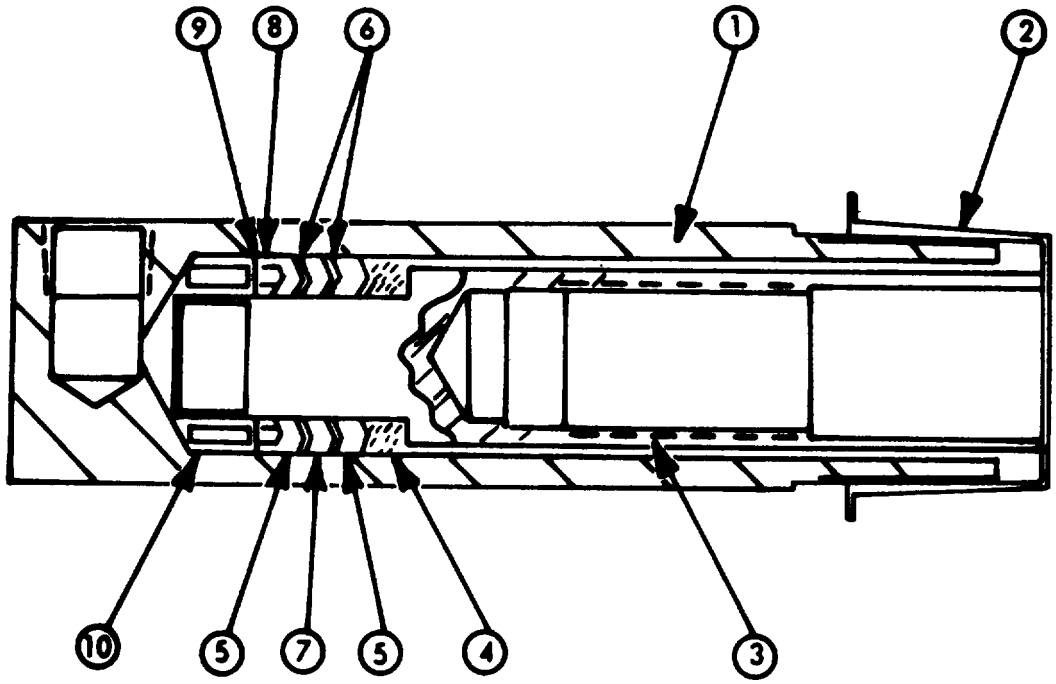


Figure 3-9.2. Packing Nut Tool



	1	CYLINDER BASE
	2	THREAD PROTECTOR
	3	PLUNGER
*	4	DISC
*	5	V CUP
*	6	CUP SEPARATOR
*	7	V CUP
*	8	SPREADER
*	9	SPRING WASHER
*	10	RETAINING NUT

* COMPONENTS OF KIT P/N KC1013

Figure 3-9.3. Hydraulic Ram

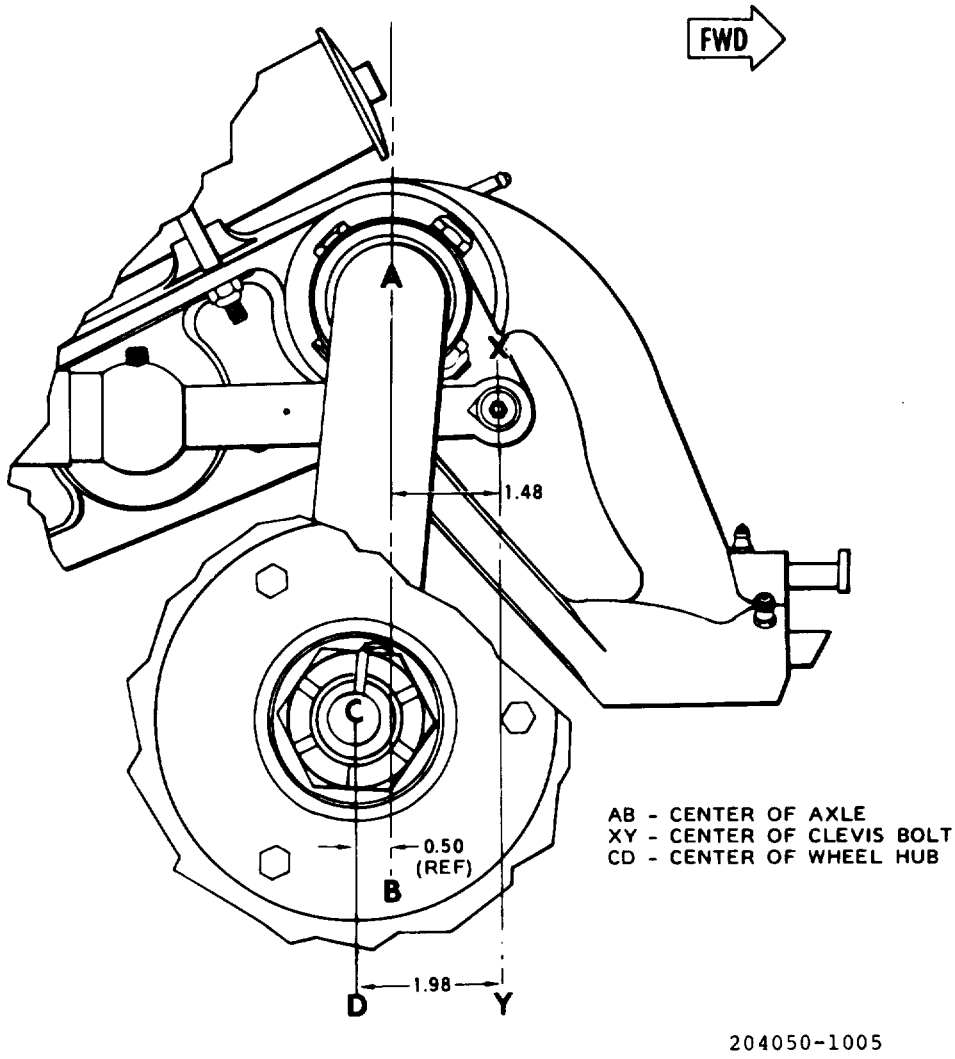


Figure 3-10. Position Wheel and Ram Clevis

(12) If air is still present in hydraulic ram (7), refill pump and repeat procedures.

(13) Tighten or replace any hardware as necessary.

(14) Build up hydraulic pressure with the pump to check for any possible leaks. Extend and retract the ground handling wheels to ensure that system functions properly.

d. Testing the ground handling gear hydraulic ram as follows:

(1) Pump until overload in hydraulic pump goes off with ram against trunnion stop.

(2) Check for leaks.

(3) Release pressure and pump ram out halfway. Allow to stand a few minutes.

(4) Check for leaks. The hydraulic ram is ready when no leaks are found.

3-40. Painting –- Ground Handling Gear. Clean components in accordance with TM 55-1500-204-25/1. Paint or touchup components in accordance with TM 55-1500-345-23. Do not paint tires.

3-41. WHEELS AND TIRE ASSEMBLY – GROUND HANDLING GEAR.

3-42. Description - Wheel and Tire Assembly - Ground Handling Gear. Each ground handling gear assembly has two 7.00-6, 6-ply rating, type III aircraft tires.

WARNING

Deflate tire before removing wheel assembly.

3-43. Removal – Wheel and Tire Assembly — Ground Handling Gear. Remove ground handling gear from skid. Remove either wheel from axle (19, figure 3-8) by removing cotter pin (15), nut (14), and retainer (13).

3-44. Inspection — Wheel and Tire Assembly — Ground Handling. a. Inspect tires for cuts, excessive wear and proper air pressure (paragraph 1-11).

b. Inspect wheels for cracks.

3-45. Repair or Replacement — Wheel and Tire Assembly — Ground Handling Gear. a. Replace tire if badly cut or excessively worn.

b. Inflate tire to proper air pressure (paragraph 1-11).

c. Repair or replace tires as required. Refer to TM55-2620-200-24.

d. Replace wheels if cracked,

3-46. Installation — Wheel and Tire Assembly, Ground Handling Gear. Place wheel (16, figure 3-8) on axle (19) and secure with retainer (13), nut (14), and cotter pin (15).

3-47. Work Aid for Ground Handling Gear. A work aid for moving ground handling gear to and from parked aircraft can be locally fabricated in accordance with figure 3-11. The device is a small towbar with lugs to fit mounting pins of ground handling gear. The gear can then be pulled or pushed on its own wheels.

SECTION II. SKIDS/STRUTS

(Not Applicable)

SECTION III. FLOATS

(Not Applicable)

SECTION IV. SKIS

(Not Applicable)

SECTION V. BRAKES

(Not Applicable)

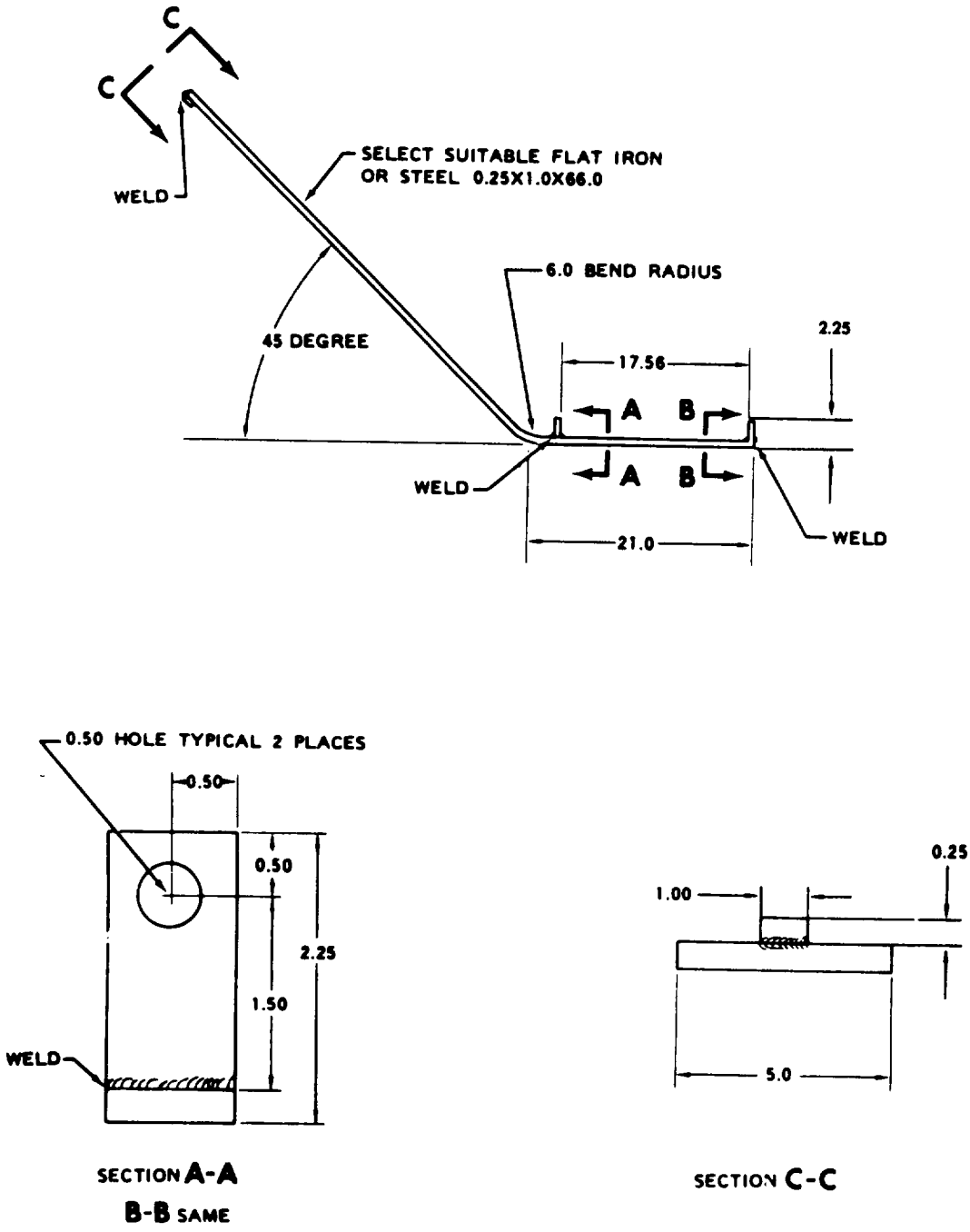


Figure 3-11. Work Aid Towing Ground Handling Gear

CHAPTER 4

POWER PLANT

SECTION I. POWER PLANT

4-1. POWER PLANT ASSEMBLY.

4-2. Description — Power Plant Assembly (figures 4-1 and 4-2). Power plant installation consists of a shaft turbine engine equipped with adapting parts and connections to fuel, oil, electrical, instrument, and engine control systems. Maintenance instructions which pertain specifically to the engine are contained in TM 55-2840-229-23. Special tools required will be found in TM 55-2840-229-23P, Organizational Maintenance Repair Parts and Special Tools List, Engine, Aircraft, Turbine. Refer to paragraph 4-133 for buildup of quick change assembly.

4-3. Engine Maintenance Precautions — Power Plant Assembly.

WARNING

Prolonged contact with lubricating oil may cause a skin rash. Those areas of skin and clothing that come in contact with lubricating oil should be thoroughly washed immediately. Saturated clothing should be removed immediately. Areas in which lubricating oil is used should be adequately ventilated to keep mist and fumes to a minimum.

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

CAUTION

Do not use tape to seal fuel or oil openings, since tape adhesive is soluble and can cause contamination.

Ensure tools used on engine are not cadmium plated. Cadmium plating tends to chip from tools, and chips entering engine can contaminate oil system and cause magnesium parts to deteriorate.

The use of nonapproved marking materials such as common lead pencils on materials subjected to high temperatures may cause engine contamination or cracking of detail parts.

a. Marking on materials subject to high temperatures shall be done only with one of the following: marking pencil, (C199), marking ink, (C137), marking ink pencil, (C175), or felt ink, (C112).

b. Use extreme caution to prevent dirt and foreign objects from entering engine. Place temporary covers on all exposed openings when engine components are removed or disconnected. All open hoses and tubing should be protected with plastic or metal caps. If suitable caps are not available, use commercial grade aluminum foil crimped to fit the particular opening.

c. Apply penetrating oil (C193) as required to assist in removal of parts during disassembly. On parts to be reinstalled, remove all traces of penetrating oil with dry-cleaning solvent (C261).

d. Protect engine from dust and inclement weather. When possible perform maintenance in a sheltered area.

WARNING

The ignition unit contains a very small amount of radioactive material (Cesium-Barium 137) and normally requires no handling precautions. However, severely damaged units that have been broken open, must be handled with forcepts or lead gloves and disposed of in accordance with AR 385-11.

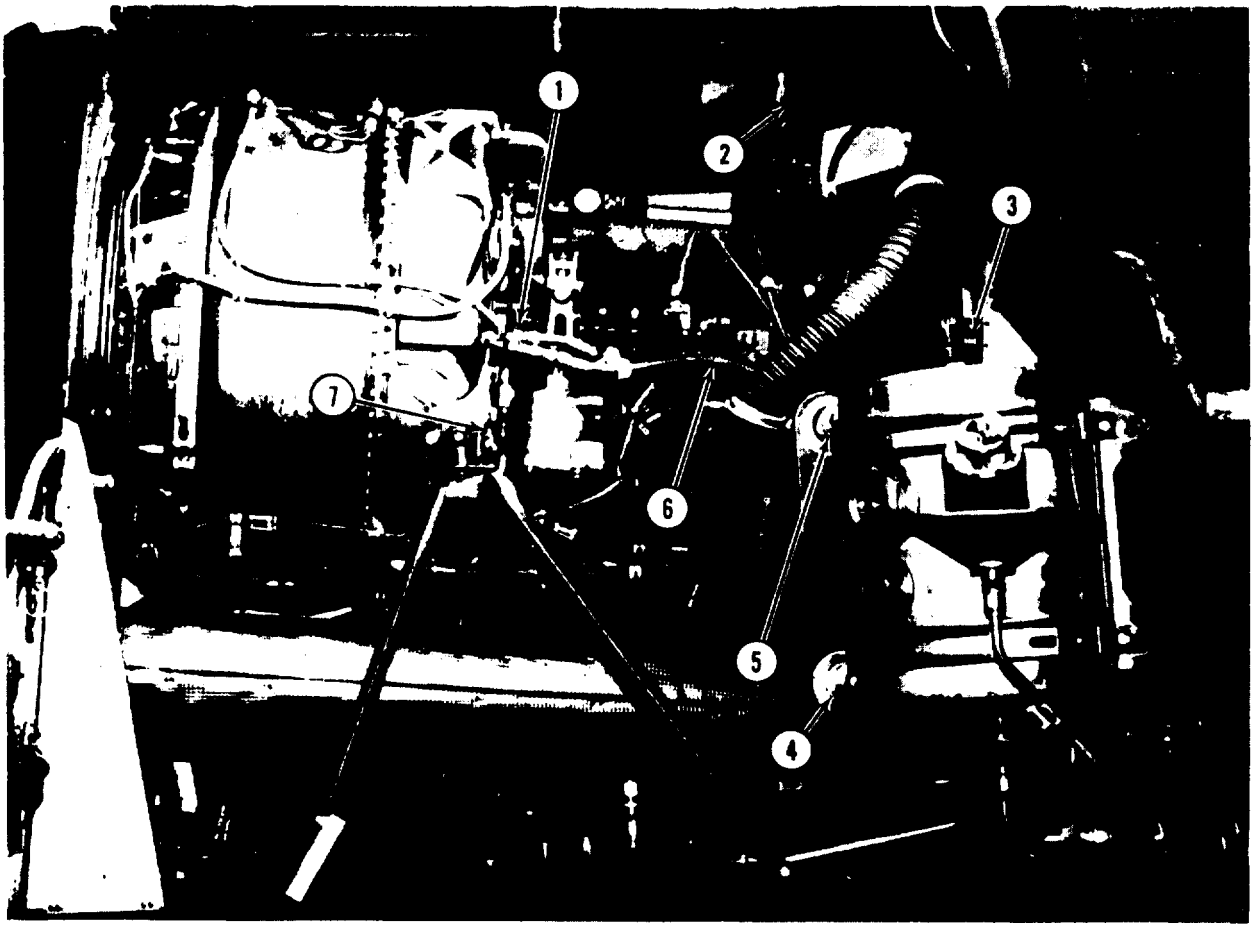
Make certain that all electrical power is disconnected.

e. When performing maintenance on the ignition system, or removing ignition system items to allow other maintenance, disconnect wiring harness at ignition exciter unit and ground the ignition leads.

f. Carefully inspect condition of all parts to be installed on engine,

g. Install new lockwire, cotter pins, tabwashers, lockpins, lockwashers, gaskets, and preformed packings.

h. Remove hoses and tubing that may be damaged during removal of engine components.



1. Diffuser air pressure hose
2. Starter-generator air duct
3. V-band coupling nut
4. Oil inlet hose
5. Engine breather hose
6. Particle separator hose
7. Pillow block bolt

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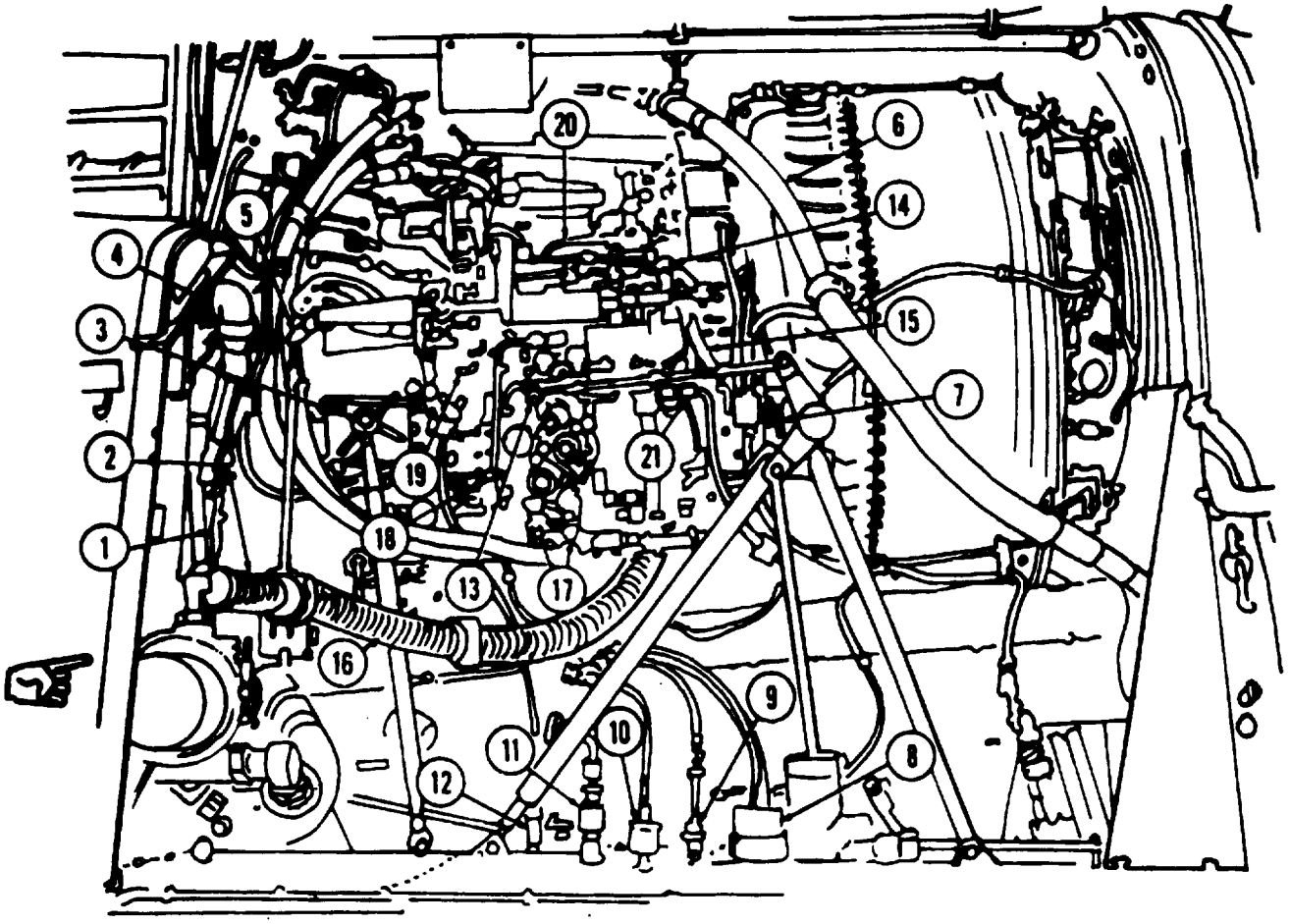
Figure 4-1. Power Plant Installation - Right Side (T53-L-13 Power Plant Installation Shown)



1. Electrical connector
2. Fuel inlet hose
3. Engine mount bolt
4. Power plant electrical connector
5. N2 engine control belt
6. Bleed air hose
7. Pillow block bolt
8. Starter-generator electrical connector
9. Fuel drain coupling
10. Starter-generator drain pad coupling
11. Oil outlet coupling (See NOTE)
12. Governor fuel drain coupling
13. N1 engine control bolt
14. Governor bleed hose
15. Fuel control pressure sensing hose
16. Fuel inlet hose
17. Fuel pressure differential switch hoses
18. Governor seal drain line
19. Solenoid valve electrical connector
20. Starting fuel hose
21. Fuel line

NOTE

On helicopters with ODDS, oil outlet hose (11) is routed to external oil filter unit, then to quick-disconnect fitting at service deck.

Figure 4-2. Power Plant Installation - Left Side (T-53-L-13. Power Plant Installation Shown)

4-4. Cleaning — Power Plant Assembly.

Premaintenance requirements for cleaning power plant assembly

Conditions	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	Portable air compressor
Minimum Personnel Required	Two
Consumable Materials	**(C42), (C65), (176), (C261)**
Special Environmental Conditions	Temperature/ Dust Free/ Well Ventilated

NOTE

Clean engine when inspection reveals an accumulation of dirt, when engine performance decreases excessively, and whenever exhaust gas temperature increases steadily during normal operation. Cleaning of air inlet area, inlet guide vanes, and compressor rotor blades is performed while engine is installed in helicopter.

a. Exterior cleaning of engine.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(1) Exterior of engine and attached components can be cleaned, when thoroughly cool, with cleaning solvent (C261). Dry parts thoroughly after cleaning.

(2) When sprayed solvents or compressed air are used on or around engine, take suitable precautions to avoid forcing dirt, solvent, or moisture into engine openings, bearings, or electrical units or

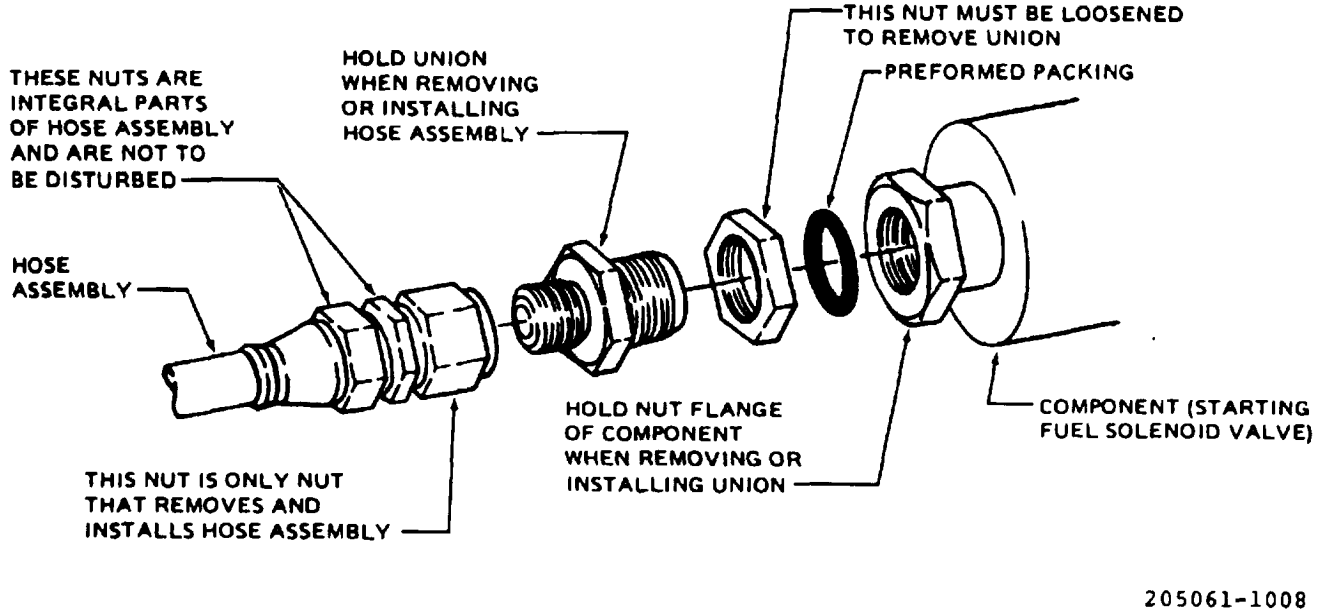


Figure 4-3. Engine Hose Assembly Replacement - Typical

connections. Choice of any particular cleaning agent or process depends on nature and composition of parts to be cleaned and type of contaminants to be removed.

b. Interior cleaning of engine. (Refer to TM 55-2840-229-23.)

4-5. Operational Check — Power Plant Assembly.

NOTE

Operational checks of the power plant assembly will be performed in accordance with TM 55-1520-210-10 and TM 55-1500-328-25.

4-6. ENGINE ASSEMBLY.

4-7. Description — Engine Assembly. Basic engine consists of an inlet housing and reduction gear section, an axial-centrifugal compressor and diffuser, a combustion chamber, a gas producer turbine driving the compressor, a power turbine driving a power shaft, and an exhaust diffuser. Fuel control, starting and ignition, lubrication, and air systems are separately discussed in detail. Considered functionally, the engine is made up of two mechanically independent groups: The gas producer turbine and associated components, the rotational speed of which is commonly designated as N1 on charts and other references; and the power turbine and associated components with rotational speed designated as N2.

4-8. Inspection — Engine Assembly. (Refer to TM 55-2840-229-23.)

4-9. Removal — Engine Assembly.

Premaintenance requirements for engine removal and installation

Conditions	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T8), (T10), (T16), (T20), (T53), (T70)
Test Equipment	None
Support Equipment	Hoist 800 lbs capacity minimum
Minimum Personnel Required	Two
Consumable Materials	(C47), (C155), (C295).
Special Environmental Conditions	None

NOTE

Remove engine from helicopter as a quick-change assembly, with adapting parts attached as outlined below. Preservation should be accomplished, as applicable, before removing engine. (Appendix E and TM 55-2840-229-23.)

a. Disconnect battery; open door and disconnect starter-generator air duct (2, figure 4-1) at upper end.

b. Remove doors and cowling.

NOTE

Position rotor blades to allow for engine removal.

c. Remove air particle separator (paragraph 4-38,4-53 or 4-57.3 as applicable).

d. Remove engine-to-transmission driveshaft (paragraph 6-6 or 6-19, as applicable). Disconnect oil inlet hose (4, figure 4-1) and engine breather hose (5) from oil tank.

e. Disconnect particle separator hose (6) from forward firewall.

f. Loosen nut on V-band coupling (3), release latch, and remove coupling from flange on engine air inlet.

g. Disconnect electrical connector (1, figure 4-2) from fuel filter.

g.1. (Helicopters with ODDS) Disconnect cable plug from chip detector on oil separator (Lubriclone).

h. Disconnect fuel inlet hose coupling (2) from fuel filter.

h.1. (Helicopters with ODDS) Disconnect oil outlet hose (11) at oil separator (Lubriclone).

i. Disconnect power plant electrical connector (4) at firewall. Remove twine securing fire detector wiring to power plant wiring harness.

j. Disconnect droop compensator control tube from cambox assembly by removing cotter pin, nut, washers and bolt (5).

k. Disconnect power lever control tube from power lever control arm by removing cotter pin, nut, washer and bolt (13).

l. Disconnect starter-generator electrical connector (8) at service deck.

m. Disconnect following quick-disconnect couplings at service deck:

(1) Fuel drain coupling (9, figure 4-2).

(2) Starter-generator drain pad coupling (10).

(3) (Helicopters without ODDS) Oil outlet coupling (11).

(4) Governor fuel drain coupling (12).

n. Disconnect bleed air hose (6) at fitting forward of aft firewall.

o. Disconnect tail pipe drain hose from fitting on service deck.

p. Release fasteners securing upper aft firewall to lower firewall.

q. Position hoist (T53) or suitable hoist, having a lifting capacity of at least 800 pounds, over engine (figure 4-4).

NOTE

Engine is nose heavy, adjust engine sling as required.

r. Install sling (T10) on engine. Attach sling to hoist and support weight of power plant on hoist.

s. Check area around power plant to ensure all hoses, lines and electrical cables are disconnected.

t. At each engine mount pillow block, open hinged bearing caps by loosening nuts on pillow block bolts (7, figure 4-2).

u. Remove engine mount bolt (3) with washer from engine mount trunnion.

WARNING

Do not stand underneath engine while engine is suspended from maintenance hoist. Do not stand between engine and airframe while engine is suspended from the maintenance hoist.

v. Hoist power plant from helicopter, carefully guiding engine inlet from mounting flange of forward firewall.

CAUTION

Before engine can be installed in engine maintenance stand, upper forward trunnion mount bolt must be removed (see figure 4-5, detail A) to prevent damage to the support and fuel hose.

w. Install power plant in engine stand. Remove tailpipe (refer to paragraph 4-69). Remove air particle separator mounting ring assembly (paragraph 4-38). Retain removed parts for installation on replacement power plant. Install a suitable inlet cover.

x. Remove particle separator hose (6, figure 4-1) and attaching parts to be used on new power plant

(1) Remove bolt attaching clamp on particle separator hose to clamp on starter-generator air duct (2). Retain bolt for installation on new power plant.

(2) Disconnect diffuser air pressure hose (1).

(3) Remove bolt and gaskets securing elbow and air particle separator hose to engine.

(4) Retain removed parts for installation on replacement power plant.

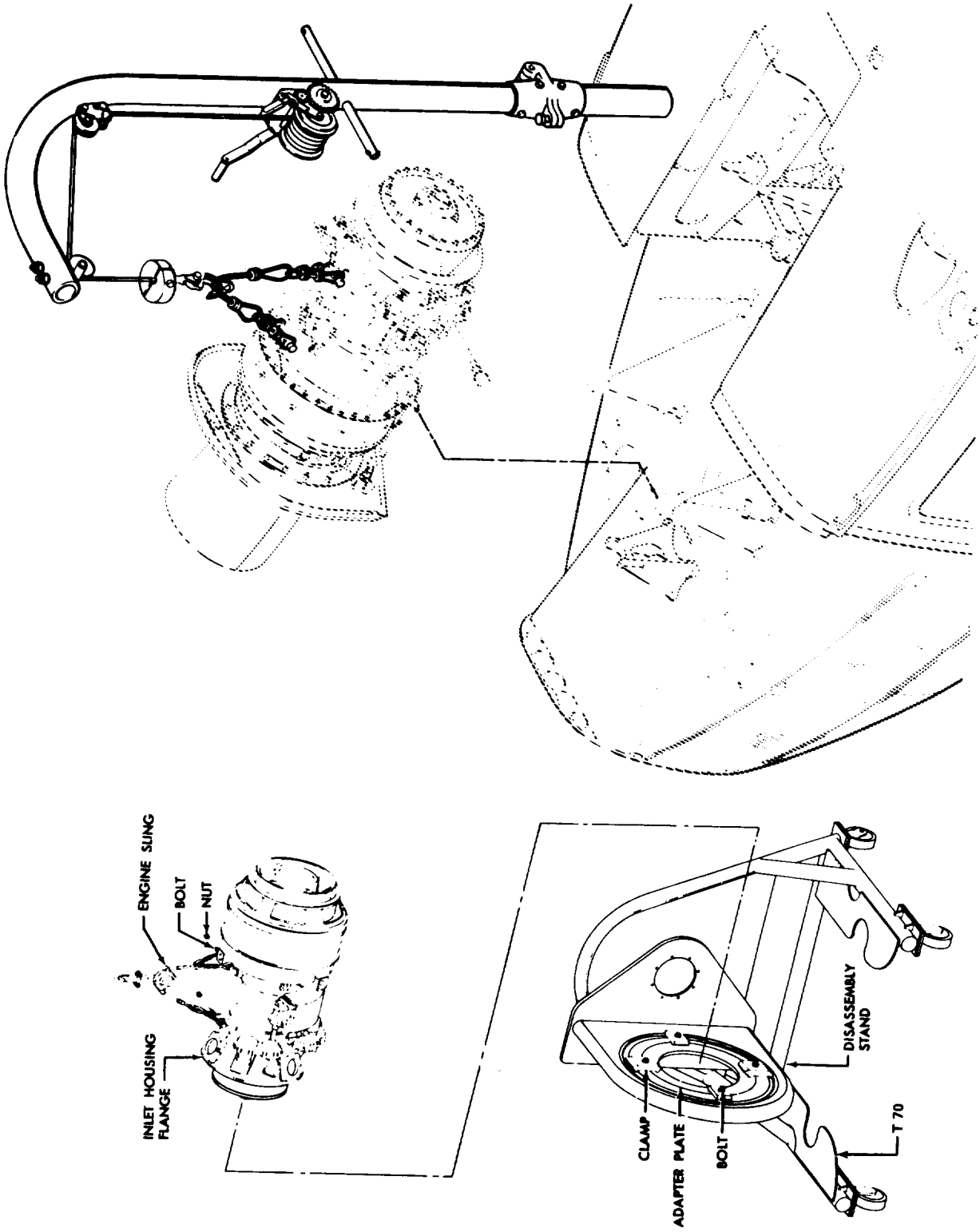
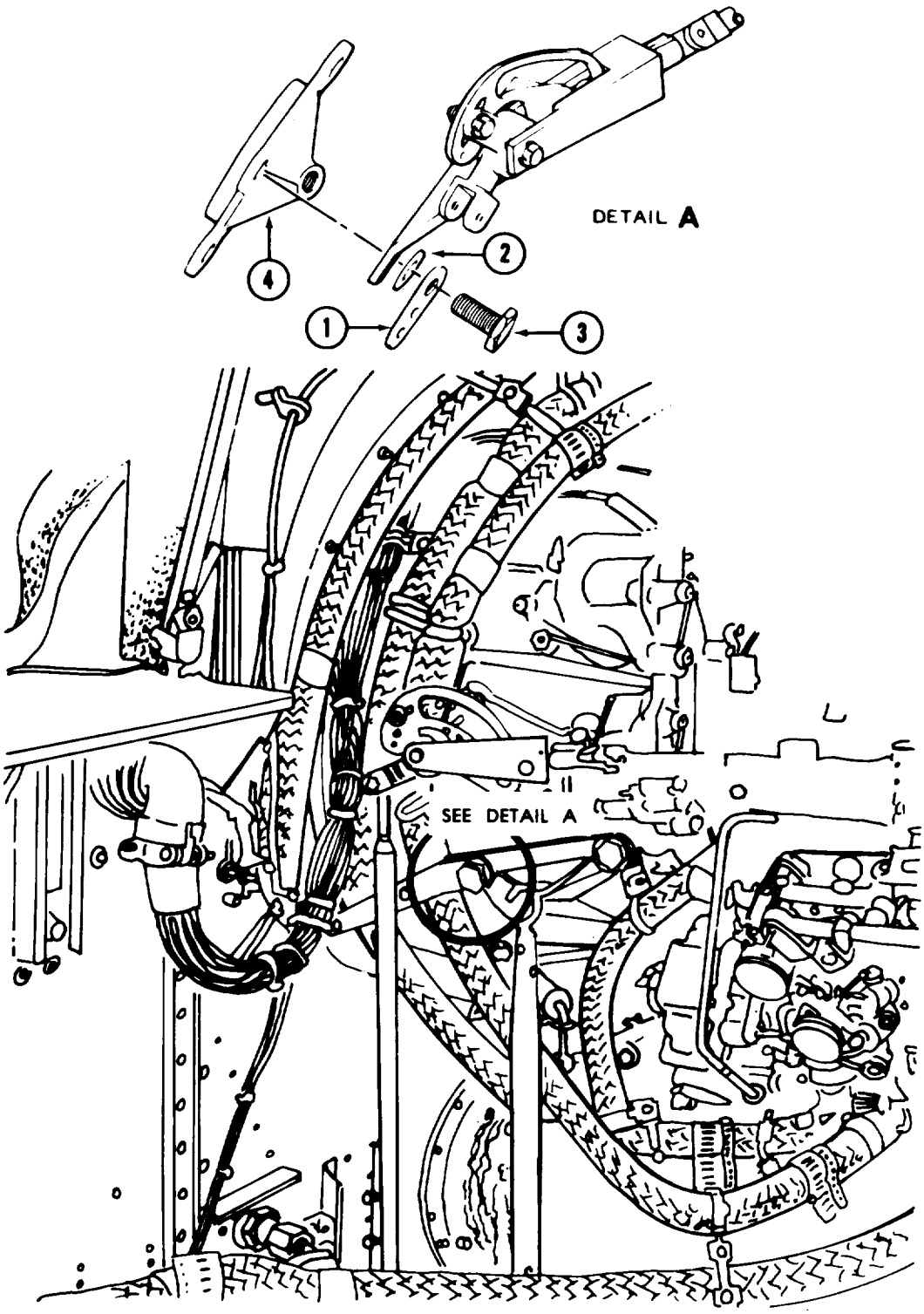


Figure 4-4. Engine Removal from Helicopter



1. Support
2. Washer
3. Bolt
4. Trunnion

Figure 4-5. Engine Trunnion Mount

y. Move rotor blades to stowed position and install blade tie-down.

NOTE

Refer to paragraph 4-142 for build-up instructions of quick-change engine assembly.

z. To convert a quick-change engine assembly to a bare engine assembly, remove parts not included on or with engines as supplied in shipping containers. Remove all adapting parts when preparing an engine for shipment or storage in container, or remove parts only to extent required when preparing for partial disassembly of engine. With engine on a stand, remove parts in any order found practical, using outlined steps as a guide and check list.

(1) Remove retaining bolt, lockwasher, and output shaft adapter.

(2) Remove starter-generator, cable, starter-generator fan assembly, and seal drain hose as follows:

(a) Remove cooling ducts from aft end of starter-generator and at starter-generator shroud assembly.

(b) Loosen hose clamps at each side of starter-generator fan assembly, and remove hose sections from fan. Remove clamp on inlet housing, and remove long hose from engine.

(c) Remove starter-generator fan assembly and cable. Remove seal drain hose and fitting at underside of drive pad, and install plug. Install drive pad cover.

(3) Remove main electrical cable by disconnecting leads from harness and units on engine and from exhaust thermocouple connector on rear firewall, and by detaching cable support clamps end brackets.

(4) Remove linear actuator, governor control shaft lever, and droop compensator cambox and bracket assembly. Remove power lever control arm.

(6) Remove tachometer generators from drive pads on overspeed governor tachometer drive gearbox assembly and on right rear of accessory drive gearbox. Install drive pad covers.

(6) Remove fuel control inlet hose, and cap fitting.

(7) Disconnect two differential pressure switch hoses from restrictor fittings on fuel control. Replace fittings with plugs.

(8) Disconnect hoses from combustion chamber drain valve and from drain tee on fuel control drive pad.

(9) Remove governor seal drain tube and fitting and drain tee.

(10) Remove fuel control vent hose and fittings from inboard side of governor.

(11) Plug open ports, and cap lines.

(12) Detach support clamps and brackets of fuel differential pressure switch hose and oil pressure hose from left side of engine inlet housing.

(13) Remove oil pressure transmitters, pressure switch, brackets, and hoses.

(14) Disconnect pressure hose from oil filter.

(15) Disconnect torquemeter pressure transmitter hoses from left side of inlet housing and left front of accessory drive gearbox.

(16) Replace fittings with plugs.

(17) Remove oil pressure switch and transmitters from support, and remove support assembly from top of inlet housing.

(18) Remove oil pump inlet and outlet hoses and engine breather hose. Replace fittings with plugs.

(19) Remove bleed air hose and elbow from port at top of centrifugal compressor housing. Remove hose support clamps and bracket from engine. Install cover and gasket on studs at bleed port.

(20) Remove exhausts tailpipe with V-bend coupling.

(21) Disconnect exhaust thermocouple cable from connector on rear firewall.

(22) Remove upper rear firewall assembly by releasing V-band clamp around support cone flange and working adapter ring carefully aft over thermocouple tubing.

(23) Remove engine mount trunnions.

4-10. Repair or Replacement--Engine Assembly. (TM 55-2840-229-23)

4-11. Installation - Engine Assembly. This procedure applies to an engine built up with adapting parts to constitute a quick-change assembly.

NOTE

Ensure all parts are clean and serviceable prior to installation.

NOTE

Refer to paragraph 4-142 for assembly of quick-change engine assembly.

a. Install particle separator hose (6, figure 4-1) on new engine assembly using parts removed from old engine assembly.

(1) Disconnect existing bleed valve actuator hose, and remove nipple from diffuser case port.

(2) Install connector (9, figure 4-6) with washers (12) and bolt (11) in diffuser case port, using anti-seize compound (C47) on bolt.

CAUTION

Do not over-torque bolt (11). Cracking of diffuser mounting boss will require engine replacement.

(3) Torque bolt (11) 160 TO 260 inch-pounds. Connect engine line (10). Connect hose (7), and torque. Clamp hose (7) to torquemeter vent hose.

(4) Remove bolt from clamp on starter-generator air duct. Attach clamp on particle separator hose to clamp on starter-generator air duct using bolt from removed engine assembly, spacer, washers, and nut.

(5) On removed engine assembly, install bolt, spacer, washer and nut to secure clamps on starter-generator air duct and torquemeter vent line. Install packing and nipple at port in combustion diffuser. Connect diffuser air pressure hose to nipple.

NOTE

Position rotor blades to allow for positioning hoist and to install engine.

b. Position hoist (T53) or suitable hoist, having a lifting capacity of at least 800 pounds.

NOTE

Engine is nose heavy, adjust engine sling as required.

c. Install sling (T10) on engine. Attach sling to hoist and support weight of engine assembly. Disconnect engine assembly from stand or trailer.

d. Position engine assembly over engine mounts. Guide engine inlet to align with mounting flange of forward firewall while lowering engine assembly until trunnion bearings rest on engine mount pillow blocks.

e. Align forward support tube with hole in forward mount. Install bolt (3, figure 4-2) with washer. Torque bolt 50 TO 60 inch-pounds. Safety bolt (3, Fig 4-2) to forward pair of trunnion mount bolts, safety aft trunnion bolts vertically with lockwire (C155). Refer to paragraph 2 272.a.(4) for alternate procedure.

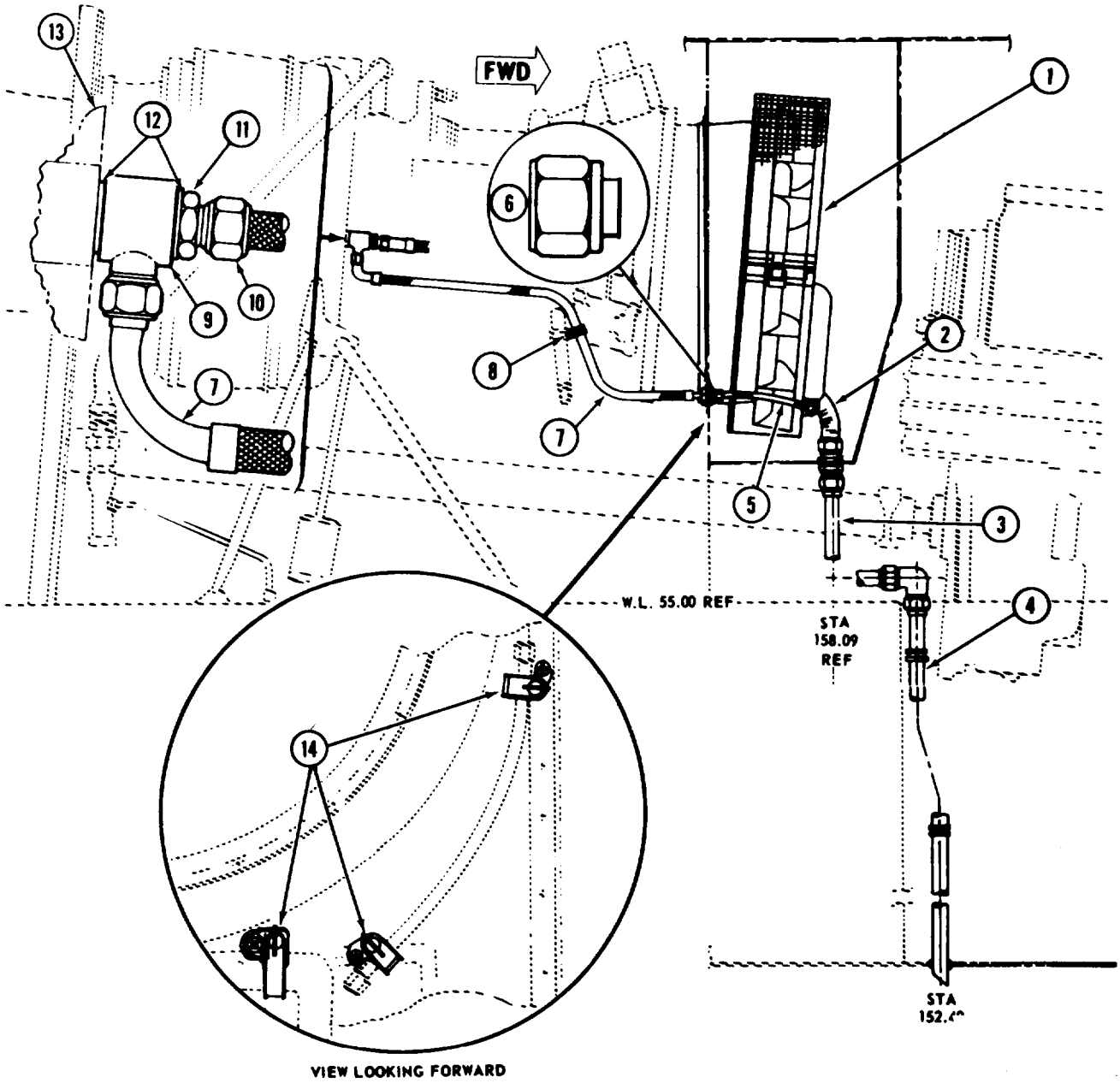
f. Close bearing caps of mount pillow blocks, and tighten nuts on pillow block bolts (7). Torque nuts **50 TO 70** inch-pounds. Lockwire pillow block bearing caps (C155).

g. Remove engine lifting sling from engine and maintenance hoist if used from helicopter.

h. Check to ensure that flange of engine inlet aligns with flange of forward firewall. Loosen screws on forward firewall mounting flange slip joint if alignment is necessary.

NOTE

V-band coupling clamp shall be installed at 3 o'clock position only. This will position the 3.25 inch cut-out in V-band clamp at 6 o'clock position to assist in preventing corrosion on mating surface of engine inlet housing.



1. Particle separator
2. Hose assembly, left-hand
3. Tube assembly, discharge
4. Tube assembly, overboard discharge
5. Hose assembly, right-hand
6. Cap
7. Hose assembly
8. Clamp
9. Connector
10. Engine line
11. Bolt
12. Washer
13. Engine
14. Clamps, stowage

Figure 4-6. Self-Purging Particle Separator Bleed Air Installation

i. Position V-band coupling over engine inlet flange and mounting flange of forward firewall. Close latch of coupling and secure. Torque V-band coupling nut (3, figure 4-1) 40 TO 50 inch-pounds. Tap around clamp to seat and retorque nut 40 TO 50 inch-pounds. If loosened, retighten screws on firewall mounting flange slip joint.

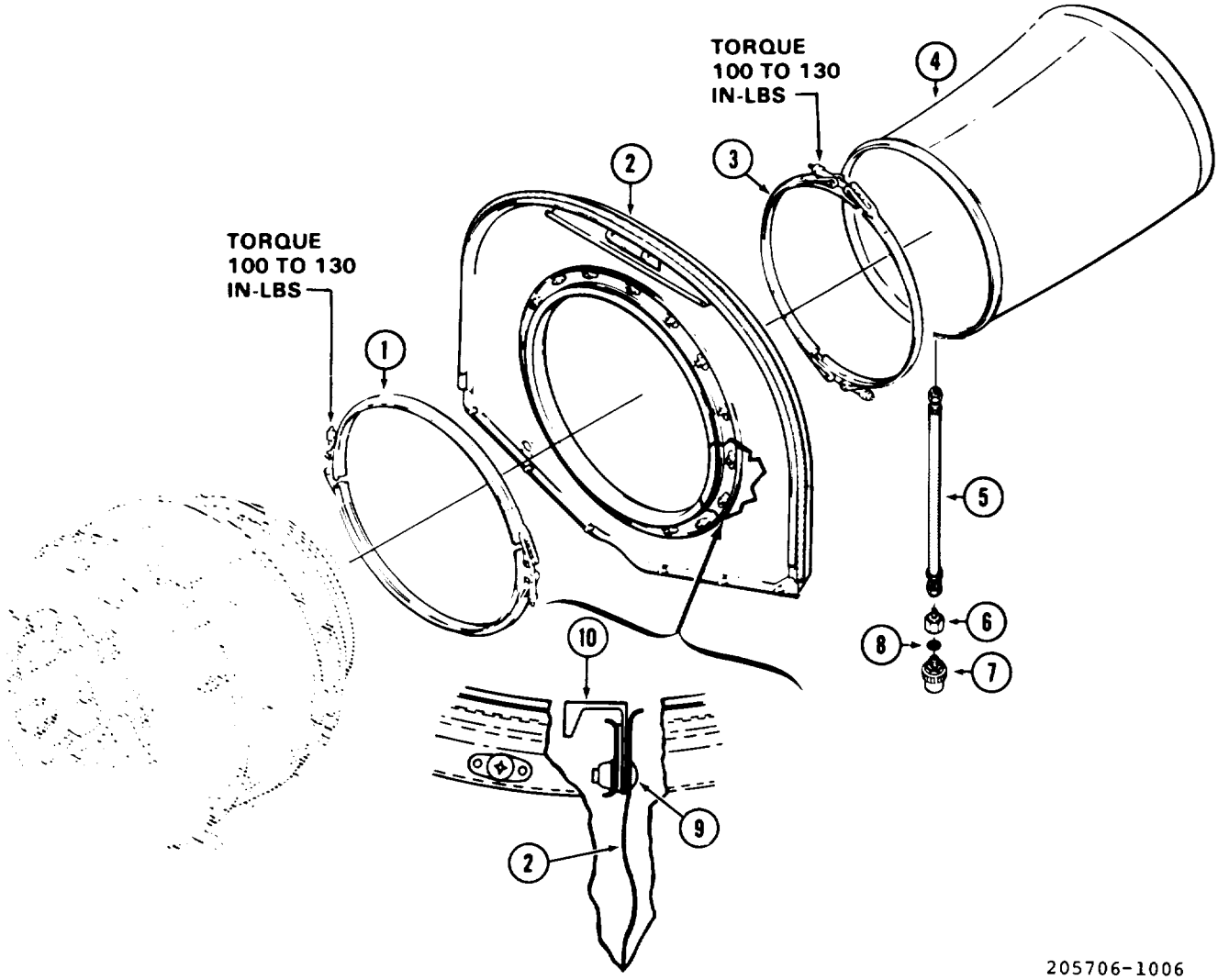
j. Attach upper aft firewall to lower firewall by securing fasteners. If fasteners in upper and lower firewall do not align, screws around slip joint in upper firewall maybe loosened for alignment (figure 4-7), If screws around slip joint are loosened, retighten after firewall fasteners are secured.

k. Connect particle separator hose (6, figure 4-1) to forward firewall.

1. Connect oil inlet hose (4) and engine breather hose (5) to engine oil tank.

m. Connect bleed air hose (6, figure. 4-2) at fitting forward of aft firewall.

n. Connect tailpipe drain hose to coupling on service deck.



1. Clamp
2. Firewall
3. Clamp
4. Tailpipe
5. Hose
6. Bushing
7. Coupling half
8. Gasket
9. Screw
10. Ring

Figure 4-7. Tailpipe Replacement

o. Connect starter-generator electrical connector (8). Lockwire (C154) connector to receptacle mounting screw.

p. Connect the following quick-disconnect couplings at service deck:

(1) Fuel drain coupling (9, figure 4-2).

(2) Starter-generator drain pad coupling (10).

(3) (Helicopters without ODDS.) Oil outlet coupling (11).

(4) Governor fuel drain coupling (12).

p.1. (Helicopters with ODDS.) Connect oil outlet hose (11) to external oil separator (Lubriclone).

q. Connect fuel inlet hose (2) to coupling on fuel filter.

r. Connect power plant electrical connector (4) to receptacle on firewall. Lockwire (C154) connector to receptacle mounting screw.

r.1. (Helicopters with ODDS.) Connect wire plug to chip detector on external oil separator (Lubriclone). Lockwire (C155) wire plug.

s. Connect electrical connector at fuel filter. Secure fire detector wiring to power plant wiring harness using twine (C295).

NOTE

Check engine - to - transmission alignment (paragraph 6-24).

t. Install air particle separator assemblies (paragraph 4-42 or 4-57).

Install main driveshaft (paragraph 6-13 or 6-25 as applicable).

u. Connect power lever control tube to power lever control arm by installing bolt (13, figure 4-2) washer, nut and cotter pin.

v. Connect droop compensator control tube to cambox assembly by installing bolt (5), washers, nut and cotter pin. Place support (1, figure 4-5) and washer (2) on bolt (3) and install through upper forward holes of cambox and trunnion (4). Torque bolts **480 to 690** inch-pounds. Safety bolts in pairs with lockwire (C155). Refer to paragraph 4-11.a.(5) e.

w. Install doors and cowling.

(1) Connect antenna and anti-collision light wiring at deck connectors.

(2) Connect fire detector wiring at connectors on cowling doors.

x. Connect starter-generator air duct (2, figure 4-1) at upper end.

y. Check rigging adjustment of power lever controls (paragraph 4-112).

z. Check rigging adjustment of droop compensator power turbine governor RPM controls (paragraph 4-128).

aa. Check servicing. Reconnect battery. Accomplish post-installation inspection and ground functional checks (paragraph 1-1 and TM 55-1520-210-10 and TM 55-2840-229-23).

ab. Perform engine vibration test (TM 55-2840-229-23).

SECTION II. COOLING SYSTEM

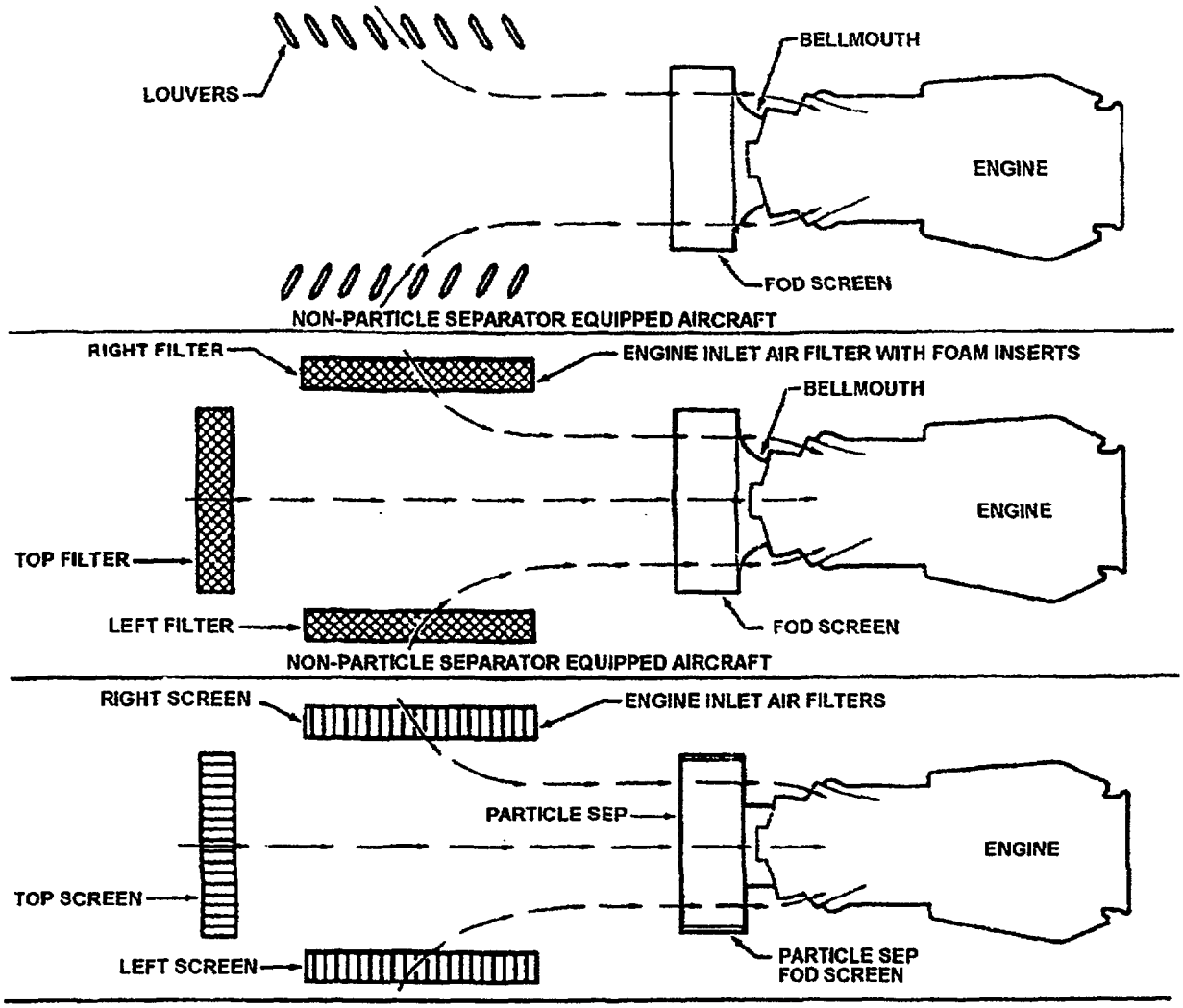
(Not applicable)

SECTION III. AIR INDUCTION SYSTEM

4-12. AIR INDUCTION SYSTEM.

4-13. Description - Air Induction System. Four different air induction system configurations are in service, Figure 4-8 depicts the air induction filter configuration for the four systems.

a. Non Self-purging particle separator equipped helicopters have engine air inlet filters similar to those described in paragraph 4-15 and 4-23 but without foam inserts.



NON-SELF-PURGING PARTICLE SEPARATORS
SCHEMATIC OF AIR FLOW AND AIR FILTER REQUIREMENTS

WARNING

Never use engine inlet air filters with foam inserts when engine is equipped with any particle separator.

NOTE

Internal screens and foam filtering material furnished with the non-self-purging particle separators will not physically or functionally work on self-purging separators.

Figure 4-8. Filter and Particle Separator Configuration

4-14. AIR INDUCTION SYSTEM LOUVER AND FILTER TYPE.

4-15. Description — Louver and Filter Type Air Induction System (figure 4-9). The engine air inlet section draws in air through a bellmouth which is fitted with a coarse wire screen and an ice detector probe. The bellmouth extends through the forward firewall into an air induction area protected by baffles, The induction area in the original configuration is covered by a set of louvered fairing or a three-piece set of air inlet filters using double layers of porous foam plastic material to protect the engine from foreign matter. A pressure switch on the firewall will actuate a warning light on the instrument panel if filters become clogged,

4-16. Induction Baffles, Intake Screen and Bellmouth. The induction baffles are sheet metal panels secured by cowling fasteners to mounting brackets on cabin structure and pylon supports, removable for access to driveshaft. The intake bellmouth is secured on the engine inlet housing flange by a V-band clamp, and to the engine forward firewall by means of a retainer ring secured in place over the bellmouth mounting flange in such manner as to form slip-joint to accommodate variations of engine alignment. The intake screen is a two-piece assembly, secured by bolts to nutplates on the end of the bellmouth, and rests on shock pads against the engine nose around the main driveshaft, The upper left section of screen can be readily removed for driveshaft access,

4-17. Inspection — Air Inlet Filters. Examine filter assemblies for visible damage or shifting of filter material from normal position, Check condition and security of seals around edges.

4-18. Removal — Intake Screen, Bellmouth, and Baffles (figure 4-9). a. Open transmission fairing. Remove air inlet filters from fairing.

b. Remove access section of intake screen and top section of forward induction baffle by releasing fasteners,

c. Remove main driveshaft (para. 6-17 as applicable).

d. Remove mounting screws to detach remaining section of intake screen from end of bellmouth.

e. Disconnect and remove ice detector probe from brackets at top of bellmouth,

f. Open engine compartment cowling. Remove V-band clamp to release bellmouth from engine inlet housing.

g. Remove screws from back of firewall to detach retainer ring and bellmouth from front of firewall.

h. Cover front of engine inlet housing to keep out dirt and foreign objects.

i. Remove remaining sections of induction baffle as necessary.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

4-19. Cleaning – Engine Air Intake. Remove all obstructions, deposits and dirt. Detached parts can be cleaned with solvent (C261). Clean engine as necessary by appropriate cleaning procedures (para. 4-4).

4-20. Inspection — Engine Air Intake,

NOTE

In areas where operational experience shows filter blockage to be a problem, it is recommended that this inspection be performed before each flight.

a. Inspect all parts for condition and for any indications that foreign objects have entered engine.

b. Inspect engine inlet housing ducts carefully for signs of internal damage, oil streaks, and for accumulated dirt which may occur as a coating conforming to contour of air flow.

4-21. Repair — Engine Air Intake. Replace damaged components.

4-22. Installation — Air Intake Bellmouth, Screen and Baffles (figure 4-9).

a. Remove protective covers from engine inlet.

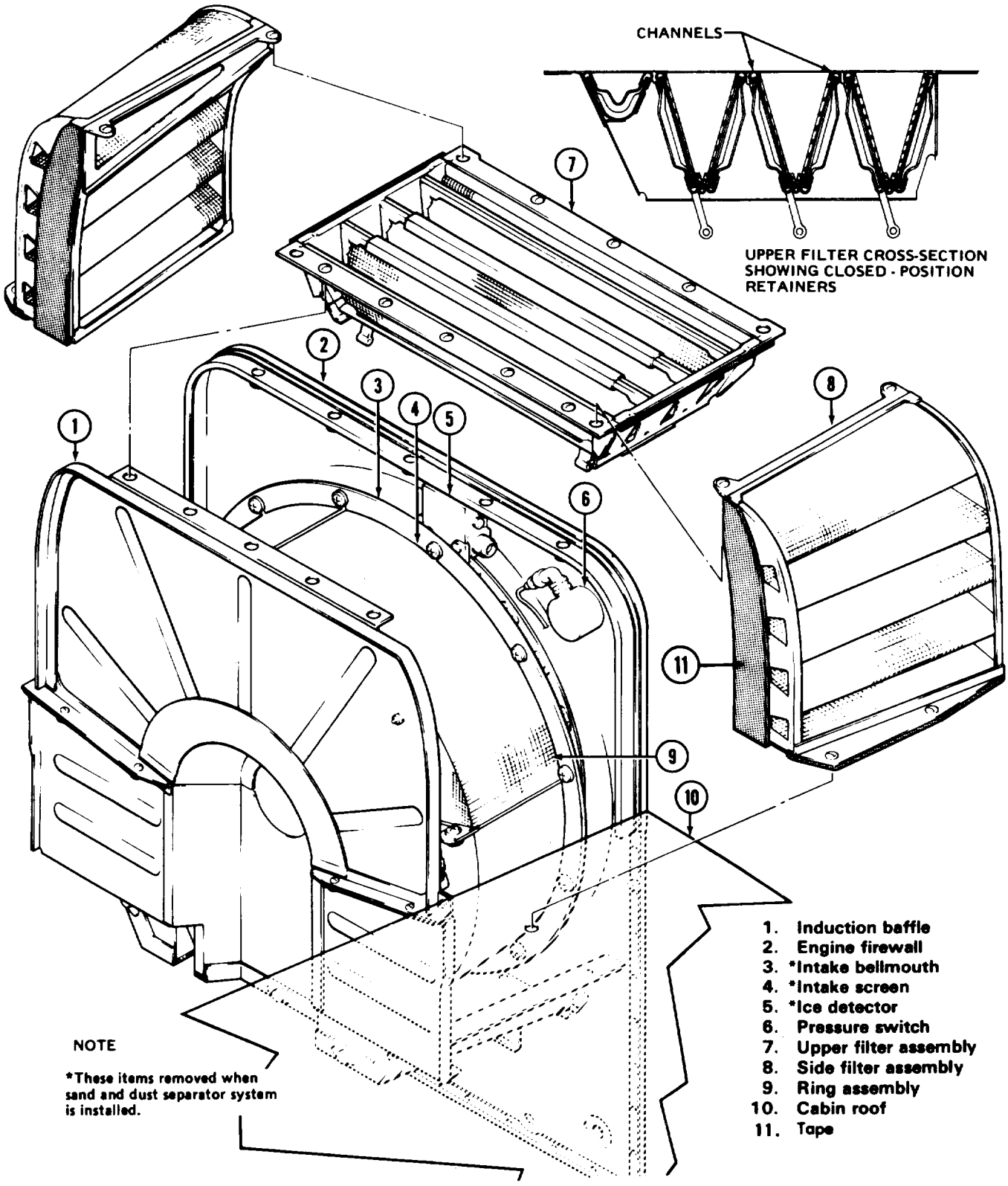


Figure 4-9. Engine Air Inlet Filter Installation

b. Place retainer ring, with plate nuts forward, on bellmouth ahead of slip-joint flange. Insert bellmouth through forward firewall from front, align to mating flange on engine inlet housing, and secure temporarily with V-band clamp at 30 degree position. Be sure mounting hole and brackets for ice detector probe are at top.

NOTE

V-band coupling clamp shall be installed at the 3 o'clock position only. This will position the 3.25 inch cutout in the V-band at the 6 o'clock position to assist in preventing corrosion on mating surfaces of engine inlet housing.

c. Align bellmouth retaining ring to mounting holes of firewall and install the washers and retaining screws loosely. Torque V-band coupling nut **40 TO 50** inch-pounds, tap around the clamp to seat it, retorque nut **40 TO 50** inch-pounds. Tighten the retaining screws.

d. Install lower sections of induction baffle, omitting upper section of forward baffle.

e. Install intake screen, without removable section, on end of bellmouth with screws.

f. Install main driveshaft (para. 6-23 as applicable). Install remaining section of intake screen and forward baffle.

g. Install and connect ice detector probe.

h. Install air inlet filters on fairing. Close engine cowling and transmission fairing.

4-23. Air Inlet Filters. The three filter sections (7 and 8, figure 4-9) have metal frames and are secured in place by cowling fasteners or bolts. The top section is made up of hinged panels with actuating levers, but in this installation the panels are always secured in closed position by means of metal channels and links.

4-24. Removal- Air Inlet Filters.

a. Open transmission fairing.

b. Remove louver assembly if installed.

c. Remove the top section of induction baffle assembly (1, figure 4-9).

d. Remove each of two side sections of inlet filter, by releasing fasteners or bolts at top and bottom edge.

e. Remove top filter by releasing fasteners or bolts along forward and aft edges.

f. Protect induction area from entry of dirt and foreign objects while filters are not in place.

4-25. Cleaning - Air Inlet Filters. Wash filters in a water solution of detergent soap (C101). Flush from inside with clear water. Allow filters to drain and air dry thoroughly. Do not use compressed air drying.

4-26. Repair or Replacement - Air Inlet Filters. Replace filter assemblies which cannot be made serviceable by cleaning and repair of edge seals by replacing foam tape. Replace loose, corroded, or missing rivets with friction-lock rivets. Apply sealant (C244) as described in para. 4-27c.

4-27. Installation - Air Inlet Filters.

NOTE

In areas where operational experience shows filter blockage to be a problem, it is recommended that this inspection be performed before each flight.

a. Clean engine air intake (para. 4-19).

b. Inspect engine air intake (para. 4-20).

c. Insure that the panels of the top filter assembly are held securely in the closed position by channels installed on the upper side over the two forward panel joints, and on the under side by two links bolted to the aft pairs of actuating levers. Insure that sealing compound (C244) has been applied to all of the rivets to prevent rivets from coming loose and causing FOD to the engine. Sealant is to be applied to the bottom under side of the inlet screen panels. Sealant may be applied to the adjacent screen mesh and should not extend further than 0.250 of an inch onto the screen. A strip of sealant larger than 0.250 of an inch would begin to restrict the air flow through the screen.

CAUTION

Remove top filter assembly from aircraft when lockwiring channels to prevent possible FOD to engine.

c.1. Secure the two channels to top filter assembly by installing lockwire (C155) through screens and around each channel at four equally spaced positions.

d. Align top filter assembly on upper edges of induction baffle and firewall. Secure cowling fastener or bolts.

e. Align each side filter assembly to mounting holes. Secure fasteners at upper end, and fasteners (or bolts) to cabin roof.

4-28. NON-SELF-PURGING PARTICLE SEPARATOR - AIR INDUCTION SYSTEM.

4-29. Description - Non-Self-Purging Particle Separator Air Induction System. The air particle separator is an inertial-type separator consisting of an upper and a lower assembly half, a deflector, a mounting ring assembly, a flange assembly and seal, gaskets and attaching hardware. Removal of the upper assembly half permits maintaining the main driveshaft and inspecting the engine inlet. The lower assembly half mounts the air cleaner which collect particles removed from the engine inlet air and ejects them overboard. A flange assembly provides means of attaching the separator to the engine inlet housing. The foreign object damage screen consists of two halves which fit around the air particle separator inlet to prevent large foreign objects from entering the engine. Engine inlet air passes through the FOD screen, where any large particles are caught immediately, and enters the separator through a curved, annular, radial inflow bellmouth provided in the upper and lower assembly halves (figure 4-10). Separation occurs when the contaminated air is drawn through a turn, causing particles to be forced to the concave inner flow wall and caught by a protruding lip of the deflector assembly. Clean air continues into the engine inlet area while contaminated portion of the air is drawn through a second turn causing further separation. The clean air resulting from the second turn is returned to the engine inlet area while particle-laden air flows into a large annular chamber and through an air cleaner mounted in the lower half of the separator.

4-30. Air Inlet Screens - Non-Self-Purging Particle Separator.

NOTE

Refer to para. 4-22 through 4-27 for maintenance procedures.

4-31. Inlet FOD Screen - Non-Self-Purging Air Particle Separator. The particle separator inlet screen is a stainless steel wire woven screen which covers the inlet area of the particle separator. The screen is comprised of two independent portions, each portion having a mesh size of 5 1/2 square per linear inch. The purpose of this inlet screen is to prevent engine damage from large foreign objects being injected into the engine intake.

4-32. Inspection Inlet Screen - Non-Self-Purging Air Particle Separator.

a. Inspect exterior of FOD screen for damage which would permit foreign object entry.

b. Inspect aft molding cuts or other damage.

c. Inspect latch assemblies for damage as follows:

(1) Erosion or damage that may cause tightness or binding.

(2) Cracks. If crack in latch assembly is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

(3) Loose or missing rivets.

d. Inspect screen for deformation.

4-33. Removal - Inlet Screen - Non-Self-Purging Air Particle Separator (figure 4-11).

a. Open right and left transmissions and engine cowl.

b. Remove baffle door. Remove top section of forward induction baffle by releasing fasteners.

c. Remove remaining sections of induction baffle.

CAUTION

Do not attempt to open catch without holding safety latch.

d. Open latches located on left and right hand side of inlet screen.

e. Remove top screen (1).

f. Remove bottom screen (12).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

4-34. Cleaning Inlet Screen - Non-Self-Purging Air Particle Separator. Clean screen with solvent (C261).

4-35. Repair — Inlet Screen — Non-Self-Purging Air Particle Separator. a. Reshape deformed parts, if feasible. If reasonable conformity cannot be obtained, replace either half or both as required.

b. Replace parts having severe damage or mutilation.

c. Replace screen halves with missing or loose rivets. Small tears and holes in screen assemblies, not exceeding 0.25 square inches per filter screen may be repaired as follows:

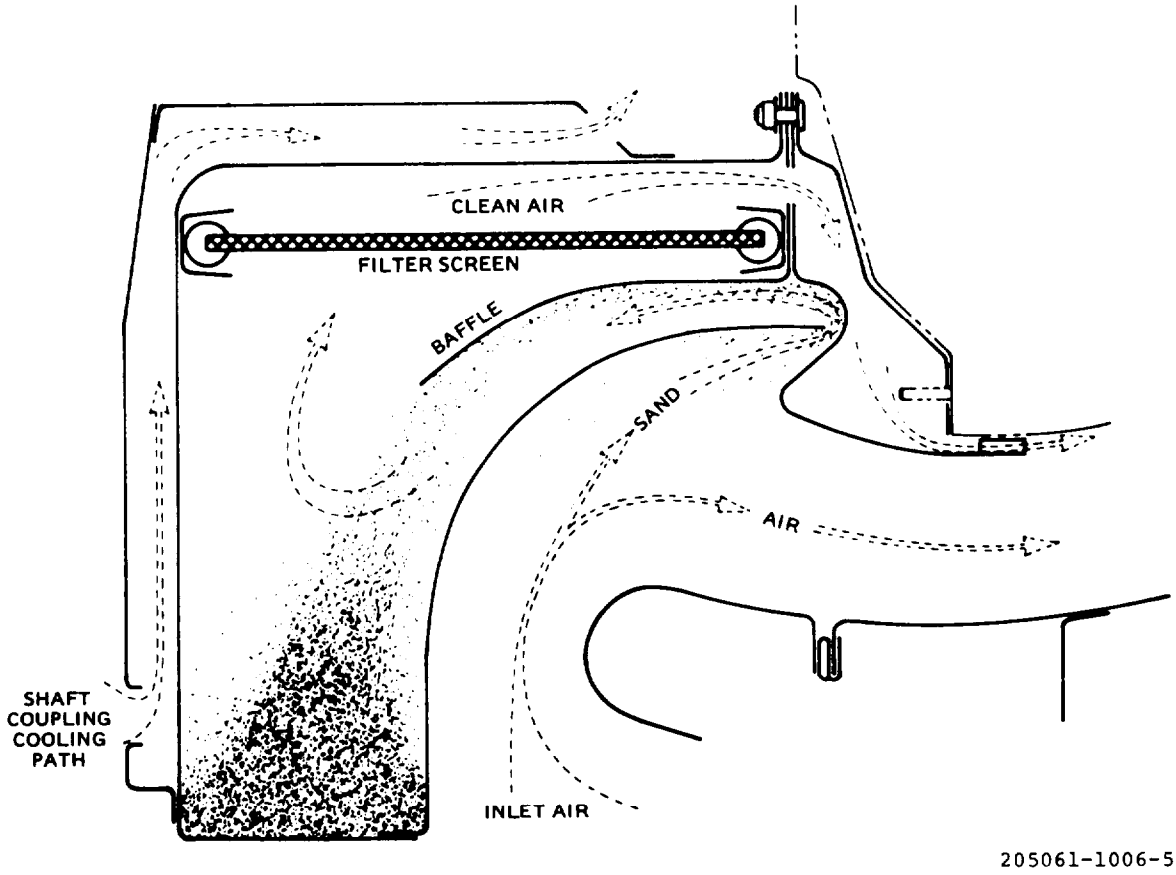


Figure 4-10. Non-Self-Purging Particle Separator Air Flow Diagram

(1) Apply small amount of adhesive (C79) at tear or hole. Spread adhesive to bridge and cover hole. Application shall be on side opposite metal guard.

(2) Allow adhesive to cure 24 hours at 75 degree F before installing screen.

4-36. Installation – Inlet Screen – Non-Self-Purging Particle Separator. a. Open right and left transmission and engine cowls.

b. Remove baffle door. Remove top section of forward induction baffle by releasing fasteners.

c. Remove remaining sections of induction baffle.

d. Install bottom screen sections with aft molding engaging filter split flange and butt molding engaging the adjacent filter inlet vanes.

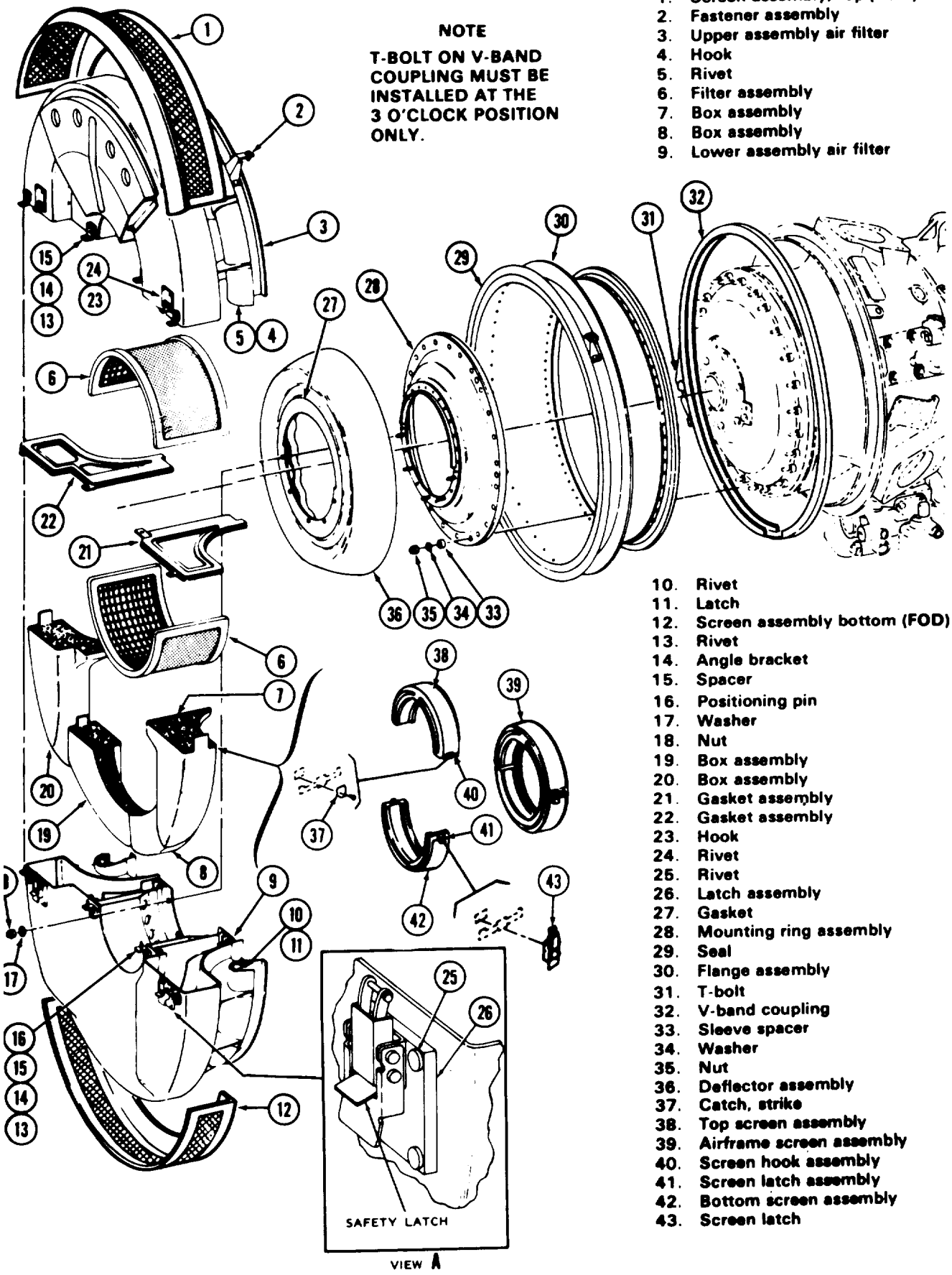
e. Install top screen section with aft molding engaging filter split flange and cut out centered over filter latch at 12 o'clock position.

f. Secure screens by latching. Latches are located on left and right side,

g. Install induction baffle assembly and secure.

h. Install baffle door

i. Close right and left transmission and engine cowl and secure.



1. Screen assembly, top (FOD)
2. Fastener assembly
3. Upper assembly air filter
4. Hook
5. Rivet
6. Filter assembly
7. Box assembly
8. Box assembly
9. Lower assembly air filter
10. Rivet
11. Latch
12. Screen assembly bottom (FOD)
13. Rivet
14. Angle bracket
15. Spacer
16. Positioning pin
17. Washer
18. Nut
19. Box assembly
20. Box assembly
21. Gasket assembly
22. Gasket assembly
23. Hook
24. Rivet
25. Rivet
26. Latch assembly
27. Gasket
28. Mounting ring assembly
29. Seal
30. Flange assembly
31. T-bolt
32. V-band coupling
33. Sleeve spacer
34. Washer
35. Nut
36. Deflector assembly
37. Catch, strike
38. Top screen assembly
39. Airframe screen assembly
40. Screen hook assembly
41. Screen latch assembly
42. Bottom screen assembly
43. Screen latch

Figure 4-11. Particle Separator-Non-Self -Purging-Exploded View

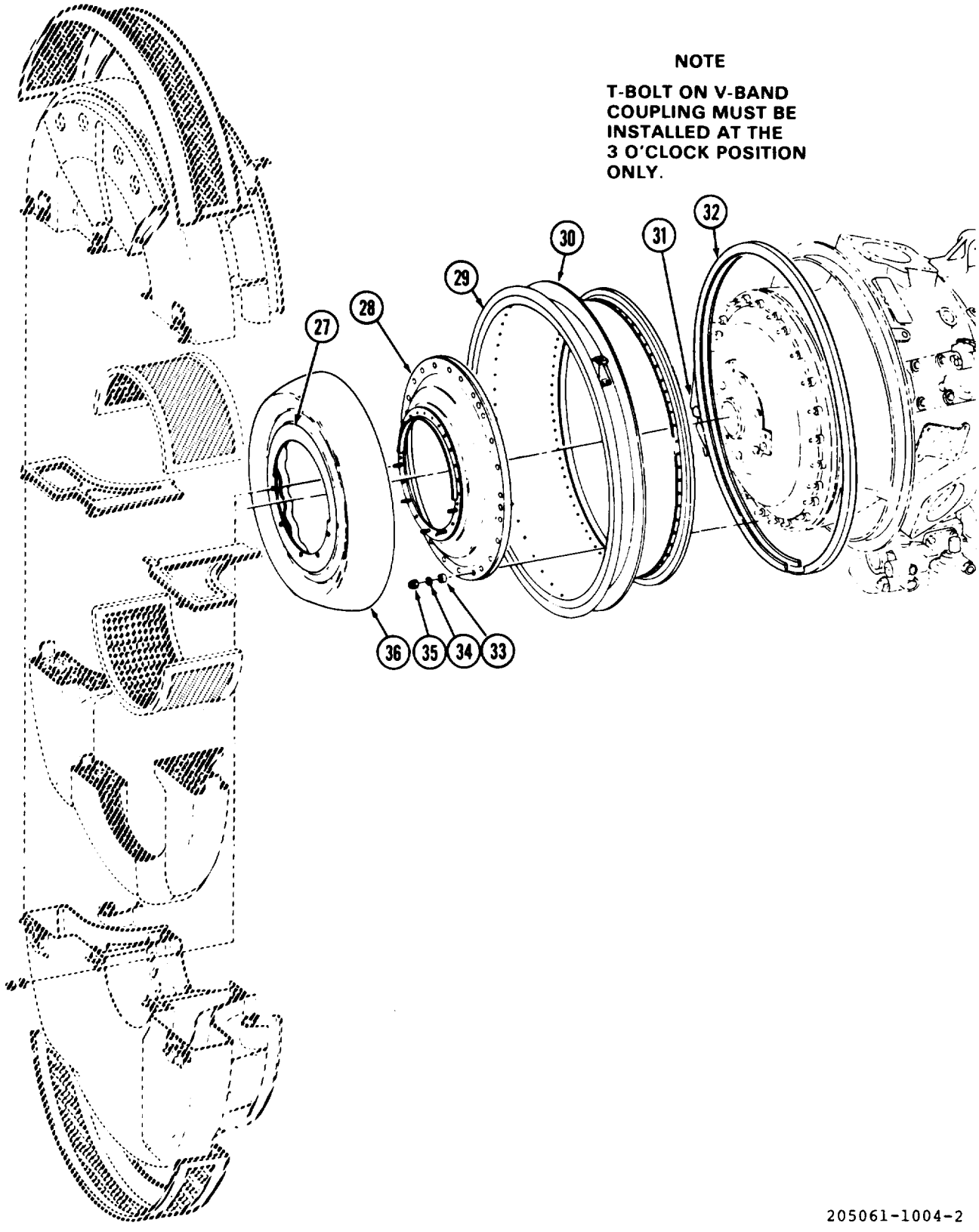


Figure 4-11. Particle Separator-Non-Self-Purging-Exploded View (Sheet 2 of 2)

4-37. Particle Separator - Non-Self-Purging. The non self-purging particle separator is an inertial type separator made in two halves. Engine inlet air enters the separator through a curved, annular, radial inflow opening. Particles entering with the air are pulled out of the airstream, and follow along the curved inner wall (figure 4-10). A lip extending into the airstream deflects the particle-laden air into a large chamber, where the air velocity decreases. The large particles in the air settle in the chamber; fine particles are removed as the air is drawn through a 230 mesh screen on the filter assembly. Removed particles are held in box assemblies which contain porous plastic foam inserts. The box assemblies can be easily removed and cleaned. Other components used with the sand and dust separator are ENG AIR FILTER CONT circuit breaker on overhead console, and engine air differential pressure switch on the firewall, and an ENGINE INLET AIR warning light on the instrument panel.

4-38. Removal - Particle Separator - Non-Self-Purging.

a. Remove stainless steel mesh filter screen if installed. Open transmission fairing and remove right and left access doors. Remove air inlet filter screens from fairing (para. 4-33).

b. Remove top section for forward induction baffle by releasing fasteners.

c. Remove remaining sections of induction baffle.

CAUTION

Do not attempt to open catch without holding safety latch.

d. Release latches (11 and 26, figure 4-11) on front and rear faces of air filters (9 and 3). Press safety latch up and hold before attempting to pull on release catch. (See View A.)

e. Release fasteners (2) at top of upper assembly air filter and remove assembly.

f. Remove gasket assemblies (21 and 22).

CAUTION

Filter assemblies shall be pulled vertically or inboard, maintaining form of curve. Pull on hard plastic tab provided at each end adjacent to screening. Handle assemblies with care to prevent damage to screen.

g. Remove filter assemblies (6). Push on one end while pulling at other end.

h. Using tab on box for fingerhold, remove box assemblies (7, 8, 19 and 20) from lower assembly air filter.

i. Remove main driveshaft as a complete assembly, and engine curvic coupling adapter from engine. (Para. 6-17, as applicable.)

j. Remove nut (18) and washer(17). Remove lower assembly air filter (9) and deflector assembly (36).

k. Remove nut (35), washer (34), and spacer (33). Remove mounting ring assembly (28). Loosely install spacers, washers, and nuts on engine.

l. Remove washers and screws that secure split ring assembly to firewall and remove split ring assembly. Loosen V-band coupling clamp and remove flange assembly (30).

m. Cover front of engine inlet housing to keep out dirt and foreign objects.

4-39. Cleaning - Air Particle Separator - Non-Self-Purging.

a. Empty box assemblies (7, 8, 19, and 20, figure 4-11) of sediment and moisture. Wash mud from plastic box and foam insert with water. Shake off excess water. Allow to air-dry or wipe with clean cloth.

b. Remove any sand or water accumulation from well of lower assembly air filter (9). Wipe the well with a clean cloth. When filter assemblies (6) are in place, use care to prevent damage to the screen.

c. Shake filter assemblies (6) to remove loose dirt from screen. If necessary, wash in clean water, and scrub with soft-bristle (C52). Shake off excess water; allow to air-dry or wipe with clean cloth.

d. If equipped with stainless steel mesh filter screens, use hot water solution of detergent soap (C101) to remove heavy contamination.

4-40. Inspection - Air Particle Separator-- Non-Self-Purging.

a. Inspect gasket assemblies (21 and 22, figure 4-11) for severe rubber separation from backing plate and for cuts.

b. Inspect gasket on mounting ring assembly (28) for cuts or looseness.

c. Inspect gasket (27) on deflector assembly for cuts or looseness.

d. Inspect filter assemblies (6) for tears in screen.

e. Inspect for loose rivets on air filters (9 and 3).

f. Inspect seal (29) on mounting flange assembly for cuts or looseness.

g. Inspect all metal parts for cracks and damage. If crack is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

4-41. Repair - Air Particle Separator - Non-Self-Purging (figure 4-11).

Minor repairs only are possible on an installed assembly.

Premaintenance requirements for repair of non-self-purging particle separator

Conditions	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	Welding Equipment
Minimum Personnel Required	One
Consumable Materials	(C22), (C34), (C62) (C155), (C224), (C229), (261), (C281), (C290), and (C308)
Special Environmental Conditions	Temperature/ Dust Free/ Well Ventilated

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

a. Cement loose gaskets to gasket assemblies (21 and 22) mounting ring assembly (28), and

deflector assembly (36) with adhesive (C34). Clean mating surfaces with trichloroethylene (C290).

b. Replace loose or damaged gasket on mounting ring assembly (28) with 0.125 inch thick by 0.190 inch wide tape, cut from rubber (C229). Clean metal surface with trichloroethylene (C290) and cement with adhesive (C34).

c. Replace loose or damaged gasket (27) on deflector assembly. Clean metal surface with trichloroethylene (C290), and cement with adhesive (C34).

d, Repair filter assemblies (6) by applying silicone rubber, (22). Clean mating surfaces with trichloroethylene (C290).

e. Cement loose seal (29) to flange assembly (30) with silicone rubber (C22). Clean mating surfaces with trichloroethylene (C290).

f. Replace damaged areas of seal (29) using one length of seal to make complete repair. Clean metal surface with trichloroethylene (C290) with cement seal with silicone rubber (C22).

g. Replace damaged latch assemblies (26) on lower assembly air filter (9) as follows:

(1) Remove rivets and remove latch.

(2) Assemble upper and lower assembly air filters without gasket assemblies (21 and 22).

(3) Position latch assembly or latch on air filter in line with hook on upper assembly air filter. Scribe lines to position latch.

(4) Separate air filters.

(5) Position latch within scribed lines, and drill 0.128 TO 0.133 inch holes for rivets.

(6) Secure latch assembly (26) with four solid rivets (25).

(7) Use vinyl tape (C281) between latch (11) and mounting surface. Secure with two solid rivets (10).

h. Replace a damaged positioning pin (16, figure 4-11) or bracket (14) on lower assembly air filter.

(1) Remove rivets, bracket, and spacer (15).

(2) Assemble upper and lower assembly air filters without gasket assemblies (21 and 22).

(3) Position spacer and bracket on air filter in line with bracket on upper assembly air filter, Top of bracket will be slightly higher than edge of air filter, Scribe lines to position spacer and bracket,

(4) Separate air filters

(6) Position spacer and bracket within scribed lines and drill two 0.128100.133 inch holes for rivets.

(6) Use vinyl tape (C281) between spacer and bracket, Secure with solid rivets (13).

(7) Use vinyl tape (C281) between latch (11) and mounting surface. Secure with two solid rivets (10).

(8) Drill a 0.250 TO 0.252 inch hole through bracket.

(9) Install positioning pin (16) in bracket.

(10) Tack-weld pin at two places, 180 degrees apart, using welding wire (C307).

i. Replace damaged hook assembly (23, figure 4-11) or hook (4) on upper assembly air filter as follows:

(1) Remove rivets, and remove hook.

(2) Assemble upper and lower assembly air filters without gasket assemblies (21 and 22).

(3) Position hook assembly or hook on air filter in line with latch on lower assembly air filter. Scribe lines to position latch.

(4) Separate air filters.

(6) Position latch within scribed lines, and drill 0.128 T0 0.133 inch holes for rivets.

(6) Secure hook assembly (23) with four solid rivets (24).

(7) Use vinyl tape (C281) between hook (4, figure 4-11) and mounting surface. Secure with two solid rivets (5).

j. Repair Particle Separator. Make repairs to particle separators, P/N 1-010-500, as follows:

(1) Remove anodize coating from area to be welded by grinding or other physical means,

(2) Repairs shall be made using TIG welding in accordance with Military Specification MIL-W-8604 (Aer), and filler rod (C224).

(3) After welding, clean area affected by welding, including side of material opposite the weld, and brush on chemical film material (C62).

(4) Patches and doublers shall be attached by welding where possible.

(5) Material shall be aluminum alloy of the same thickness as the part being repaired. "

NOTE

Blind rivets will not be used to repair panicle separator.

(6) Where welding is not possible, repair may be made using rivets, Where possible, solid rivets shall be used.

(7) Brush chemical film material (C62) on drilled areas.

4-42, Installation – Air Particle Separator – Non-Self-Purging. a. Remove cover from front of engine inlet housing.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

b. Wipe engine inlet housing clean with cloth moistened with dry cleaning solvent (C261).

c. Place ring assembly around flange assembly (30, figure 4-11) and install flange in position on inlet housing of engine. Secure loosely with V-band coupling clamp.

d. Using ring assembly, position forward section of flange assembly to firewall. Install washers end straws from rear of firewall to secure ring,

e. Install mounting ring assembly (28) on 24 studs of engine inlet housing so that the five studs on the ring assembly are at the bottom with center stud at 6 o'clock position. Secure with sleeve spacers (33), washers (34) and nuts (35). Torque nuts 70 to 80 inch-pounds,

CAUTION

Carefully install deflector assembly to avoid cutting rubber seal of ring assembly.

f. Position deflector assembly (36) in place on the five ring assembly studs and press in until firmly seated,

NOTE

Nut and washer at 6 o'clock position are not required and if omitted will permit removal of botton half of separator without removing main drive shaft.

g. Position lower assembly air filter (9) on five studs of ring assembly, Secure with washers (17) and nuts (18). Torque nuts 30 to 35 inch-pounds.

h. Position upper assembly air filter (3) on lower assembly (9).

NOTE

Do not install gasket assemblies (21 and 22) at this time,

i. Rotate flange assembly on inlet housing to align receptacles with fasteners (2) on filter assembly

NOTE

V-band coupling clamp shall be installed at the 3 o'clock position only. This will position the 3.25 inch cut-out in the V. band clamp at the 6 o'clock position to assist in preventing corrosion on mating surface of engine inlet housing.

j. Secure the flange assembly with V-band coupling, and torque nut 40 TO 50 inch-pounds. Tap around clamp to seat it, retorque nut 40 TO 50 inch-pounds.

k. Remove upper assembly air filter (3).

l. Install engine curvic coupling adapter in output shaft of engine (para. 6-23 as applicable).

m. Install main driveshaft between engine and transmission (para. 6-23 as applicable).

n. Install baffle panels.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

CAUTION

Do not use oil or grease in track when installing screen filter assemblies. Push from back end while pulling into position.

o. Install filter assemblies (6) in upper and lower assembly air filters (3 and 9), with backing screen on inside diameter. The filters should protrude equally at each end. If necessary clean tracks with trichloroethylene (C290).

p. Install four box assemblies (7,8. 19. and 20, figure 4-11) into lower assembly air filter.

q. Position gasket assemblies (21 and 22) over pins on lower assembly air filter.

r. Position upper assembly air filter (3) on lower assembly air filter (9). Tip top slightly forward to place on four positioning pins (16) first.

s. Secure air filter to flange assembly with fasteners (2) at top,

CAUTION

Secure front latches before securing rear latches.

t. Engage latches (26) on front face of air filters; then lock.

CAUTION

Ensure that safety latch on latches is engaged by exerting a slight pull on release catch. Catch will not open. (See View A. figure 4-11.)

u. Engage latches (11) at rear of filters; then lock.

v. Check for proper seating by appearance of seals. Approximately 0.125 inch of rubber on gasket assemblies will be uniformly exposed. Seal (29) on flange will be approximately half compressed.

w. Secure engine and transmission cowling.

x. Install stainless steel mesh screen, if so equipped.

4-43. AIR PARTICLE SEPARATOR — SELF-PURGING — AIR INDUCTION SYSTEM.

4-44. Description — Air Particle Separator Self-Purging — Air Induction System. Helicopters have a sand and dust separator that is an inertial-type separator consisting of an upper and lower assembly half, a deflector, a mounting ring assembly, a flange assembly and seal, gaskets, and attaching hardware (figures 4-6, 4-12 and 4-13). Removal of the upper assembly half permits maintaining the main driveshaft and inspecting the engine inlet. The lower assembly half mounts the air cleaner which collects particles removed from the engine inlet air and ejects them overboard. A flange assembly provides means of attaching- the separator to the engine inlet housing. The foreign object damage screen consists of two halves which fit around the sand and dust separator inlet to prevent large foreign objects from entering the engine. Two latch assemblies hold the halves together. Engine inlet air passes through the FOD screen, where any large objects are caught immediately, and enters the separator through a curved, annular, radial inflow bellmouth provided in the upper and lower assembly halves. Separation occurs when the contaminated air is drawn through a turn, causing particles such as sand and dirt to be forced to the concave inner flow wall and caught by a protruding lip of the deflector assembly. Clean air continues into the engine inlet

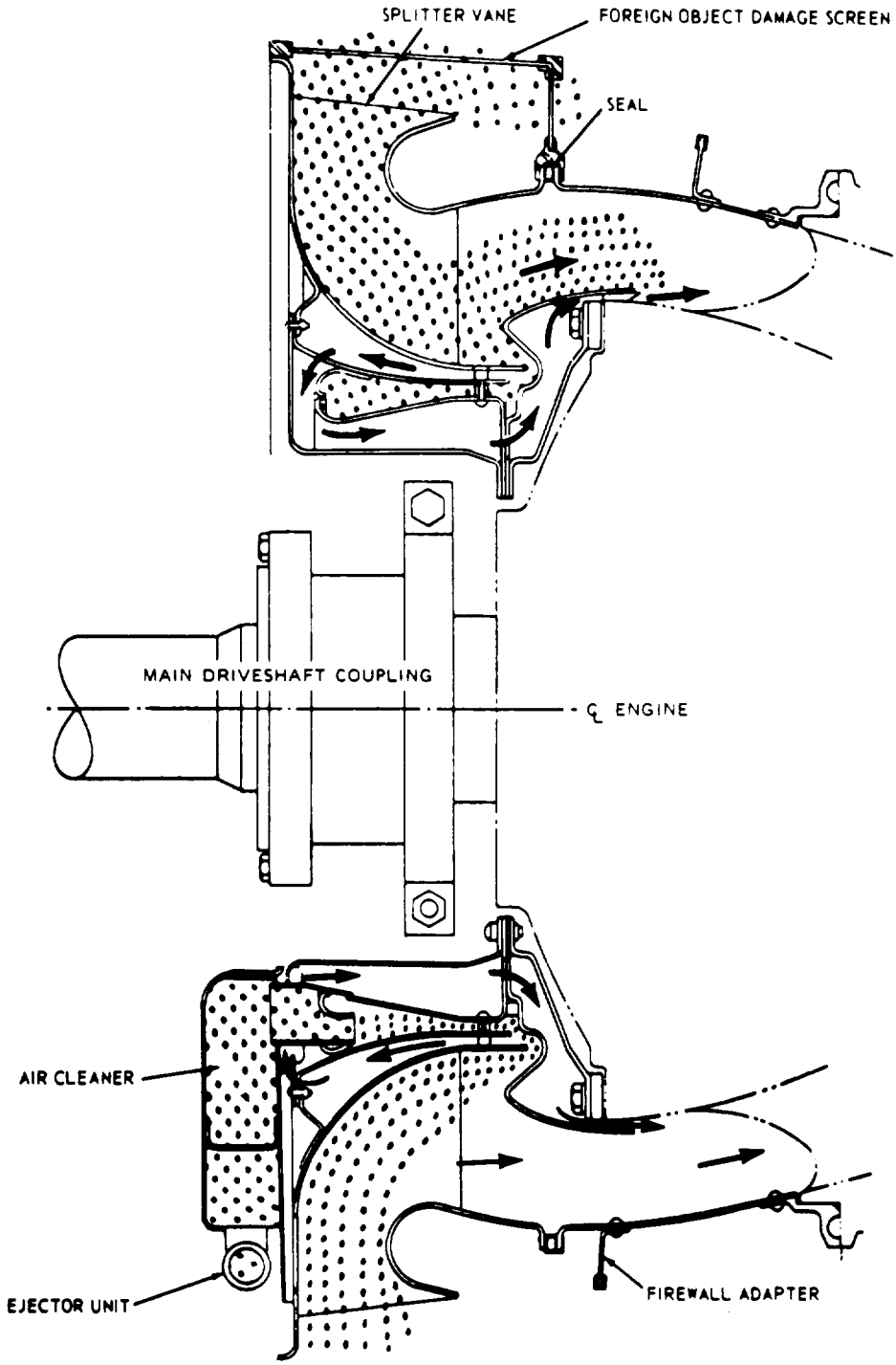
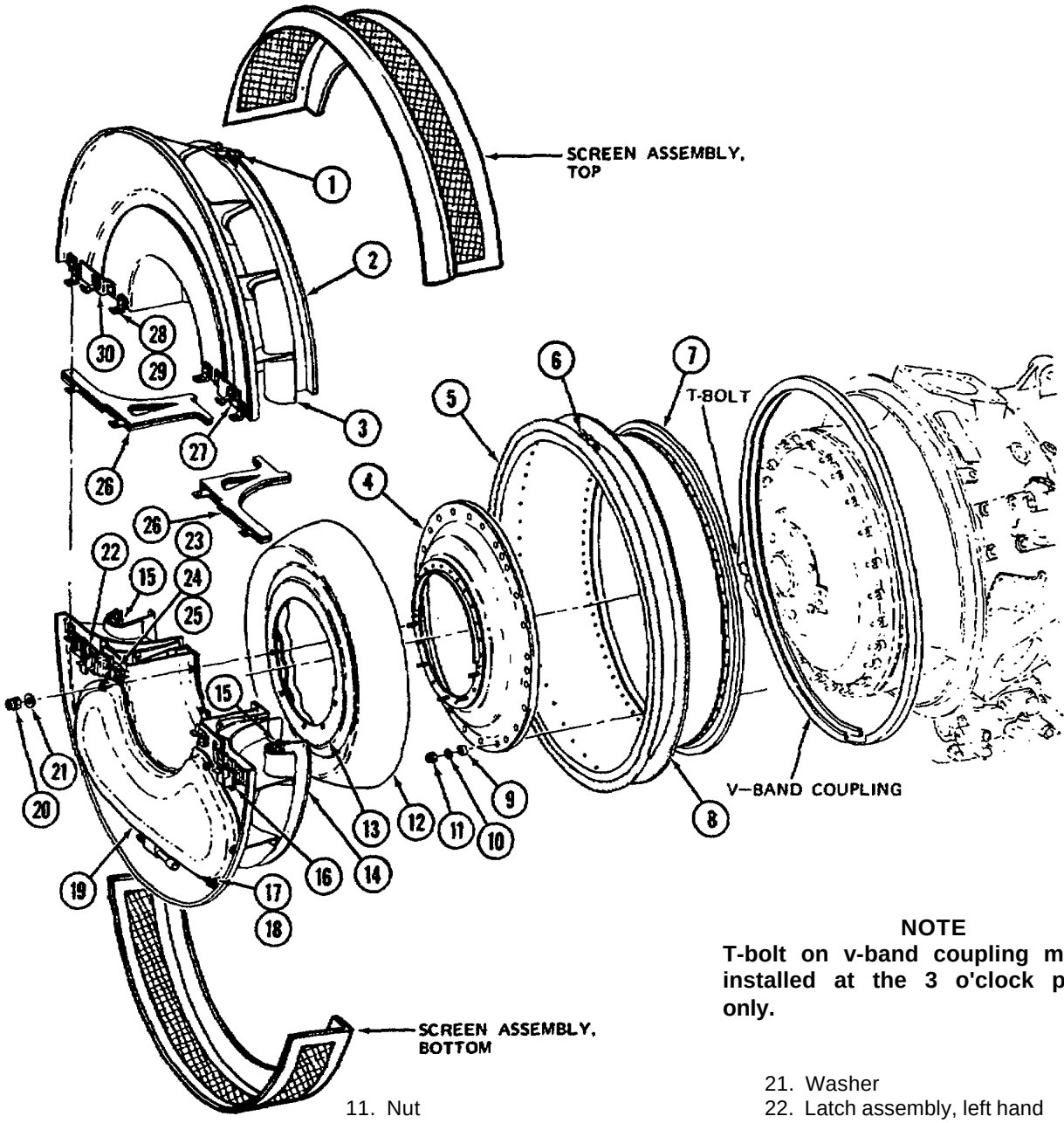


Figure 4-12. Self-Purging Particle Separator Air Flow Diagram



NOTE

T-bolt on v-band coupling must be installed at the 3 o'clock position only.

1. Latch
2. Upper assembly half
3. Hook
4. Mounting ring assembly
5. Seal
6. Hook assembly
7. Mounting flange assembly
8. Gasket
9. Sleeve spacer
10. Washer
11. Nut
12. Deflector assembly
13. Gasket
14. Lower assembly half
15. Latch
16. Latch assembly, right hand
17. Nut
18. Washer
19. Air cleaner
20. Nut
21. Washer
22. Latch assembly, left hand
23. Positioning pin
24. Angle bracket
25. Spacer
26. Gasket assembly
27. Hook assembly
28. Angle bracket
29. Spacer
30. Hook assembly

Figure 4-13. Particle Separator, Self-Purging

area while contaminated portion of the air is drawn through a second turn causing further separation. The clean air resulting from the second turn is returned to the engine inlet area while particle-laden air flows into a large annular chamber and through an air cleaner mounted on the lower half of the separator. Engine compressor discharge (P3) air from a fitting mounted on the engine air diffuser flows through the venturi effect ejector and carries the particles overboard through airframe plumbing (figure 4-6).

4-45. Air Inlet Filters - Particle Separator Self-Purging.

NOTE

Refer to para. 4-24 through 4-27 for maintenance procedures.

4-46. Inlet Foreign Object Damage (FOD) Screen - Air Particle Separator - Self-Purging. The foreign object damage screen consists of two halves which fit around the air particle separator inlet to prevent large foreign objects from entering engine (figure 4-13).

4-47. Removal FOD Screen - Air Particle Separator - Self-Purging.

a. Remove air inlet filters (para. 4-24).

b. Remove top half of FOD screen from the sand and dust separator as follows (figures 4-14 and 4-15).

(1) Unlock both latches.

(2) Disengage hook portions.

(3) Lift screen free of the air particle separator.

c. If required, remove upper assembly half of particle separator (para. 4-53).

d. Remove bottom half of FOD screen from the particle separator as follows:

(1) Lift forward split portion of the butt molding free of the vane and hold in that position.

(2) Lift rear (notched) portion free of the curled inlet of the particle separator.

(3) Repeat preceding steps (1) and (2) for the other side.

(4) Withdraw bottom half of FOD screen from under the separator.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

4-48. Cleaning FOD Screen - Air Particle Separator - Self-Purging. Clean screen with solvent (C261).

4-49. Inspection FOD Screen - Air Particle Separator - Self-Purging.

a. Inspect exterior of FOD screen for damage which would permit foreign object entry.

b. Inspect aft molding for cuts or other damage.

c. Inspect latch assemblies for damage as follows:

(1) Erosion or damage that may cause tightness or binding.

(2) Cracks. If crack in latch assembly is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance AVUM/AVIM NDI procedures for UH-1 helicopter series.

(3) Loose or missing rivets.

d. Inspect FOD screen for deformation.

4-50. Repair FOD Screen - Air Particle Separator- Self-Purging.

a. Reshape deformed parts, if feasible. If reasonable conformity cannot be obtained, replace either half or both as required.

b. Replace parts exceeding inspection limits.

c. Replace screen halves with missing or loose rivets.

4-51. Installation FOD Screen -Air Particle Separator-Self-Purging.

a. Position bottom half of the foreign object damage screen, aft molding side toward engine inlet, under the sand and dust separator so butt molding is approximately **2.25** inches below horizontal centerline and aft molding is seated over the sand and dust separator split flange (figure 4-15).

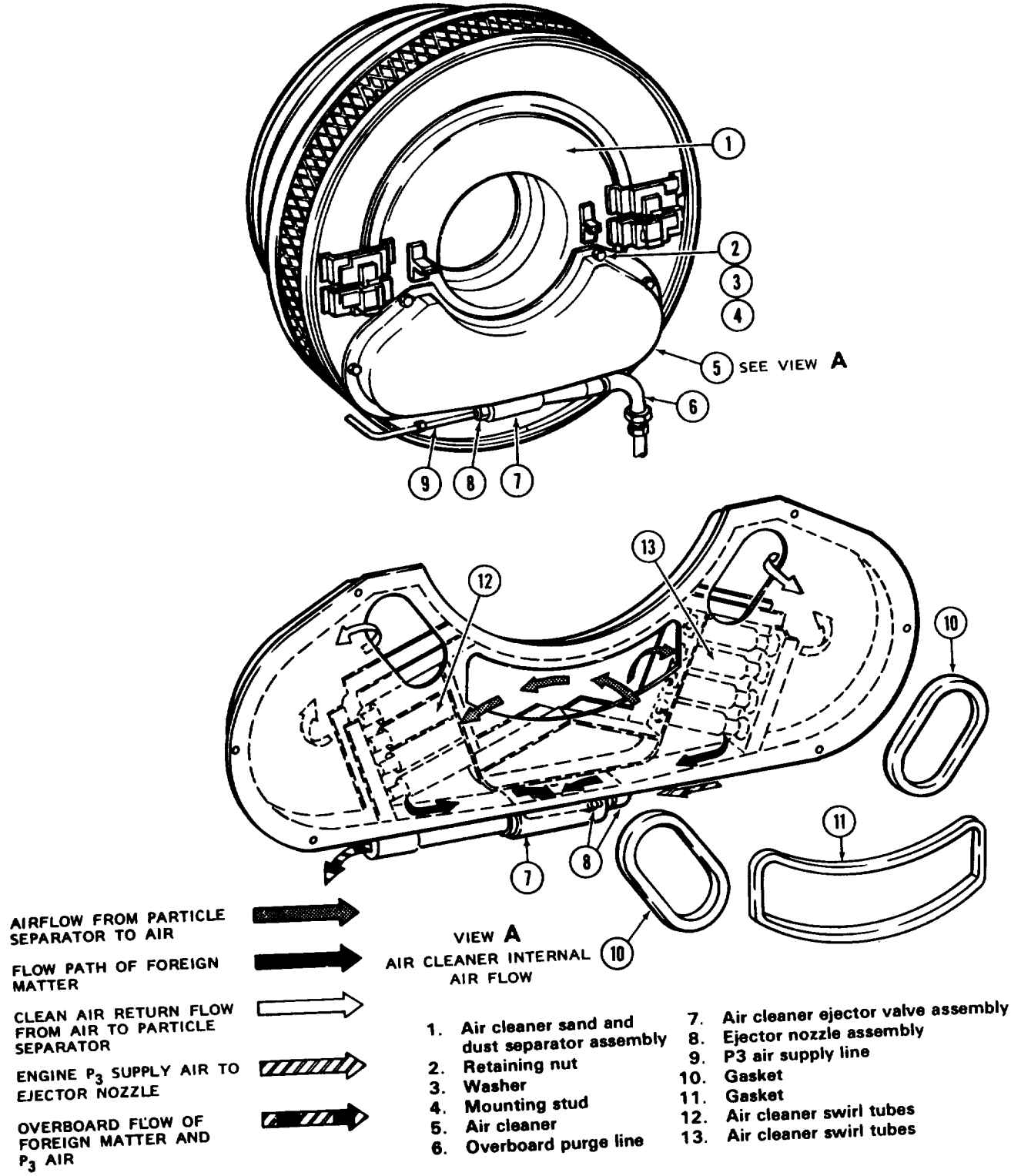


Figure 4-14. Self-Purging Air Filter and Foreign Objects Screen

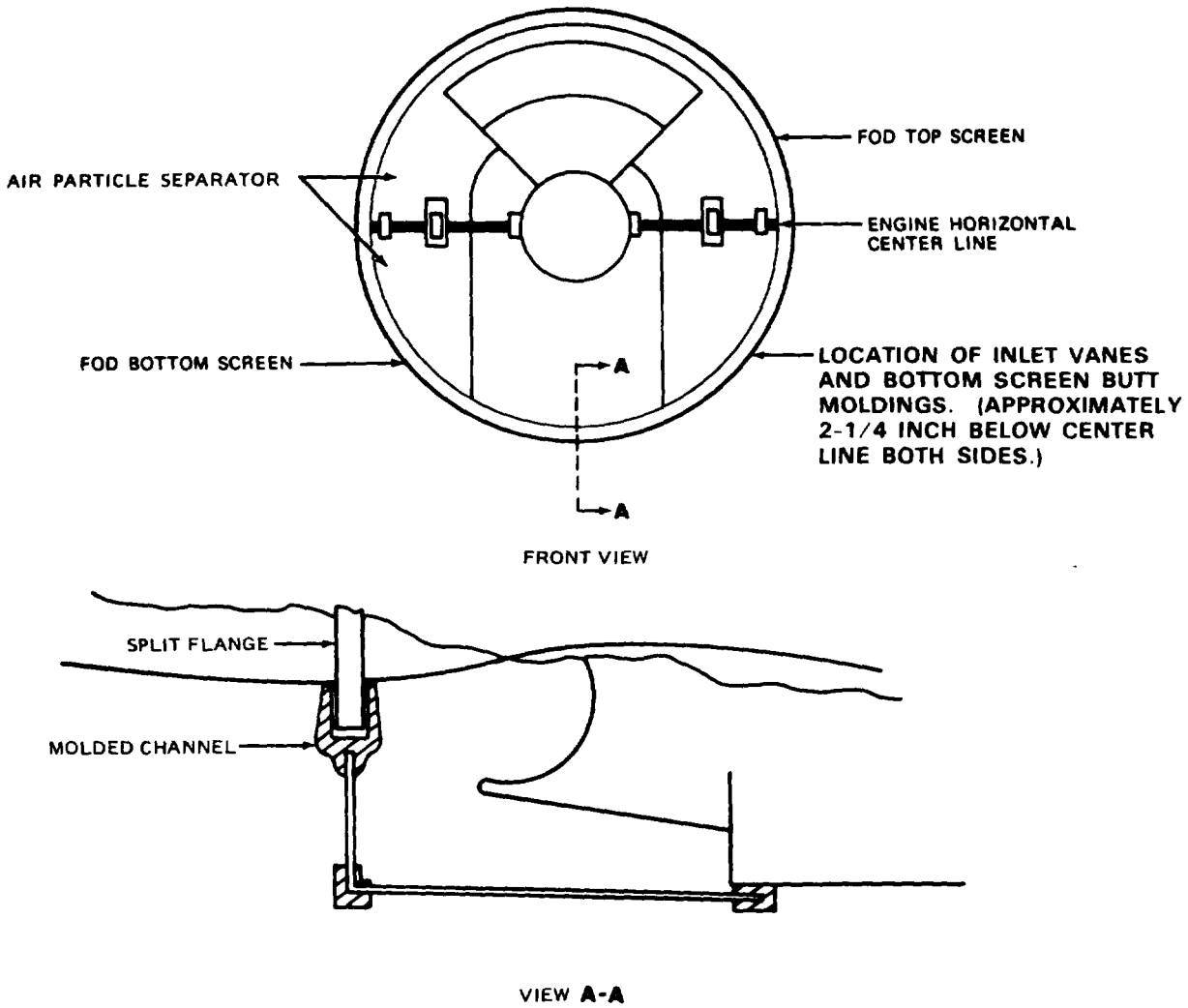


Figure 4-15. Foreign Objects Damage Screen Replacement

CAUTION

Improper seating of the aft molding over the separator split flange can result in cuts or other damage to the molding as well as placing excessive stress on all portions of the screens and latches. To check for proper seating, run hand along the lower split flange to ensure that the molded channel is properly seated over both sides of the split flange (figure 4-15).

b. Insert aft molding while holding butt molding away from the vane in the separator (refer to steps I and II, figure 4-16).

c. Line up the slot in forward portion of butt molding with the vane over which it is to be fitted, and press into place (step III, figure 4-16).

NOTE

When properly installed, the notched area of the butt molding should be positioned behind the sand and dust separator inlet curl, and the forward portion of the molding should have one part of the split on the top of the vane and one part underneath the vane as shown in figure 4-16.

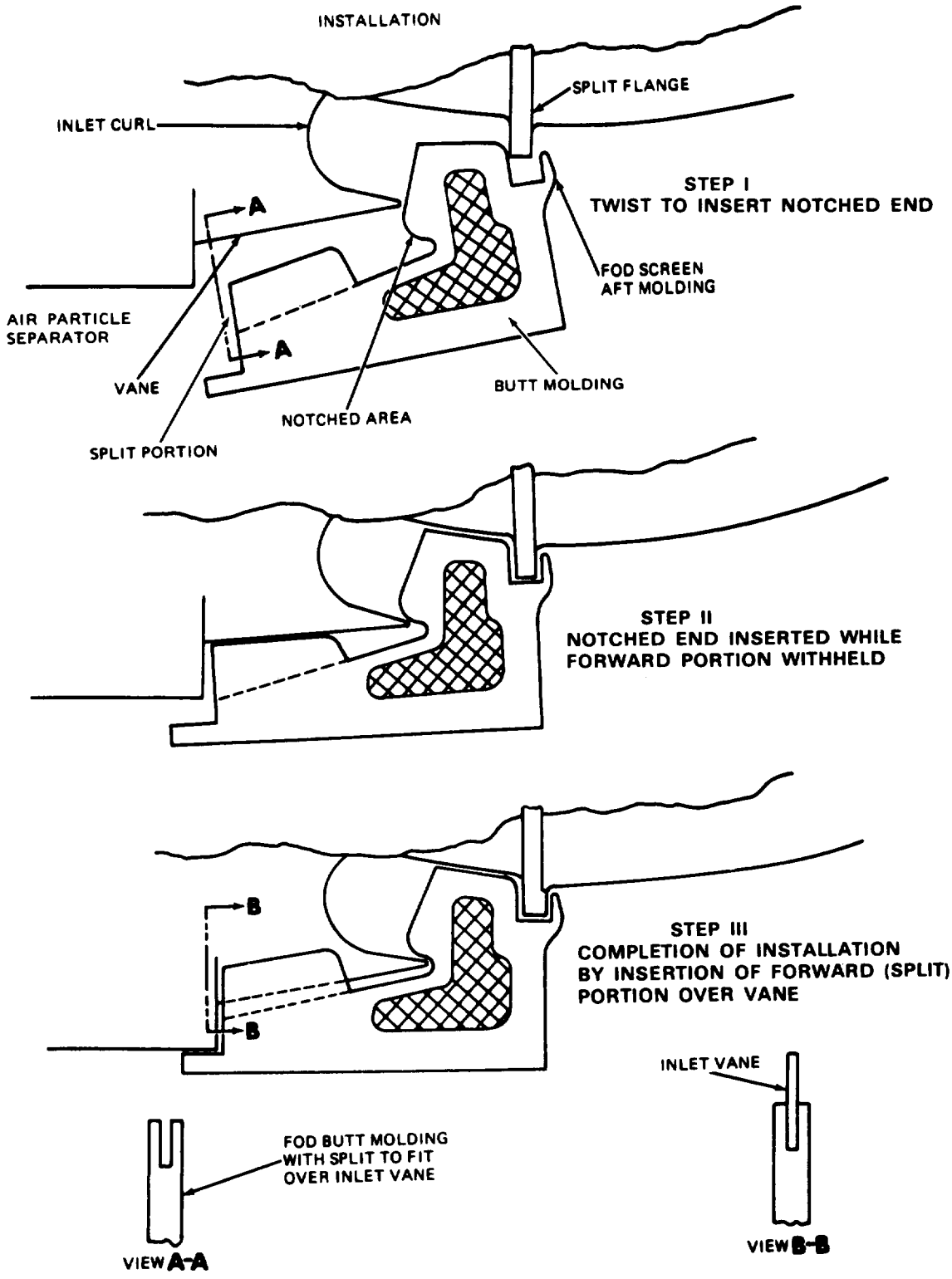


Figure 4-16. Foreign Object Damage Screen Installation (Bottom Half)

d. If removed, install top half of the sand and dust separator.

e. Position top half of the FOD screen so as to engage the aft screen molding slot over the separator split flange. Position the screen cut-out over the latch at the 12 o'clock position of the separator,

NOTE

Both latches must be engaged with the meting hooks before closing either latch to a locked position.

f. Secure top half to the bottom by engaging and locking both latches.

4-52. Air Particle Separator — Self-Purging. The air particle separator is an inertial-type separator consisting of an upper and a lower assembly half, a deflector, a mounting ring assembly, a flange assembly and seal, gaskets and attaching hardware. Removal of the - upper assembly half permits maintaining the main driveshaft and inspecting the engine inlet. The lower assembly half mounts the air cleaner which collects particles removed from the engine inlet air and ejects them overboard. A flange assembly provides means of attaching the separator to the engine inlet housing.

4-53. Removal — Air Particle Separator — Self-Purging. a. Open transmission fairing.

b. Remove filter assemblies (7 and 8, figure 4-9),

c. Remove the top section of induction baffle assembly (1).

d. Remove top half of FOD screen (pararagraph 4-47).

e. Release two latches (15, figure 4-1 3) and latch assemblies (16 and 22) on front and rear faces of upper and lower separator halves (2 and 14) by simultaneously pressing the safety latch up and lifting upon the release catch. Release latch (1) on top of separator upper half and remove the upper half,

f. Remove gasket assemblies (26).

NOTE

It is not necessary to further disassemble the separator unless the inspection procedures indicate that gaskets and seals may be damaged. If further inspection is required, proceed with the following steps.

g. Remove lower half of FOD screen (paragraph 4-47),

h. Remove main driveshaft from aircraft as a complete assembly, and remove curvic coupling adapter from engine output shaft (paragraph 6-17, as applicable).

CAUTION

In following step, use a suitable size open end wrench to hold and prevent the ejector valve assembly body from rotating.

i. Disconnect hose assemblies (2 and 5, figure 4-6) and overhead plumbing from air cleaner (5, figure 4-14) fittings

j. Remove five nuts (20, figure 4-13) and five washers (21). Remove lower half of separator (14) and deflector assembly (12)

k. Remove air cleaner (5, figure 4-14).

CAUTION

Use care to prevent damage to gaskets (10 and 11, figure 4-14).

(1) Remove six nuts (2) and six washers (3),

(2) Pull air cleaner (5) forward and remove from mounting studs.

(3) Immediately cover openings in separate lower half to prevent entrance of foreign matter.

1. Remove 24 nuts (11, figure 4-13), 24 washers (10), 24 sleeve spacers (9), and remove mounting ring assembly (4).

NOTE

Loosely install spacers, washers, and nuts on engine inlet housing studs.

m. Remove washers, screws, and split ring assembly that secure mounting flange assembly (7) to aircraft.

n. Loosen V-band coupling and remove mounting flange assembly (7).

4-54. Cleaning - Air Particle Separator - Self-Purging.

Premaintenance requirements for cleaning air particle separator self-purging

Conditions	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	Regulated Source of Air Pressure
Minimum Personnel Required	One
Consumable Materials	(C65), (C261)
Special Environmental Conditions	None

a. Clean air cleaner (19 figure 4-13).

(1) Using a pneumatic cleaning gun and regulated air pressure source, clean the overboard discharge tube assembly (4, figure 4-6) of possible dirt accumulation as follows:

(a) Apply 10 psi air pressure to end of left hand hose assembly (2) which was disconnected from ejector valve assembly. Check for free flow of air from airframe overboard discharge port.

CAUTION

If airflow is not evident, the line obstruction must be isolated and removed prior to continuing cleaning operation.

(b) To clean any foreign matter accumulation from line, repeat preceding step (a) except, using a suitable air/solvent vaporizing gun, apply **60** psi air pressure together with **1** quart of cleaner (65) mixed with **4** parts water.

(c) Repeat previous step (a) except, apply **60** psi air pressure to the line to purge residual cleaning solution.

(2) Using a pneumatic cleaning gun and a regulated air pressure source **(60 psi),** clean air cleaner (19, figure 4-13) using a solution of **4** parts water to **1** part cleaner (C65).

(a) Support air cleaner in an upright (as installed) position. Spray cleaning solution down through both left and right air cleaner swirl tubes (12 and 13, figure 4-14). Ensure any accumulation of foreign matter is completely rinsed out of both air cleaner housing and ejector valve assembly body.

(b) Using air pressure, purge ejector valve assembly of residual cleaning solution.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

b. Clean all other metal parts of particle separator only as required to facilitate inspection using dry-cleaning solvent (C261).

4-55. Inspection - Air Particle Separator - Self-Purging.

a. Inspect seal (5, figure 4-13) on mounting flange assembly (7) for tearing and/or ripping at the edges and for lack of adhesion.

b. Inspect gasket (8) on each side of mounting flange assembly (7) for damage or lack of adhesion.

c. Inspect gasket assemblies (26) for a permanent set and lack of adhesion:

NOTE

Cracks are acceptable provided there is no chance of fractured segments entering engine.

d. Inspect all metal surfaces for cracks or other damage.

e. Inspect for loose or missing rivets. If rivets are loose or missing in upper or lower assembly half (2 or 14), repair loose or missing rivets in accordance with (TM 1-1500-204-23 series). If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

f. Inspect for weld cracks or weld separation (particularly in area of inlet vanes in both the upper and lower assembly halves). If cracks or separation is evident, repair in accordance with (TM 1-1500-204-23 Series). If crack is suspected, refer to TM 1-1520-256-23, AVUM/ AVIM NDI procedures for UH-1 helicopter series.

g. Inspect for damaged or inoperable safety latches, damaged positioning pins (23), and angle brackets (24 and 28). If damage is evident, repair affected assembly half.

(1) Replace entire latch assembly if it is damaged.

(2) Replace bent or broken positioning pins (23).

(3) Replace broken brackets (24 and 28).

h. Inspect airframe mounted P3 air supply righthand hose assembly (5, figure 4-6) and overboard discharge tube assembly (4) for integrity.

i. Inspect air cleaner for defective swirl tubes (12 and 13, figure 4-14) and/or cracks in air cleaner (5). Replace air cleaner if defects of swirl tubes are noted. Minor nonstructural air cleaner housing (sheet metal) cracks may be repaired by stop drilling. Refer to (TM 1-1500-204-23 series). If in air cleaner is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

j. Inspect gaskets (10 and 11) for damage and proper bonding to air cleaner (5). Replace damaged gaskets. Refer to paragraph 4-56 for procedure.

k. Inspect all other parts for evidence of erosion. Replace damaged parts.

4-56. Repair or Replacement - Air Particle Separator -Self-Purging (AVIM).

Premaintenance requirements for repair of air particle separator - self-purging

Conditions	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	Welding Equipment
Minimum Personnel Required	One
Consumable Materials	(C22), (C34), (C57), (C177), (C233), (C248), (C281), (C290), and (C302)
Special Environmental Conditions	Well Ventilated

a. General repair procedures. Refer to (TM 1-1500-204-23) series manuals for methods of repair on all defects.

CAUTION

Ensure integrity of repairs. Materials used to make repairs may be ingested by engine if not properly secured.

(1) Repair nonconverging cracks by stop-drilling crack ends. Where necessary to prevent air leakage, seal with tape or silicone rubber, RTV (C22).

(2) Using solid rivets or tack welds, patch-repair converging cracks following standard airframe sheet metal repair procedures.

NOTE

Any standard solid aluminum aircraft rivets of proper size may be used for all rivet repairs except hardware replacement, Blind rivets will not be used.

(3) Using solid rivets or tack welds, patch-repair punctures too large to repair with silicone rubber, RTV (C22). Follow standard airframe sheet metal repair procedures.

(4) Repair torn tack and spot welds with tack, Interrupted, or plug weld repairs, using doublers (as needed) (figure 4-17]. Rivet repairs using doublers and solid rivets (as needed) are also acceptable, if necessary.

(5) Repair serious erosion damage by replacing damaged parts or using doublers,

(6) Reshape deformed parts, if feasible, If reasonable conformity cannot be obtained (particularly at mating edges, sealing surfaces, etc.) replace part.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

b. Repair loose seal and gaskets as follows:

(1) Repair loose gasket (8, figure 4-13) by cementing gasket to mounting flange assembly with cement (C57). Clean mating surfaces with methylethyl-ketone (C177).

(2) Repair loose gaskets (13 and 26, figure 4-13) by cementing gaskets to mating surface with adhesive (C34). Clean mating surfaces with methylethyl-ketone (C177).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(3) Repair loose seal (5, figure 4-13) by recementing seal to mating surface, using adhesive, silicone rubber (C22). Clean mating surfaces with methylethyl-ketone (C177) and then with trichloroethylene (C290).

c. Replace damaged gaskets (13, figure 4-13) and gaskets (10 and 11, figure 4-14) as follows:

(1) Remove defective gasket and old adhesive from deflector assembly,

WARNING

All grease, oil, or other surface contaminants must be removed from the bonding surface.

(2) Wipe all metal surfaces to be bonded with lint-free gauze moistened (not dripping) with methyl-ethyl-ketone (C177). Continue wiping surface, changing gauze frequently, until gauze remains clean,

CAUTION

Porous surfaces which have been contaminated with oil or grease cannot be satisfactorily cleaned to ensure proper bonding and shall be discarded.

(3) Using clean, stiff brush (C52), remove contaminants from surface of new gasket.

(4) Using clean applicator (clean fingers may be used), apply a continuous uniform film of adhesive (C34) to surfaces to be bonded. Allow adhesive to thoroughly air dry for approximately 3 hours.

(5) After adhesive coating has dried, apply a second uniform, continuous film of adhesive to surfaces to be bonded. Allow adhesive to thoroughly air dry for approximately 3 hours.

(6) Align surfaces to be bonded to obtain contact over entire surface.

(7) Apply light compressive load (1/4 to 1/2 psi) to surfaces being bonded. Allow adhesive to cure under this pressure for a minimum of 4 hours.

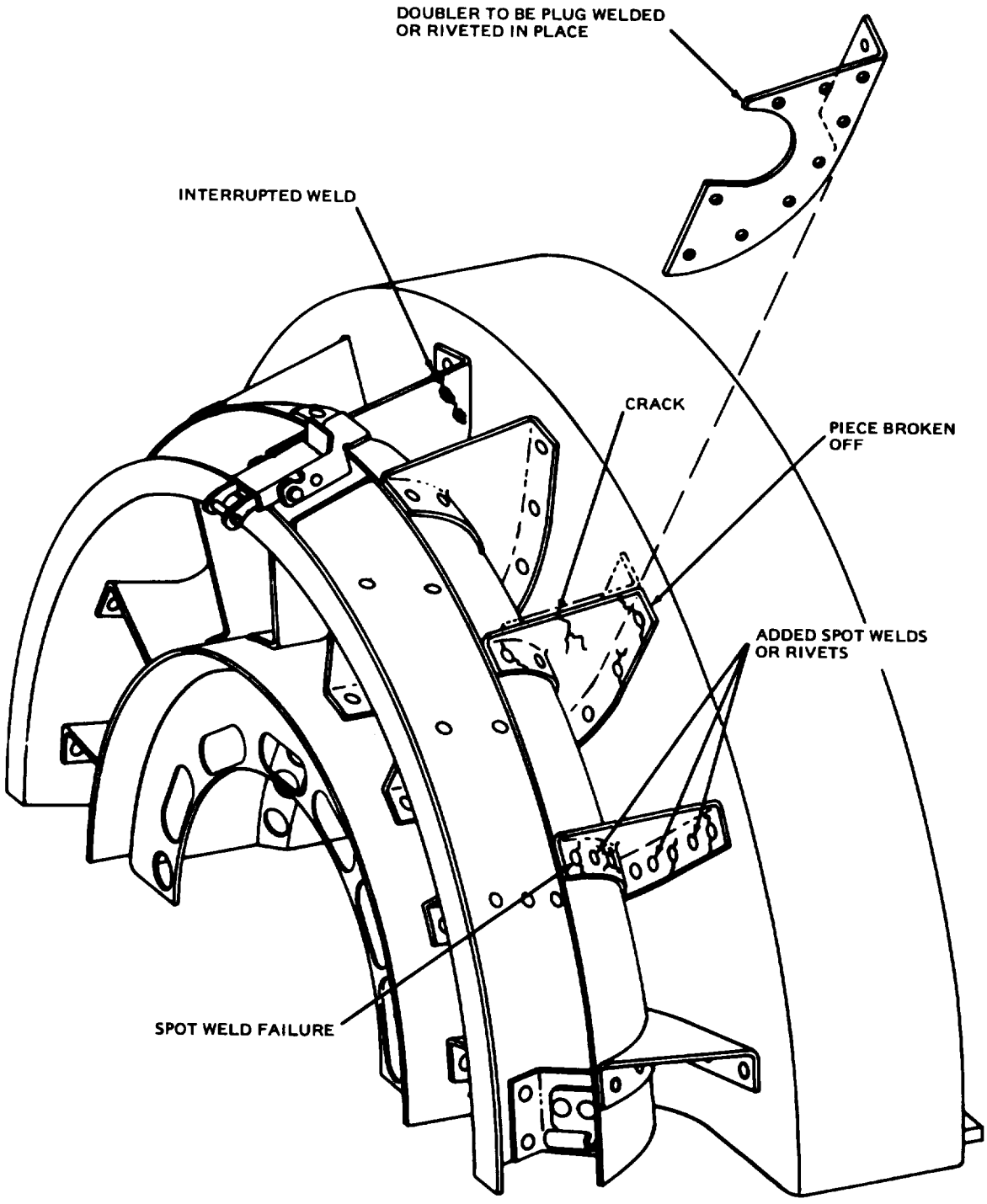


Figure 4-17. Self-Purging Particle Separator Welding Repairs-Typical

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

d. Replace damaged seal (5, figure 4-13) on mounting flange assembly (7) as follows:

(1) Remove defective seal. Remove old adhesive film from metal surfaces with a knife blade. Then use a wire brush or 400 grit abrasive paper (C233).

(2) Wipe metal surfaces to be bonded with lint-free gauze, moistened (not dripping) with methyl-ethyl-ketone (C177) followed by trichlorethylene (C290).

CAUTION

Ensure integrity of repairs. Materials used to make repairs may be ingested by engine if not properly secured (rivets, patches, or doublers). Refer to TM 55-1500-204-25/1 for methods of repair.

e. Replace damaged hooks on upper screen as follows:

(1) Remove rivets and remove hook.

(2) Assemble upper and lower screens and position hook in line with latch on lower screen.

(3) Scribe lines to position hook.

(4) Separate assembly halves.

(5) Position latch within scribe lines and drill 0.128 T0 0.133 inch holes for rivets.

NOTE

If during drilling, rivet holes are elongated or new holes are drilled, back up sheet metal with a doubler before riveting.

(6) Secure hook with two rivets.

f. Replace damaged latches on lower screen as follows:

(1) Remove rivets and latch.

(2) Assemble upper and lower screens and position latch on lower screen in line with hook on upper screen.

(3) Mark lines to position latch.

(4) Separate assembly-halves.

NOTE

If during drilling, rivet holes are elongated or new holes are drilled, back up sheet metal with a doubler before riveting.

(5) Position latch within lines and drill 0.128 TO 0.133 inch holes for rivets.

g. Replace damaged latches on lower assembly half as follows:

NOTE

Teflon tape patch between hardware items and assembly half must be replaced if damaged during removal of hardware.

(1) Remove two rivets and remove latch.

(2) Assemble upper and lower assembly halves without gaskets installed between halves.

(3) Position latch on lower assembly half in line with hook or upper assembly half. Mark lines to position latch.

(4) Separate the assembly halves.

(6) Position latch on lower assembly half within lines, and drill 0.128 TO 0.133 inch holes for rivets.

NOTE

If during drilling procedures, rivet holes are elongated or new holes are drilled, back up sheet metal with doubler before riveting.

(6) Secure latch with two rivets.

h. Replace damaged positioning pins or angle brackets on lower assembly half as follows:

(1) Remove rivets, bracket and spacer.

(2) Assemble upper and lower assembly halves without gaskets.

(3) Position spacer and bracket on lower assembly half in line with bracket on upper assembly half. Top of bracket will be slightly higher than the edge of the half. Top of bracket will be slightly higher than the edge of the assembly half. Mark lines to position spacer and bracket.

(4) Separate assembly halves.

(5) Position spacer and bracket within scribed lines and drill two 0.128 TO 0.133 inch holes for rivets.

NOTE

Use vinyl tape (C281) between spacer and bracket.

(6) Secure bracket to spacer with two rivets.

(7) Align assembly halves and identify center on bracket in line with hole of bracket on upper assembly half.

(8) Drill a 0.250 TO 0.252 inch hole through bracket.

(9) Install new pin in bracket, and tack weld in two places, 180 degrees apart, using wire filler (C302).

i. Replace damaged hooks on upper assembly half as follows:

(1) Remove rivets, and remove hook.

(2) Assemble upper and lower assembly halves without gasket assemblies.

(3) Position hook on upper assembly half in line with latch on lower assembly half. Mark lines to position.

(4) Separate assembly halves.

(5) Position latch within scribed lines and drill 0.128 TO 0.133 inch holes for rivets.

(6) Apply vinyl tape (C302) between hook and mounting surface. Secure hook with two rivets.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

4-57. Installation — Air Particle Separator — Self-Purging. a. Wipe engine inlet housing clean with clean cloth moistened with dry-cleaning solvent (C261).

NOTE

Leave mounting flange assembly loose enough to be rotated.

b. Position mounting flange assembly (7, figure 4-13) in front of airframe firewall and on engine inlet housing. Retain mounting flange loosely with V-band coupling and on firewall with split ring assembly, P/N 204-060-868-1. Insert screws with washers from back of firewall to secure ring assembly

c. Remove spacers, washers, and nuts from engine inlet housing studs, discard the nuts, retain the washers and spacers for reuse.

NOTE

Ensure that five studs on ring assembly are at the bottom, with the center stud located at the 6 o'clock position.

d. Position mounting ring assembly (4) on engine inlet housing studs.

e. Secure mounting ring assembly with 24 sleeve spacers (9), 24 washers (10), and 24 nuts (11). Torque nuts 70 TO 80 inch-pounds.

f. Position deflector assembly (12) over locating pins and studs on mounting ring assembly (4) and press in until firmly seated,

g. Install air cleaner (19) on lower assembly half (14) as follows:

(1) Ensure gaskets (10 and 11, figure 4-14) are properly installed on air filter.

(2) Ensure interior of air filter is free of foreign matter.

(3) Remove protective covering from separator lower half and inspect interior for foreign matter.

(4) Install air cleaner (19, figure 4-13) on mounting studs. Install six washers (18) and nuts (17) on mounting studs. Torque nuts 30 TO 35 inch-pounds.

(5) Secure lines to ejector inlet and discharge ports before installing lower assembly half.

NOTE

Nut and washer at 6 o'clock position are not required and if omitted will permit removal of bottom half of separator without removing main driveshaft.

h. Position lower assembly half (14, figure 4-13) on locating pins and studs on mounting ring assembly (4). Secure with five washers (21) and five nuts (20). Torque nuts 30 TO 35 inch-pounds.

i. Position upper assembly half (2) on lower assembly half (14).

NOTE

Do not install two gasket assemblies (26) at this time.

j. Rotate mounting flange assembly (7) on inlet housing to align hook assembly (6) with latch (1) on upper assembly half (2).

NOTE

V-band coupling clamp shall be installed at approximately the 3 o'clock position. This will position the 3.25 inch cut-out in the V-band clamp at the 6 o'clock position to assist in preventing corrosion on mating surface of engine inlet housing.

k. Secure mounting flange assembly (7) with V-band coupling. Torque V-band coupling nut 40 TO 50 inch-pounds. Tap around coupling from middle toward each end with a soft-faced mallet to seat properly.

l. Tighten screws to secure flange assembly to firewall.

m. Remove upper assembly half (2).

n. Install curvic coupling in output shaft of engine and install main driveshaft (para. 6-23), as applicable.

o. Connect pressure and overboard plumbing to air cleaner fittings.

p. Install baffle panels (figure 4-9).

q. Position gasket assemblies (26, figure 4-13) over positioning pins (23) on lower assembly half (14).

r. If FOD screen is to be installed, install lower half (para. 4-51).

s. Position upper assembly half (2) on lower assembly half (14).

NOTE

Tilt top slightly forward to position assembly on four positioning pins (23).

t. Engage upper assembly half (2) to mounting flange assembly (7) with latch (1).

u. Engage latch assemblies (16 and 22) on front face and latch assemblies (15) on rear curl of separator.

CAUTION

Ensure that safety catch on latches is engaged by exerting a slight pull on release catch. Catch should not be open.

v. Check for proper seating of seals by appearance. Approximately 0.125 inch of rubber on gasket assemblies will be uniformly exposed. Seal (5) on flange assembly will be approximately half way compressed.

w. Install top half FOD screen (paragraph 4-51).

x. Install inlet screen (para. 4-27).

y. Close transmission cowling and secure with latches.

4-57.1 IMPROVED PARTICLE SEPARATOR (IPS) - AIR INDUCTION SYSTEM.

4-57.2 Description - Improved Particle Separator (IPS) - Air Induction System (figure 4-17.1) The IPS is a selfpurging particle separator air induction system. It is an inertial type system consisting of an upper and lower assembly half, compressor bleed air hose and fitting, attaching hardware, and a compressor wash kit. Removal of upper assembly half permits detailed examination of main driveshaft and engine inlet. The lower assembly half is attached to the fuselage. The upper assembly half is attached to lower half and engine firewall and contains vortex generator tubes which separate dust from incoming air, thereby preventing dust and foreign objects from entering engine. Incoming air enters vortex tubes, where it is rapidly rotated. Dust particles and foreign matter are forced by centrifugal force to the outer walls of the vortex tubes and are passed into cavity between inlet and outlet plate. High pressure air piped from engine to rear wall on IPS ejects separated dust through rear vertical slots. The cleaned air passes through vortex outlet tubes to engine.

CAUTfON

If top screen assembly is removed for any reason, personnel shall not stand on, or place any objects on vortex panel.

4-57.3 Removal - Improved Particle Separator.

a. Open transmission fairing.

b. Disconnect bleed air line (3, figure 4-17.1) from bulkhead fitting.

c. Disconnect bulkhead fitting (4) from upper half of air cleaner through firewall-installed fitting (1).

d. Disconnect five DZUS fasteners (23) holding IPS to firewall.

e. Remove ball locking pin from firewall and hold top of firewall aft.

f. Remove safety pins from the four mounting latches and release four mounting latches that hold upper (22) and lower (14) halves together by simultaneously pressing safety latch up and lifting up on release catch. Remove upper half (22).

g. Remove bolts (12) and washers (11) from forward end of inner bellows (21) and slide bellows aft.

h. Remove six mounting bolts (17) and washers (18). Remove upper can half (16).

i. Remove driveshaft as a complete assembly in accordance with Section 6.

j. Remove inner bellows assembly (21).

k. Remove 18 firewall slip ring hex bolts and V-band coupling.

L Remove four lower half mounting bolts (7) and lift lower half (14) from aircraft.

4-57.4 Cleaning - Improved Particle Separator.

Premaintenance requirements for cleaning the Improved Particle Separator.

Conditions	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	Regulated source of Air Pressure
Minimum Personnel Required	One
Consumable Materials	(C81) (C193) (C205)
Special Environment Conditions	None

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

a. Cleaning Air Cleaner Upper Half.

(1) Clean exterior and interior surfaces and remove any foreign objects from vortex inlet and outlet tubes.

CAUTION

If airflow is not evident, or restricted, the obstruction must be located and removed.

(2) Apply 60 psi air pressure to bleed air inlet fitting. Check for airflow from both right and left high pressure ejector nozzles.

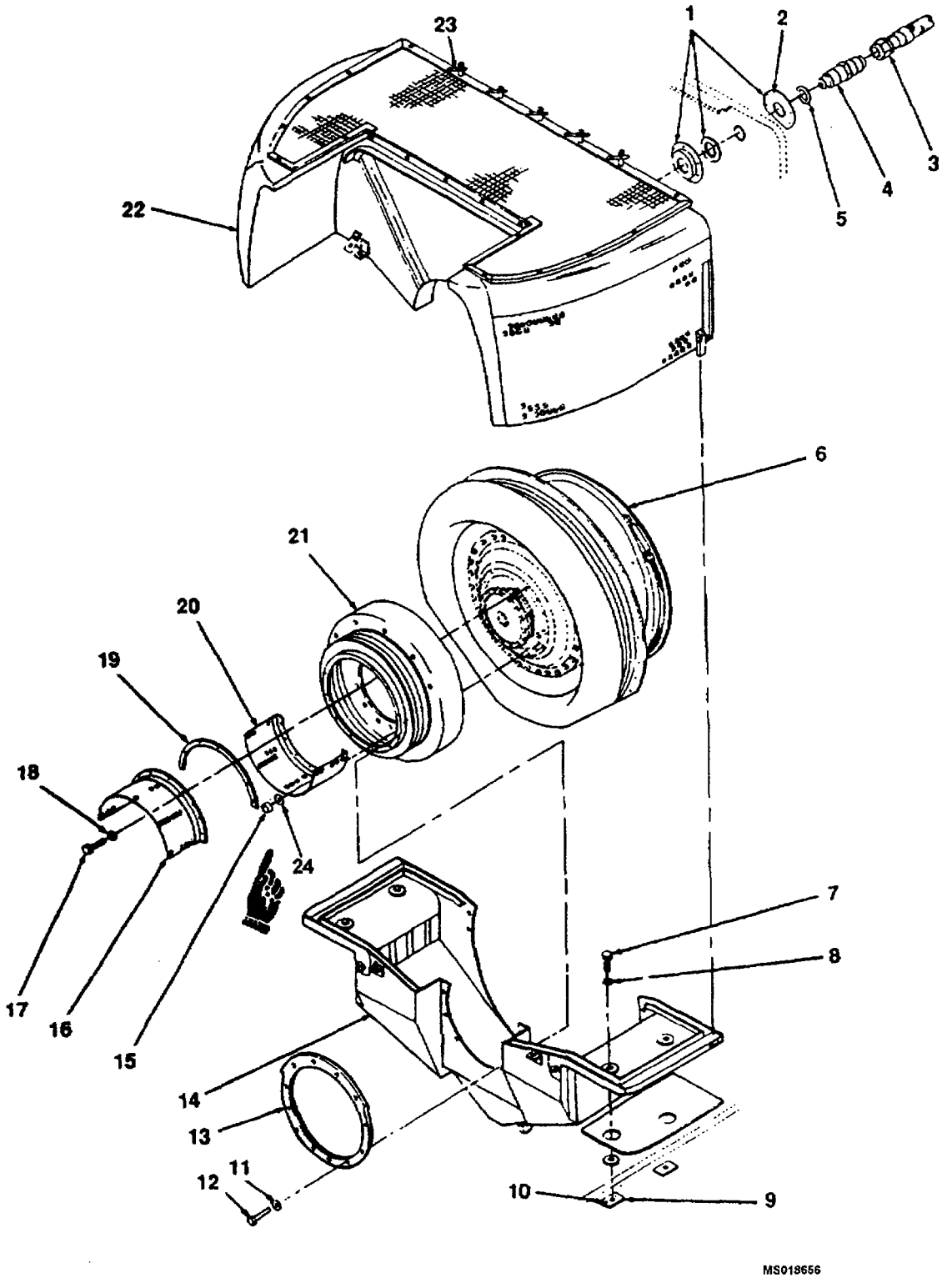


Figure 4-17.1. Improved Particle Separator (IPS) - Air Induction System (Sheet 1 of 2)

1. Firewall Ring Assembly
2. Rivet
3. Bleed Air Hose
4. Bulkhead Fitting
5. Boss Seal
6. Ring, Engine Intake Assembly
7. Bolt
8. Washer
9. Nutplate Assembly
10. Rivet
11. Washer
12. Bolt
13. Ring, Lip Seal
14. Lower Half Assembly
15. Nut
16. Can Assembly, Upper
17. Bolt
18. Washer
19. Gasket, Top Can
20. Can Assembly, Lower
21. Seal Assembly, Inner
22. Upper Half Assembly
23. Ejecting Blades
24. Washer

Figure 4-17.1. Improved Particle Separator (IPS) - Air Induction System (Sheet 2 of 2)

(3) To clean any foreign matter accumulation from vortex tubes and ejector slots, repeat preceding step (2) except, using a suitable air/solvent vaporing gun, apply 60 psi air pressure together with one quart of cleaner (C65) mixed with four parts water.

(4) Repeat step (2), using air pressure only, eject residual cleaning solution.

b. Cleaning Air Cleaner Lower Half.

(1) Clean exterior and interior surfaces.

(2) Apply regulated air pressure source (60 psi) to water wash fitting and ensure engine inlet ring holes are clean.

(3) The improved particle separator has an engine wash facility incorporated in the engine inlet. The intent of wash facility is to allow the engine to be flushed without removing upper half of particle separator. In order to flush engine, gain excess to wash-block fitting. Remove one metal cap. Connect wash equipment to fitting. Pressure entering the wash-block must be a minimum of one psi and a maximum of five psi. Flush engine in accordance with TM 55-2840-229-23. Reinstall metal cap.

4-57.5. Inspection - Improved Particle Separator.

NOTE

To perform following inspection, IPS must be removed from aircraft.

a. Inspection of Upper Half.

(1) Inspect all visible vortex tubes for proper position in inlet plate

NOTE

Tubes damaged or missing must be replaced. Missing inlet tube pips are not a reason for replacement unless more than 50 percent of pips in any side or top panel is missing.

(2) Inspect inner surface of dust ejector slots to ensure bare metal is not showing.

(2.1) Visually inspect IPS ejector tubes for clogged or restricted ejectors (10 ejectors in long slots in AFT portion of side panels of IPS). If ejectors are restricted or clogged:

(a) Disconnect P3 line at engine fitting.

(b) Fill P3 line with solvent (C261).

(c) Reconnected P3 line to engine fitting use antiseize compound (C47).

(d) Motor Engine.

(e) Re-inspect ejector tubes for restrictions.

CAUTION

Do not use wire to probe for clogges, the wire can break-off and restrict the ejector tube.

(3) Inspect gasket to ensure it is retained in channels. The gasket should be free of rips, gouging, and have no missing section. Check for resilience by compressing with finger.

(4) Inspect for structural damage or serious deformation of surfaces. Ensure there are no cracks in structure or welds, and no loose or missing rivets. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

(5) Inspect latches to ensure serviceability.

(6) Inspect two alignment pin receptacles to ensure they are straight, undamaged, and securely attached.

b. Inspection of Stepping Screen

(1) Inspect DZUS fasteners for proper installation and completion.

(2) Inspect for holes or other damage to screen.

NOTE

Damage or holes in screen should not exceed 1/8 inch diameter.

c. Inspection of Lower half.

(1) Inspect for structural damage. Ensure there are not cracks in structure or welds, and no loose or missing rivets. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

(2) Disassemble drain valve, remove and clean any foreign materials. Inspect plastic umbrella valve for damage and pliability.

(3) Inspect water wash assembly. Ensure wash blocks are securely attached to engine inlet ring, hoses are securely attached and are not frayed, and end caps are properly installed.

(4) Inspect metal mating surfaces that connect with upper half seals and ensure all are free of nicks, bends, dirt, and debris.

(5) Inspect two alignment pins to ensure they are straight, undamaged and securely attached.

d. Inspection of Inner Bellows Assembly.

(1) Inspect for structural damage. Ensure there are no cracks, dents, or distortions. If crack in metal portion of bellows assembly is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

(2) Inspect bellows assembly for proper installation. Ensure stitched joints are tight and no holes are found in bellows.

(3) Inspect driveshaft protection shields. Ensure there are no loose or missing rivets or other visible damage.

(4) Inspect locking nutplates are properly installed and their self-locking capability is satisfactory.

e. Inspection of Bleed Air System.

(1) Inspect bleed air connector for obvious deformation, cracks, or leaks. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

(2) Inspect bleed air hose for visible damage and security.

f. Inspection of Attachment Plates (Airframe). Inspect self-locking nutplates are properly installed and their self-locking capability is satisfactory.

g. Deleted.

(1) Deleted.
(2) Deleted.
(3) Deleted.
(4) Deleted.
(5) Deleted.

NOTE

Deleted.

4-57.6 Repair or Replacement - Improved Particle Separator.

Conditions	Requirements
Model	All
Part No. or Serial Number	All
Special Tools	None
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C34), (C57), (C62) (C233), (C248), (C281), (C290), (C302)
Special Environmental Conditions	Well Ventilated

CAUTION

Repairs are limited to following items only. Cracks in any assembly will require replacement of that assembly.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

CAUTION

Ensure integrity of repairs. If not properly sealed, materials used to make repairs may be ingested by engine.

a. Gasket Repair Procedures. Remove damaged gasket and replace as required with new gasket material; Ensure gasket is fitted properly into channel. Use adhesive to keep gasket in place.

a.1. Repair of holes in secondary FOD screen. (Top screen).

NOTE

Screen is limited to 20 repairs. Each repair shall not exceed 1/2 inch diameter and must be a minimum of 1/2 inch between each repair.

(1) Small tears and holes in screen assemblies not exceeding **0.25** square inch may be repaired.

(2) Apply small amount of adhesive (C245) at tear or hole. Spread adhesive to bridge and cover hole.

b. Repair of Vortex Tubes.

(1) Damage to Swirl Vanes is considered negligible if no more than 0.250 inch of leading or trailing edge of each vane is eroded away or broken off. Jagged tears in the first 0.250 inch of each vane should be trimmed off to prevent further tearing. If more damage is not restricted to 0.250 of inch or damage to outside circumference of the tube, replace the tube.

NOTE

Plugging of vortex tube can be accomplished using tape (reinforced) or epoxy. Grounding of the aircraft is not required.

(2) Damaged vortex tubes can be removed and replaced with serviceable vortex tubes or plugged temporary. No more than 50 holes shall be plugged in any side or top panel not to exceed 100 holes per aircraft. Replaced vortex tubes do not have a flight restriction unless a total of 300 tubes have been replaced. If more than 300 tubes are replaced the IPS must be removed and replaced.

NOTE

Make an entry on 2408-16 of number of tubes replaced. The replacement tubes are about 1/32 inch smaller in diameter than the original tubes. A dot of paint may be placed above each tube as it is replaced.

(3) To remove a damaged tube, crimp tube with long nose pliers. Ensure all pieces of tube are removed from hole. Use care not to damage hole while removing tube. Particular attention should be given to the small triangular protrusion in hole which is used to lock tube to prevent rotation (figure 4-17.2).

NOTE

Should tube hole or protrusion become enlarged or damaged, insert only a plug.

(4) To replace missing or damaged vortex generator tubes, position replacement tube in vacant hole. Push tube through hole using thumb pressure until the groove in tube O.D. engages the inlet panel. Tube is considered properly installed when the groove on the tube fully engages with inlet panel hole, lip is flush with the panel and is aligned with the outlet tube. The replacement vortex tube is shorter than the original designed tube. Do not attempt to twist tube into hole. Damage could occur to triangular protusion used to lock the tube in place. The quantity of vortex tubes replaced should be documented on the 2408-16.

(5) To replace a displaced (pushed-in) vortex generator tube, ensure the vortex generator tube should be aligned with the outlet tube. Do not annotate quantity on 2408-16.

(6) Deleted.

(7) Deleted.

c. Replacement of External Side Inlet Panel. Remove rivets per TM 1-1500-204-23. Use caution so as not to enlarge rivets holes. Cleco panel as required to avoid panel flexure as rivets are removed. After rivet removal, remove cleo's and separate panel from structure. Remove all debris from interior of IPS unit. Debur rivet holes if required. Apply sealant (C237) to interfacing sheet metal open to outside air. Align panel to structure, insuring vortex and outlet tubes are in proper alignment, cleco as required for riveting.

d. Replacement of Bulkhead Fitting. Remove defective bulkhead fitting and boss seal by disconnecting the bleed air hose and then remove bulkhead fitting and boss seal. Install new fitting with new boss seal into bulkhead use antiseize compound (C47), tighten fitting and I install bleed air hose and tighten. Assure bulkhead fitting is installed in proper direction.

e. Replacement of Bleed Air Connector Assembly. Gain access to bleed air connector assembly located on engine and disconnect bleed air line. Remove four mounting bolts and washers. Remove bleed air connector assembly and gasket. Position new gasket and bleed air connector assembly on engine compressor port and install four mounting bolts and washers. Do not tighten bolts. Connect bleed air line to bleed air connector assembly use antiseize compound (C47). Ensure bleed air line is properly aligned and has no kinks. Torque the bleed air connector mount bolts to 35 inch pounds and lockwire (C155).

f. Replacement of Check Valve Assembly. Remove check valve assembly on bottom of lower half assembly by loosening B nut. Install new check valve and tighten B nut.

g. Deleted.

h. Replacement of Engine Intake Ring. Remove lockwire from 10 attaching bolts and remove bolts from lip seal ring.

i. Replacement of Wash Hose Assembly. Remove wash hose assembly by disconnecting B nuts on both ends. Position new wash hose assembly and tighten B nuts on both ends.

j. Replacement of Lower Half Assembly Mounting Nutplates. Remove nutplate by drilling out two attaching rivets. Position new nutplate and install two rivets.

k. Replacement of Inner Bellows.

CAUTION

When drilllng to remove rivets, exercise caution not to enlarge rivet holes. Use #40 size drill bit.

(1) Remove rivets holding front end of bellows (2, figure 4-17.3) to aluminum bellows ring (3). Remove rivets holding aft end of bellows to aluminum pan (I).

NOTE

When removing rivets, it maybe required to cut bellows at the apex of first pleat.

(2) Clean faying surfaces of aluminum parts to remove any particles or corrosion that maybe present. Coat surface with primer (C312).

(3) Insert doubler rings (4) under flaps of bellows (2) at each end.

(4) Rivet bellows (2), bellows ring (3), and doubler (4) using rivets (6).

(5) Insert rivets with rivet head on inside of bellows.

NOTE

Do not pinch bellows during riveting.

NOTE

Bellows ring nut plate flange to be on outside of bellows assembly.

(6) Use care to properly align pan (1) and bellows ring (3). Assemble pan (1) to the inner bellows (2) and doubler (4).

(7) Locate nut plates (5), on bellows ring (3), with the widest separation, centered, with the bottom center hole in pan (1).

(8) Rivet pan (1), inner bellows (2), and doubler ring (4) using rivets (6).

(9) Insert rivets with rivet heed on pan (1) side.

NOTE

Do not pinch bellows during riveting.

NOTE

Inspect inside of bellows for debris and dean as required.

l. Replacement of Aft Bellows.

CAUTION

When drilling out rivets, exercise caution not to enlarge rivet hales. Use a #40 size drill bit.

(1) Remove rivets holding aft end of bellows (1. figure 4-17.3), from seal lip ring (2).

(2) Clean faying surfaces of aluminum parts to remove particles or corrosion. Coat with primer (C312).

(3) Insert aft clamp ring (3) under aft end flap of bellows (1).

(4) Rivet bellows(1), damp ring (3), and seal lip ring (2) using rivets (4).

NOTE

Do not pinch bellows during riveting.

NOTE

Insert rivets with rivet head away from bellows (1).

(5) Inspect inside of bellows for debris and dean as required.

m. Repair of eroded ejector slot (AVUM).

(1) Obtain adhesive repair material kit (C29.3).

(2) Remove areas of old adhesive that are disbonded using No. 240 grit abrasive paper (C11 .5), and sand edges of adjacent bonded adhesive.

(3) Clean sanded and adjacent area(s) thoroughly with cheesecloth (C61) saturated with isopropyl alcohol (C42). On final wipe, use dry cheesecloth before alcohol evaporates.

(4) Put on rubber or plastic gloves (C120.2).

NOTE

Pot life of TSK-L-100 (C29.3) adhesive is 10 to 15 minutes at 72° F (22° C). Time is shorter at higher temperatures.

(5) Mix the two part adhesive thoroughly.

(6) Using a paint brush or spatula, apply light coats of adhesive to eroded area(s). Continue adding coats until area is built-up to adjacent thickness. Remove any air bubbles.

(7) Allow adhesive to cure, normally 2 hours at ambient temperatures. (NOTE: Cure rate may be accelerated using a heat gun or lamp.)

(8) Optimum durability for adhesive will develop in six to eight hours.

n. Replacement of external side inlet panel (AVIM).

(1) Disassembly

(a) Remove rivets per TM 1-1500-204-23-10. Use caution so as not to enlarge rivet holes.

(b) Cleco panel as required to avoid panel flexure as rivets are removed.

(c) After rivet removal, remove cleo's and separate panel from structure.

(d) Remove all debris from interior of IPS unit.

(2) Assembly

(a) Deburr rivet hales if required.

(b) Apply sealant (C237) to interfacing sheet metal open to outside air.

(c) Align panel to structure, insuring vortex inlet and outlet tubes are in proper alignment, deco as required for riveting.

(d) Rivet panel to IPS structure.

(e) Clean-up any displaced sealant.

(f) Paint if required.

o. Debonded rear sheet metal panel (at interface aft of ejector slot) (AVUM.)

(1) Clean faying surfaces with isopropyl alcohol (C42) prior to Supplication of sealant.

(2) Bond aft sheet metal panel to existing metal set with sealant (C22). Clamp as required and dean-up any displaced sealant.

(3) Leave damped till sealant has cured per manufacturers instructions.

(4) Paint if required.

p. Ejector Exhaust Manifold Access (AVIM)

(1) Disassembly

(a) Remove rivets on aft panel per TM 1-1500-204-23-10 in addition to those located on the aft panel, 2 each on top edge, and 3 each on comers, must be removed.

(b) Remove all exterior bolts holding manifold to aft sheet metal panel.

(c) Remove panel then manifold. NOTE: Ejectors/manifold may require internal cleaning, use solvent (C261) with suitable air source.

(d) Remove all debris from interior of unit.

(2) Assembly

(a) Deburr rivet holes as required.

(b) Apply sealant (C237) to all interfacing sheetmetal open to outside air, except interface aft of ejector slot, where sealant (C22) will be utilized.

(c) Place manifold into rear of air cleaner.

(d) Align sheet metal panel and deco as required.

(e) Align manifold bolt holes to panel holes and start bolts.

(f) Rivet rear panel to structure.

(g) Tighten manifold bolts.

(h) Clamp panel at ejector slot(s) until sealant (C22) cures.

(l) Clean-up any displaced sealant.

(J) Paint if required.

4-57.7 Installation - Improved Particle Separator

CAUTION

Perform FOD inspection of area before installation.

a. If firewall nutplate ring was removed, position ring around intake bellmouth ring. Ensure nutplate ring is between wash kit hoses and inlet flange of firewall with nutplate split at top.

b. Install IPS lower half (14, figure 4-17.1) into aircraft and align four mounting holes with holes in aircraft deck. Install mounting bolts (7) and washers (8) and torque to 150 inch pounds. Check to ensure nutplate ring is properly positioned (split at the top).

c. Insert intake bellmoulh through firewall (i removed). Align flange with mating flange on engine and install V-band coupling.

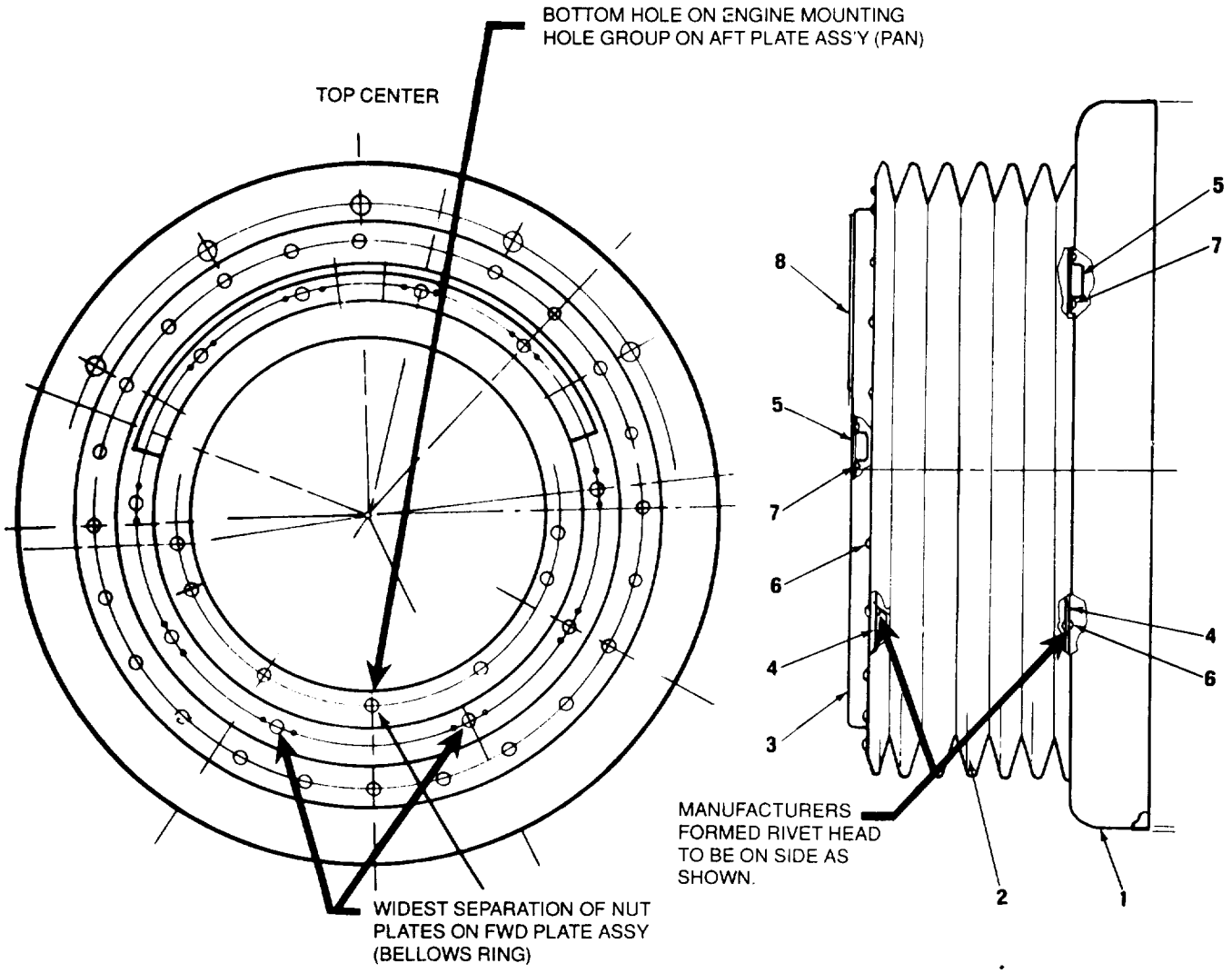
NOTE

V-band coupling damp shall be installed at 3 o'clock position only. This will position the 3.25 inch cut-out in V-band at 6 o'clock position. This position will assist in preventing corrosion on mating surfaces of engine inlet housing.

d To torque V-band coupling, tap coupling with a soft mallet from middle towards each end while tightening nut. Torque 40 to 50 inch pounds.

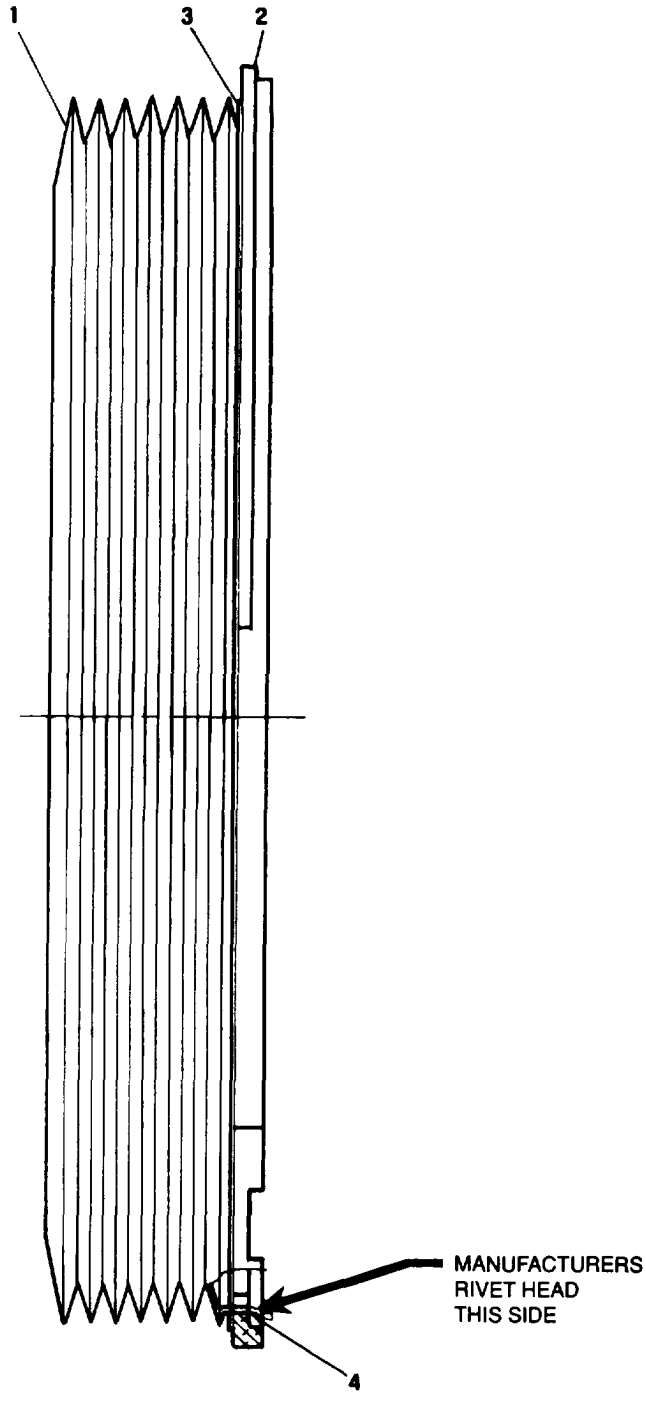
e. Starting at top, install 18 firewall slip ring hex bolts and tighten bolts.

f. Determine if a flexible plate driveshaft or solid grease-filled driveshaft is to be installed. If flexible plate driveshaft will be used, leave top can gasket (19) attached to rear of inner bellows. If solid grease-filled driveshaft will be used, remove top can gasket (19) from rear of inner bellows.



ITEM	DESCRIPTION
1	PAN
2	BELLOWS, INNER
3	RING BELLOWS
4	DOUBLER
5	NUTPLATE 10-32
6	RIVET, SOLID
7	RIVET, SOLID
8	SPACER, DOUBLER RING

Figure 4-17.3 Inner Bellows Installation IPS (Sheet 1 of 2)



ITEM	DESCRIPTION
1	BELLOWS, AFT
2	RING, AFT RADIAL SEAL LIP
3	RING, CLAMP AFT
4	RIVET

Figure 4-17.3 Aft Bellows Installation IPS (Sheet 2 of 2)

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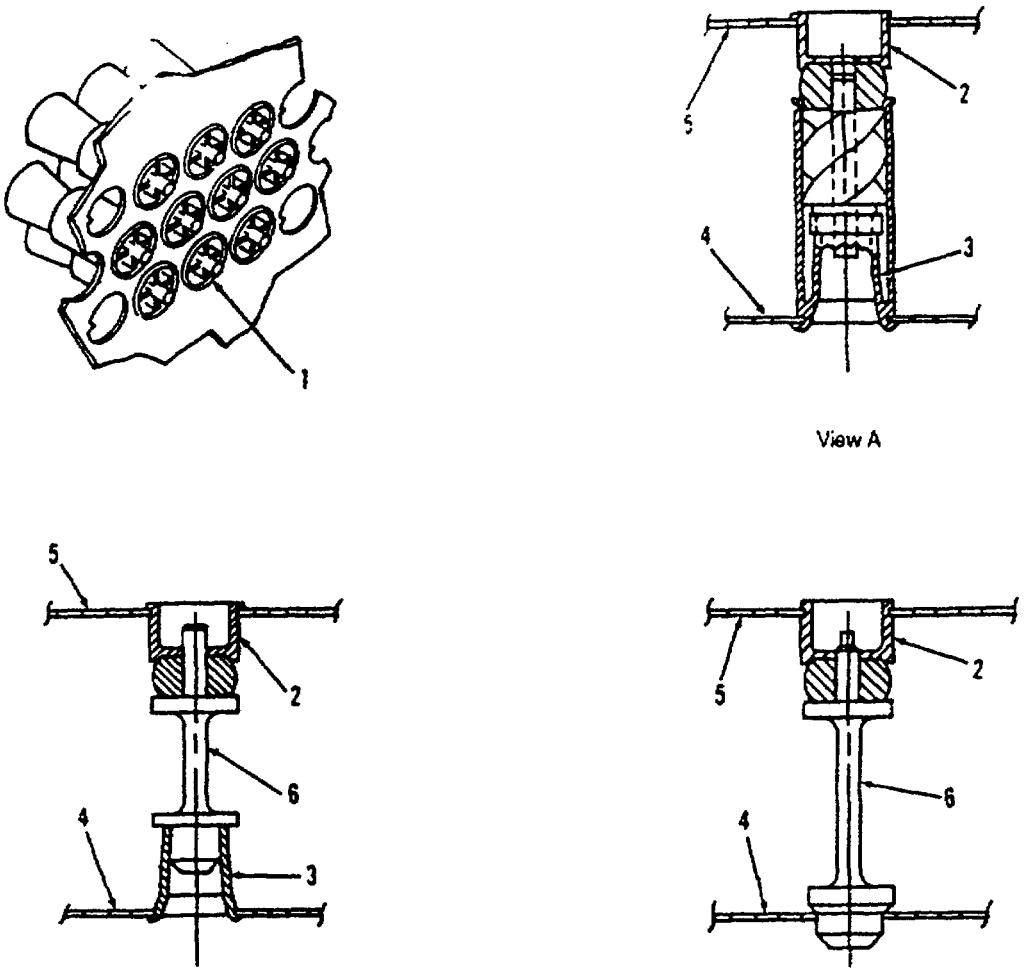


1. Typical Vortex Generator Installation.
2. Repair Plug.
3. Outlet Tube.
4. Outlet Tube Plate.
5. Inlet Tube Plate.
6. Stem.

Figure 4-17.2. Repair Procedures for Vortex Tube Generator

NOTE

The solid grease-filled driveshaft requires a cooling airflow from holes in the inner bellows. The top can gasket covers these holes. Because of this, the gasket is not installed when the solid grease-filled driveshaft is used.

NOTE

The flexible plate driveshaft does not require cooling air. Because of this, holes in inner bellows must be covered. Ensure gasket is installed.

g. Position inner bellows (21) and lower can half (20) onto five studs on gearbox nose casting. Install five nuts (15) and washer (24). Torque **30 to 35** inch pounds.

h. Position lip seal ring (13) over transmission.

i. Install driveshaft in accordance with Section 6.

j. Install upper can half (16). Install six mounting bolts (17) and washers (18). Torque **30 to 35** inch pounds.

CAUTION

Ensure upper and lower cage assemblies are round and concentric to driveshaft.

k. Pull inner bellows (21) forward and install and tighten bolts (12) and washers (11) in place to lip seal ring (13).

CAUTION

Perform FOD inspection of entire IPS lower half and surrounding area before proceeding to next step.

l. Ensure lower half mounting bolts (7) are properly torqued (**150** inch pounds).

m. Remove ball locking pin that secures firewall to top of center frame of engine cowling. This allows top of firewall to be pulled aft so air cleaner can be lowered into position.

NOTE

Forward firewall should be perpendicular to the cabin roof workdeck. It may be necessary to elongate engine tip cowling beam assembly, 205-060-0801-3, 205-060-816-1, to allow firewall to secure to aft of improved particle separator.

CAUTION

Ensure seals between upper and lower halves are properly aligned. Failure to do so allows dust to enter engine.

n. Position IPS upper half (22) over lower half (14), lower into position and engage IPS front pins in mating parts.

o. Secure four latch levers and ensure levers are fully locked in the closed position. Install latch safety pins.

p. Push top of firewall forward and insert ball locking pin.

q. Fasten five DZUS fasteners (23) on IPS top screen.

r. Place boss seal (5) on bulkhead fitting (4) and attach to top half of air cleaner through fitting (1) installed in firewall.

s. Attach bleed air line to bulkhead fitting (4).

t. Close transmission cowling.

u. Determine if any chaffing exists between IPS and transmission cowl. If so accomplish the following:

(1) Sheet metal cowl/fiberglass cowl.

(a) With cowl latched in position. Use forward edge of IPS to mark a cut line across cowl

(b) Remove cowl from aircraft and cut.

(c) Remove sharp edges.

(2) Sheet metal cowl.

(a) Anywhere former has been cut, insert a phenolic spacer and rivet to skin.

(b) Seal any openings using sealant (242).

(3) Fiberglass cowl: Anywhere former has been cut, fiberglass (C29) the void for waterproofing.

(4) Paint cowl in accordance with TM 55-1500-345-23.

(5) Reinstall cowl on aircraft.

SECTION IV. EXHAUST SYSTEM

4-58. EXHAUST SYSTEM.

4-59. Description - Exhaust System. Engine exhaust diffuser has inner and outer housings, separated by hollow struts across exhaust passage. Inner housing, which supports power turbine assembly, is capped by a cover plate. A tailpipe, clamped on outer diffuser flange, directs exhaust gases aft and slightly up away from tail boom. Pipe has a drain hose from lowest point. A rigid harness with either three or six thermocouple probes attached and inserted through diffuser into the path of exhaust gases, is connected through flexible cable to cockpit exhaust gas temperature indicator. A support cone, around diffuser, provides mounting for rear firewall.

4-60. CLAMP - EXHAUST SYSTEM.

4-61. Description - Clamp. Clamp is used to attach tailpipe to outer diffuser flange of engine.

4-62. Removal - Clamp (para. 4-69).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

4-63. Cleaning - Clamp. Clean clamp with dry-cleaning solvent (C261).

4-64. Inspection - Clamp.

a. Inspect clamp (3, figure 4-7) for security when installed on tailpipe and outer diffuser. Torque should be **100 TO 130** inch pounds.

b. Inspect clamp for cracks, corrosion, dents, and nicks. If crack in clamp is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

4-65. Repair or Replacement - Clamp.

a. Re-place clamp with new part when cracked.

b. Polish out all nicks, scratches, and corrosion using 180 grit or finer sandpaper (C231). Polish to a smooth, scratch free finish with crocus cloth (C68). Blend edges of repair into surrounding area.

4-66. Installation - Clamp. (Refer to para. 4-73).

4-67. TAILPIPE - EXHAUST SYSTEM.

4-68. Description - Tailpipe. Tailpipe is constructed of 0.032 inch corrosion resistant steel, AMS-5532, Condition N-155. It is clamped on outer diffuser flange and directs hot exhaust gases aft and slightly up away from tailboom. Tailpipe has a drain hose from lowest point to service deck (figure 4-7).

4-69. Removal - Tailpipe.

a. Open access door at lower left on tailpipe fairing, disconnect antenna and anti-collision light wiring at service deck. Open section of driveshaft cover which overlaps end of tailpipe fairing. Release fasteners and remove fairing.

b. Disconnect coupling half (7, figure 4-7) at service deck.

c. Loosen nuts and remove clamp (3) from flange on tailpipe (4). Remove tailpipe.

d. If same tailpipe is not to be reinstalled remove hose (5), bushing (6), coupling half (7) and gasket (8) from tailpipe (4).

e. To remove tailcone or cover plate from inner housing flange, cut lockwire and remove eight bolts.

f. Protect exhaust diffuser opening with fabric cover normally used on tailpipe.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

4-70. Cleaning - Tailpipe.

a. Clean tailpipe (4, figure 4-7) and ejector with wire brush and dry cleaning solvent (C261) when necessary.

b. Clean clamps and heat shield with cleaning solvent.

4-71. Inspection - Tailpipe.

a. Tailpipe and ejector for cracks, dents and burned out or buckled areas. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

b. Insulation blanket for visible damage.

c. Heat shield for cracks and distortion. If crack in heat shield is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

4-72. Repair or Replacement - Tailpipe.

NOTE

Shallow dent and scratches may be disregarded.

a. Replace tailpipe or ejector for cracks, burned out or buckled areas, or dents and distortions that cannot be straightened to normal contour.

b. Replace insulation blanket if damaged.

c. Replace heat shield for cracks or distortion that cannot be straightened.

d. (AVIM) Cracks, tears, or punctures (small holes) in any area of the tailpipe that do not exceed patching limits will be patched as follows:

(1) Stop drill end of each crack or tear.

(2) Smooth the contour of holes and prepare a patch as follows:

(a) Patch to be made of **0.032** inch corrosion resistant steel, AM5-5532, Condition N-155.

(b) The total number of patches used for repair is not limited, but maximum allowable size of any one patch is 20 square inches.

(c) Outside patch must have approximately 0.750 inch overlap of any damaged area.

(d) Inside patch must be approximately **0.500** inch larger than the outside patch in all dimensions.

(3) Heliarc weld patch on both inside and outside surfaces of tailpipe. Weld in accordance with MIL-W-8611, using rod (C227). Rod (C228) may be used as an alternate.

(4) If tailpipe ring is welded, file or machine the flange to a flat surface after welding to provide a flat seat against the attachment point of the engine.

e. Burned out parts or damage greater than that which is repairable by patching are cause for replacement of tailpipe. If out-of-round exceeds **0.5** inch (front only) on the diameter, replace the tailpipe.

4-73. Installation - Tailpipe.

a. Remove protective cover from engine exhaust diffuser.

b. DELETED

(1) DELETED

NOTE

DELETED

(a) DELETED

(b) DELETED

(2) DELETED

(3) DELETED

b. If removed, install hose (5, figure 4-7) on tailpipe (4). Install bushing (6), gasket (8) and coupling half (7) on hose.

CAUTION

Use new self-locking nuts when installing V-band coupling clamps.

d. Position tailpipe on outer flange of diffuser, with drain fitting down and locating dowels engaged. Make sure inside of pipe is aligned with exhaust diffuser. Secure with V-band clamp around flanged joint with a V-band split located at 6 o'clock, seat clamp by tapping with soft mallet from middle towards ends, while tightening nuts on clamp bolts. Torque nut **100 to 130** inch-pounds. Repeat this procedure at least twice to en-sure proper seat and torque application. Check torque again after test flight or engine ground check.

e. Connect drain hose from tailpipe to coupling on fuselage.

f. Install tailpipe fairing, connecting antenna and anti-collision light wiring at deck connectors. Close drive-shaft access door.

g. Deleted.

SECTION V. OIL SYSTEM

4-74. OIL SYSTEM.

4-75. Description - Oil System. (Figures 4-18 and 4-19). Oil is supplied from a tank mounted on forward firewall at right side of engine compartment, the oil flowing through a quick disconnect hose to the inlet of the engine-driven dual element pump on the front of the accessory gearbox. On modified helicopters, the oil debris detection system (ODDS) provides prediction/detection of impending failures. ODDS also reduces nuisance chip indications by pulsing away normal-wear particles on the detector gap. The pump, which is equipped with a pressure relief valve and a thermobulb for oil-in temperature gage, delivers oil through internal passages and a filter on the left side of the accessory gearbox for distribution through the engine lubrication system. Oil pressure gage transmitter and pressure switch for **ENG OIL PRESS LOW** caution panel lights are mounted at top engine inlet housing and connected by external hose to pressure tap on filter. The torquemeter, incorporated in the reduction gearing to provide continuous gage readings of engine output torque, requires oil at higher than normal pressure. A boost pump on the overspeed governor and tachometer drive gearbox supplies oil to the torquemeter through internal passages at boosted pressure regulated by an adjustable bypass valve. A second element of the boost pump scavenges oil from scavenges oil from the governor drive assembly. The torque gage transmitter mounted at the top of the inlet housing, has two hose connections; from pressure port of transmitter to torquemeter tap above right mount pad of inlet housing; from vent port to a tap on the cover of an unused drive pad at the right front on the accessory drive gearbox. Scavenge element of engine-drive pump circulates the oil through external lines to a thermal bypass valve and oil cooler in fuselage compartments below deck and returns it the supply tank. In helicopters with ODDS, this scavenge oil flows through a cyclonic oil separator (Lubriclone) and a 3-micron filter to a thermal bypass valve. There are separate drain lines, with manual valves, at the cooler outlet and at the supply tank. A breather hose from the right side of the accessory drive gearbox is vented into the tank through a quick-disconnect coupling. On helicopters without ODDS, a chip detector drain plug at the lower right on the accessory gearbox is wired to the **ENGINE CHIP DET** caution light. On helicopters with ODDS, this chip detector is not wired. Instead, a chip detector wired to that caution light is installed in an external oil separator (11.1, figure 4-18) in the engine compartment.

The primary benefit of the ODDS system is improved filtration of the engine and main transmission lubrication system. The ODDS system is designed to provide early identification of potential component failures. Fine filtration (3 micron) increases system life by removing oil-borne particles which cause wear in the component. Analysis shows that catastrophic failure modes that are detected through spectrometric oil analysis (SOA)/AOAP will be detected by the ODDS system chip detectors.

Replacement of the ODDS equipped engine and main transmission external oil filters are preformed "on condition" as required by maintenance actions (such as bypass buttons, major component change etc.). Since operation of fine filtration cleans the lubricant in the component, do not replace the lubricant when replacing the filter. Flushing and filtering the lubricant of the ODDS system is not required or authorized. Flushing and filtering of the lubricant is only done during replacement of engine and/or main transmission.

NOTE

If MWO 55-1520-210-30-39 has been accomplished (breakaway) self-sealing oil lines and coupling assemblies have been installed to replace standard components. See figures 4-45 thru 4-48.

4-76. Lubrication. (Refer to paragraph 1-1 Servicing.)

4-77. Description - Oil Lines, Hoses, and Fittings. (Figure 4-18.) Oil system plumbing consisting of flexible hose, metal tubing, valves and connector fittings. Flexible hose is used in low-pressure systems where components are subjected to vibration. Metal tubing is used in high pressure or critical systems.

of the lubricant is only done during replacement of engine and/or main transmission.

During modification of aircraft I.A.W. MWO 1-1520-242-50-2 (ODDS) chip detectors in the 42 and 90-degree gearboxes were changed, they are not part of the ODDS filtering oil system and still require SOA/AOAP samples and inspection.

NOTE

If MWO 55-1520-210-30-39 has been accomplished (breakaway) self-sealing oil lines and coupling assemblies have been installed to replace standard components. See figures 4-45 thru 4-48.

4-76. Lubrication. (Refer to paragraph 1-1 Servicing.)

4-77. OIL LINES, HOSES, AND FITTINGS.

4-78. Description — Oil Lines, Hoses, and Fittings. (Figure 4-18.) Oil system plumbing consist of flexible hose, metal tubing, valves and connector fittings. Flexible hose is used in low-pressure systems where components are subjected to vibration. Metal tubing is used in high pressure or critical systems.

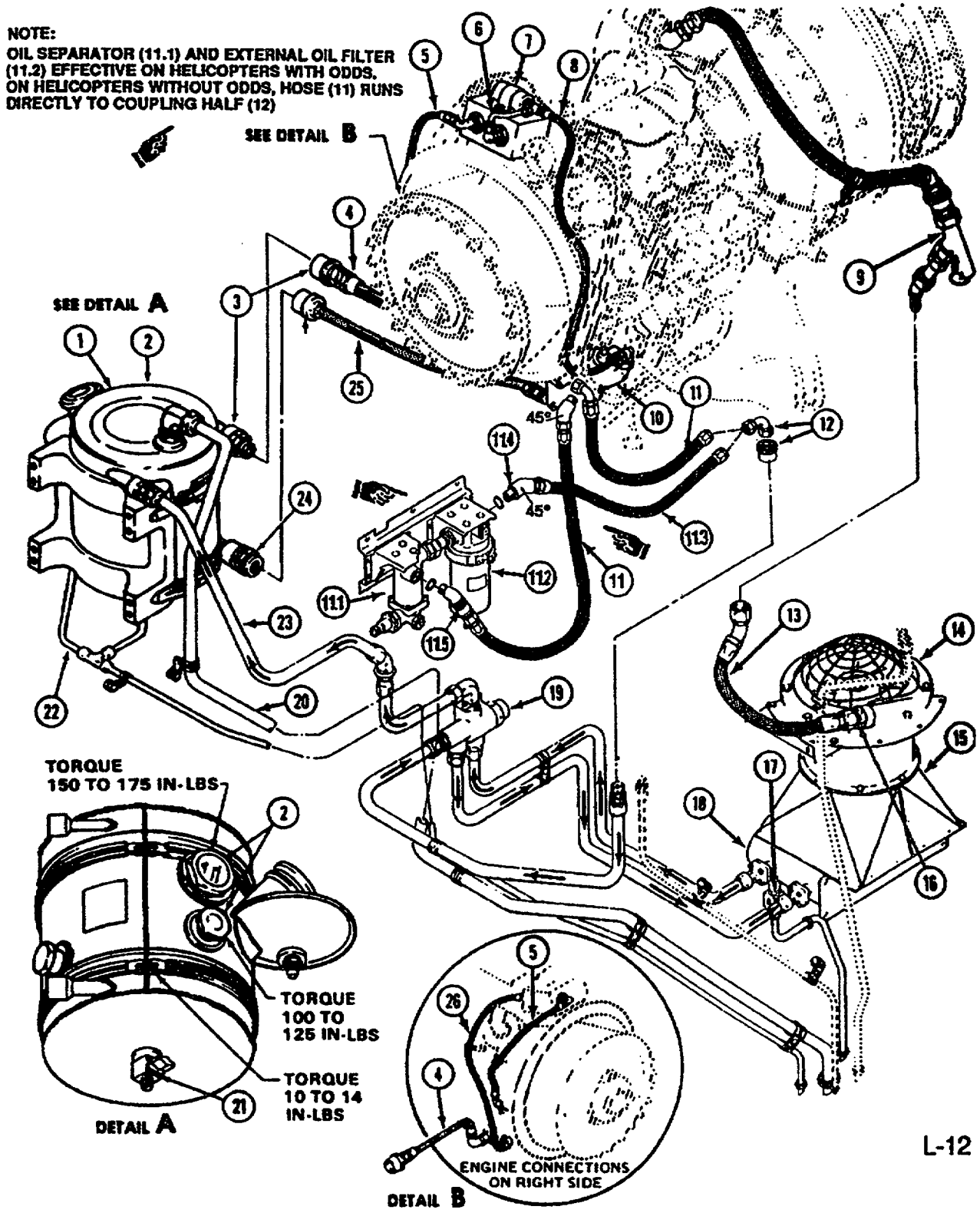


Figure 4-18. Oil Supply and External Lines (Sheet 1 of 2)

1. Oil tank
2. Sightgages
3. Coupling halves (standard) or coupling assembly (crashworthy) (See figure 4-48.)
4. Engine breather hose
5. Torquemeter pressure hose
6. Oil pressure transmitter tube
7. Oil pressure switch
8. Engine oil pressure hose
9. Engine bleed air valve
10. Engine oil filter
11. Scavenge pump outlet hose
11.1. Oil separator (Lubriclone)
11.2. External oil filter
11.3. Filter outlet hose
11.4. Elbow, 45°
11.5. Coupling halves, crashworthy, 90° and straight
12. Coupling halves (standard) or coupling assembly (crashworthy) (See figure 4-45.)
13. Slower air inlet hose
14. Oil cooling turbine fan
15. Turbine duct
16. Reducer fitting (204-060-494-1)
17. Cooler drain valve
18. Oil cooler
19. Thermal bypass valve
20. Oil tank vent line
21. Oil tank drain valve
22. Oil scupper drain line
23. Oil tank return line
24. Coupling halves (standard) or coupling assembly (crashworthy) (See figure 4-48.)
25. Oil pump inlet hose
26. Torquemeter vent hose

Figure 4-18. Oil Supply and External Line Sheet 2 of 2)

NOTE

If MWO 55-1520-210-30-39 has been accomplished the oil tank and engine oil pump inlet and outlet lines consist of self-sealing hoses and breakaway fittings. The fittings shear on impact and seal both the oil in the hose and the oil in the tank and engine.

4-79. Removal - Oil lines, Hoses, and Fittings.

NOTE

Remove hoses and tubing that may be damaged during removal of engine components. Before removing any tube or hose, be sure it is properly identified and its route understood for replacement in same manner. When possible, leave supporting brackets in place to simplify reinstallation.

a. When removing or installing oil, or air hoses, do not apply torque to narrow hex nut of sleeve and nipple (figure 4-3). Apply torque to the wide hex nut only. When loosening or tightening wide hex nut, hold nipple or sleeve to prevent twisting of hose.

b. Cap or cover openings immediately when disconnected, and take all possible precautions to prevent contamination or dirt from entering oil system.

4-80. Cleaning - Oil Lines, Hoses, and Fittings. Clean oil lines, hoses and fittings with a clean dry cloth.

4-81. Inspection - Oil lines, Hoses, and Fittings.

a. Inspect metal lines and fittings for cracks, corrosion, scratches, dents, deformation, damaged threads, and leakage. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

b. Inspect hose assemblies for signs of deterioration indicated by separation of the rubber cover or braid from the inner tube, cracks, hardening, deformation, damaged threads, and linkage.

c. Inspect coupling (item 11.5, figure 4-18) Measure the wear on the break-away pins using a feeler gage as follows:

NOTE

When attempting to measure the gap do not rock coupling halves back and forth. Apply an even pressure so that a consistent reading is obtained.

(1) Apply pressure to coupling halves (as if to push them together). Measure and record the breakaway joint gap at each pin position with the coupling fully compressed.

(2) Apply opposite pressure to the coupling halves (as if to pull them apart). Measure and record the breakaway joint gap at each pin position with the coupling fully extended.

(3) If the difference is .085 inch or less at all locations, the coupling is serviceable. If the difference is greater than .085 inch at any of the three locations replace coupling.

NOTE

When installing coupling position the 90 degree coupling half so that the least amount of side load is placed on the break-away coupling. Ensure that the clamp used to secure the oil line to the lower fuel filter is positioned as close to the break-away coupling end of the oil line as practical to reduce vibration.

4-82. Repair or Replacement - Oil lines, Hoses and Fittings.

a. All nicks, scratches and corrosion no deeper than 15 percent of wall thickness and not in a bend will be removed by polishing. Replace lines when damage exceeds 15 percent of wall thickness or damaged in bend.

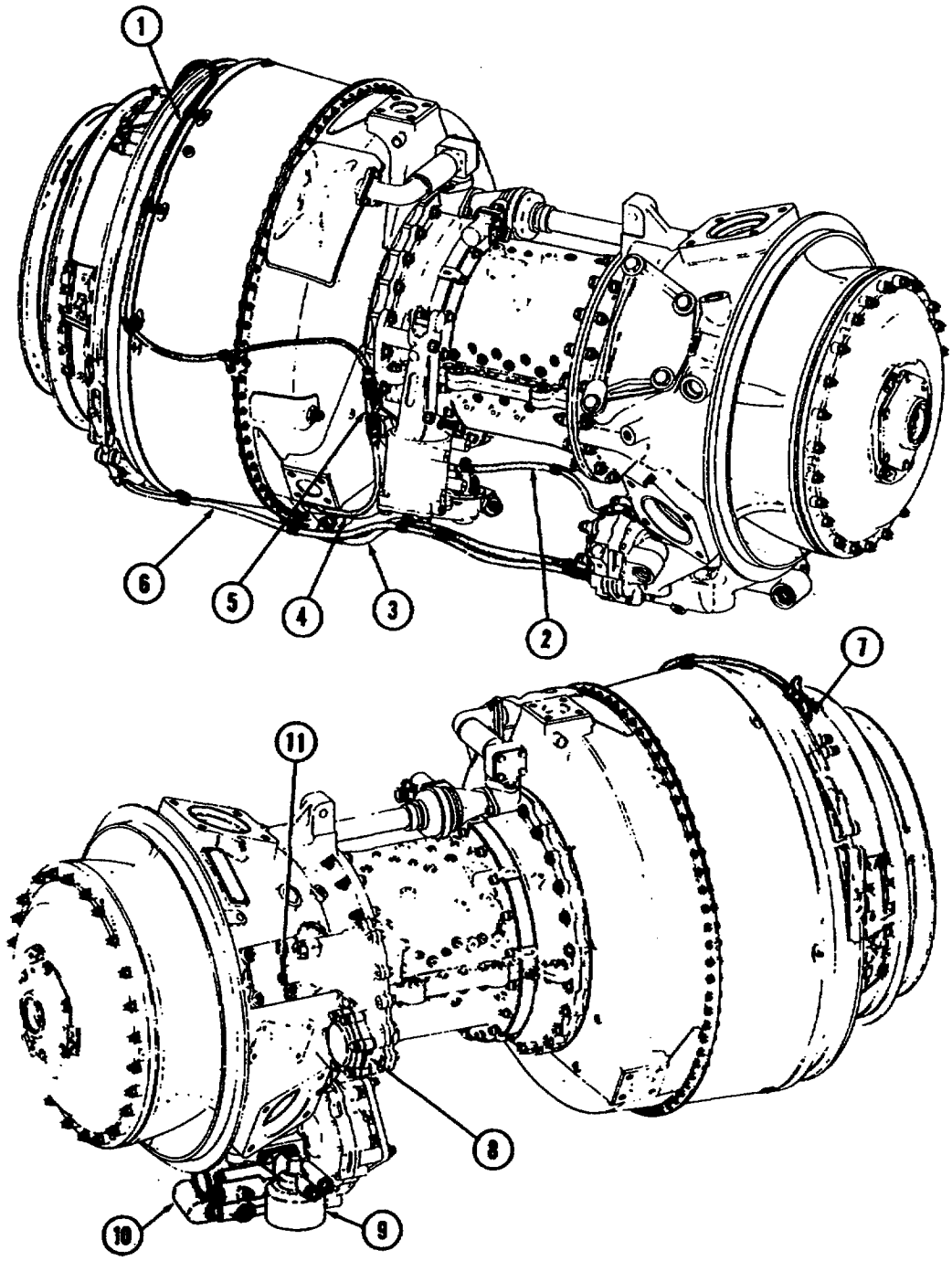
b. Replace oil lines that are cracked, or bent.

c. Smooth dents less than 20 percent of tubing diameter are permitted provided they are not in a bend radius. Replace tube with dents exceeding this limit.

d. Replace tubes or fittings with leaks or damaged threads: Inspect breakaway valves in accordance with 10-155.

e. Replace hoses that contain any of the defects listed in paragraph 4-81, step b.

f. Fabricate a two part replacement for oil tank vent tube P/N 205-060-582-1 which may be joined with a union. Fabrication data is shown as P/N UH1-L0001-1 and P/N UH1-LOO01-2.



1. Pressure line, no. 3 and 4 bearing
2. Pressure line to manifold
3. Scavenge line, no. 2 bearing
4. Pressure line, no. 2 bearing
5. Pressure manifold
6. Scavenge line, no. 3 and 4 bearing
7. Inlet strainer, no. 3 and 4 bearing
8. Torquemeter booster pump
9. Engine oil filter
10. Oil pump
11. Test gage connection

Figure 4-19. Engine Oil System Components

4-82. Installation - Oil Lines, Hoses and Fittings. Replace any unserviceable external lines, hoses, fittings, units, gaskets, and preformed packings which are accessible without unauthorized disassembly.

a. Carefully inspect condition of all tubing and/or hoses to be installed on engine. Remove any cap or plugs installed in tube openings.

b. Properly route and clamp all hose assemblies securely to prevent chafing. Proper clamping and chafe pads shall be used at all times.

c. Attach tubing or hose. (Refer to Table 1-5 for standard torque values.)

4-83. ENGINE OIL TANK.

4-84. Description - Engine Oil Tank. Engine oil supply tank (1, figure 4-18) is a welded metal container equipped with filler neck and cap, two oil level sight plugs, a scupper with drain, and fittings for connection of outlet, return, vent, drain and engine breather lines. Filler neck and vent have internal screens, and oil return port has an internal baffle. Tank is secured by straps in a padded support on right side of forward firewall.

4-85. Removal - Engine Oil Tank.

a. Open right engine cowling. Drain tank by opening valve (below tank) in drain line which discharges at left aft side of fuselage.

b. Disconnect all lines from tank. Cap or cover openings.

c. Cut lockwire, loosen tank strap turnbuckles, and remove tank from support.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

4-86. Cleaning - Engine Oil Tank. Flush out tank with cleaning solvent, (C261) removing cap and fittings as necessary. Be sure screens in filler neck and vent port are clean and undamaged. Drain thoroughly. Filtered compressed air may be used for drying.

4-87. Inspection - Engine Oil Tank.

a. Inspect tank for the following:

(1) Punctures or leaks.

(2) Torn or punctured internal screens.

(3) Damaged threads in fittings.

(4) Damage which affects capacity or function.

(5) Inspect for loose, missing or improperly installed hardware.

b. Inspect sight plugs for discoloration, damage and proper safetying. Inspect removable fittings for damage.

c. Inspect tank support straps and strap pads for damage.

d. Inspect tank support (removed from firewall) for cracks or damage at mounting points. If crack in oil tank support is suspected, refer to TM 1-1520-256-23, AVUM/ AVIM NDI procedures for UH-1 helicopter series.

4-88. Repair or Replacement - Engine Oil Tank.

a. Replace tank for punctures or leaks, torn or punctured internal screens, damaged threads on fittings, or any damage which affects capacity or function.

b. Replace preformed packings at reinstallation. Replace any damaged sight plugs or other removable fittings.

c. Replace any damaged sight gage plugs or other removable fittings. Torque top sight gage plug **150 TO 175** inch-pounds. Torque bottom sight gage plug **100 TO 125** inch-pounds. (See figure 4-18, Detail A). Lockwire the plugs (C155).

d. Replace unserviceable pads on tank straps and support. Replace support assembly if straps are unserviceable.

e. Replace tank for punctures or leaks that can not be welded, torn or punctured internal screens, damaged threads in fittings, or any damage which affects capacity or function. (Refer to TM 1-1500-204-23 series for welding instructions.)

f. Testing. Upon completion of any sheetmetal repairs, the tank must be thoroughly cleaned and pressure tested at a pressure of **5** psi.

4-90. Installation – Engine Oil Tank. a. Check that pads are in place on tank support and straps. Open straps to place tank in support, with filler neck to right. Connect straps around tank, with turnbuckles loose enough to permit alignment.

b. Install fittings and connect tubes to tank ports.

c. Torque tank strap turnbuckles 10TO14 inch-pounds. Install lockwire (C155).

4-91. OIL COOLER ASSEMBLY.

4-92. Description – Oil Cooler Assembly. Oil cooler (18, figure 4-18) for engine oil is mounted in bottom of fuselage behind engine, and is connected into oil return line through a thermal bypass valve. Cooling air flow is provided by a turbo blower driven by bleed air taken from engine diffuser housing. Another cooler, for transmission oil, is mounted side by side with engine oil cooler. There is no functional connection between these two oil systems. A thermel bypass valve is mounted in the engine oil return lines between the engine and oil cooler, The valve consists of a valve body, thermostat, and fittings to connect the thermal valve into the engine oil system lines. When the engine oil temperature is 130 degrees F (54 degrees C) or below, the thermostat will be completely open and oil will return to oil tank without passing through oil cooler. Between 130 and 175 degrees F (54 to 79 degrees C), the thermostat will be partially closed allowing a portion of the oil to pass through the oil cooler. At a maximum temperature of 175 degrees F (79 degrees C), the thermostat will be completely closed and all of the oil will, pass through the oil cooler prior to returning to the oil tanks.

4-93. Removal – Oil Cooler Assembly.

NOTE

The neoprene packing on bleed air line quick disconnect fitting part number 375240-16 becomes brittle from bleed air heat, and shall be replaced with silicone seal when line is disconnected. Ensure parts from old seal do not fall into bleed air line and blower.

a. Removal – Turbo Blower and Duct.

(1) Open access door at right side of fuselage below engine tailpipe.

(2) Remove blower screen.

(3) Disconnect air hose from blower inlet fittings.

(4) Remove bolts, with nuts and washers. to detach blower from support bracket on fuselage bulkhead.

(5) Remove bolts and washers to detach blower from duct. Remove blower assembly.

(6) Remove bolts and washers which secure upper flanges of cooler and mount to sides of duct. Remove duct.

b. Removal — Engine Oil Cooler.

NOTE

Engine and transmission coolers must be removed as one unit.

(1) Drain engine oil cooler and connected oil lines by opening valve (17, figure 4-18) below cooler outlet.

(2) To reduce oil loss, disconnect transmission inlet and outlet oil hoses at quick-disconnect couplings (1 and 3, figure 6-56) in compartment below pylon. Drain transmission cooler lines by opening two drain valves (5) located in forward left-hand side of center fuel cell access compartment.

(3) Disconnect inlet and outlet lines from both coolers, and drain line from transmission cooler Remove drain valve from bottom of engine cooler

(4) Remove bolts and washers from both lower mounting flanges to detach engine and transmission coolers from support at bottom of fuselage compartment. Remove coolers by lifting straight up to clear support mounts. Retain shim.

(5) Remove bolts securing two coolers together.

c. Removal – Engine Oil Thermal Valve.

NOTE

Engine Oil Thermal Valve Assy should be removed when removing or torquing thermal element in housing assembly. This will prevent damage to valve attachment fittings in airframe honeycomb panel.

(1) Be sure lower part of oil system has been drained through valve at engine oil cooler outlet.

(2) Enter compartment under engine deck through access opening in bottom of fuselage.

(3) Disconnect four oil tubes from fittings on valve body, located on beam at right side of compartment.

(4) Remove screws and washers to detach valve assembly from structural beam.

4-94. Disassembly Oil Cooler Turbo Blower. (Figure 4-20)

a. Disassemble turbo blower (P/N 132101-1)

(1) Remove bolts (3), nuts (9), and washers (8) from cover assembly (4) and remove cover assembly from housing (16).

(2) Using spanner wrench, remove lock nut (12) and washer (11) from aft end of shaft (21).

(3) Remove locknut (5) and washer (6) from shaft (21); then remove fan and turbine assembly (7) and woodruff key (17) from shaft.

(4) Cut lockwire and remove four screws (18) and retainer (19) from housing. Carefully pull shaft (21) with bearings (10 and 20) from housing as a unit.

NOTE

Do not remove identification plate (15) or directional arrows (14) unless damaged, or unless housing replacement is required.

(5) Using bearing puller, removed bearings (10 and 20) from shaft.

b. Disassembly turbo blower (P/N A20152-3)

(1) Remove reducer fitting (1, figure 4-21) and packing (2) from nozzle (4), figure 4-21.

(2) Remove nuts (18 and 20), washers (19 and 21), and screws (3 and 5) and remove nozzle (4), inlet ring (6) and mounting plate (22) from housing (17).

(3) Remove nut (13), and washer (14), from end of shaft (30).

(4) Remove nut (7), and washer (8) from shaft (30). Then remove Impeller (9) and key (29) from shaft (30).

(5) Cut lockwire and remove screws (25) and bearing retainer from housing (17).

(6) Remove bearing (15) and spring washer (16) from shaft (30).

(7) Using a plastic mallet, tap the shaft (30), with bearing (28) and bushing (27) installed, from the liner (23). Do not remove liner. If it is scored or loose in housing, then replace.

(8) Remove bushing (27) and bearing (28) from shaft (30). Use suitable puller to remove bearing.

4-95. Cleaning Oil Cooler Assembly. When the oil cooler is removed, it shall be cleaned internally and externally as follows:

CAUTION

Oil Coolers which have been removed because of metal particle contamination shall be condemned (Example: Failure of a component in the lubrication system). The above stated requirement does not apply to oil coolers removed with engines as a result of high iron content in accordance with AOAP laboratory analysis/recommendation (Example: Oil coolers removed due to high iron/AOAP result shall be cleaned per instructions provided in this paragraph).

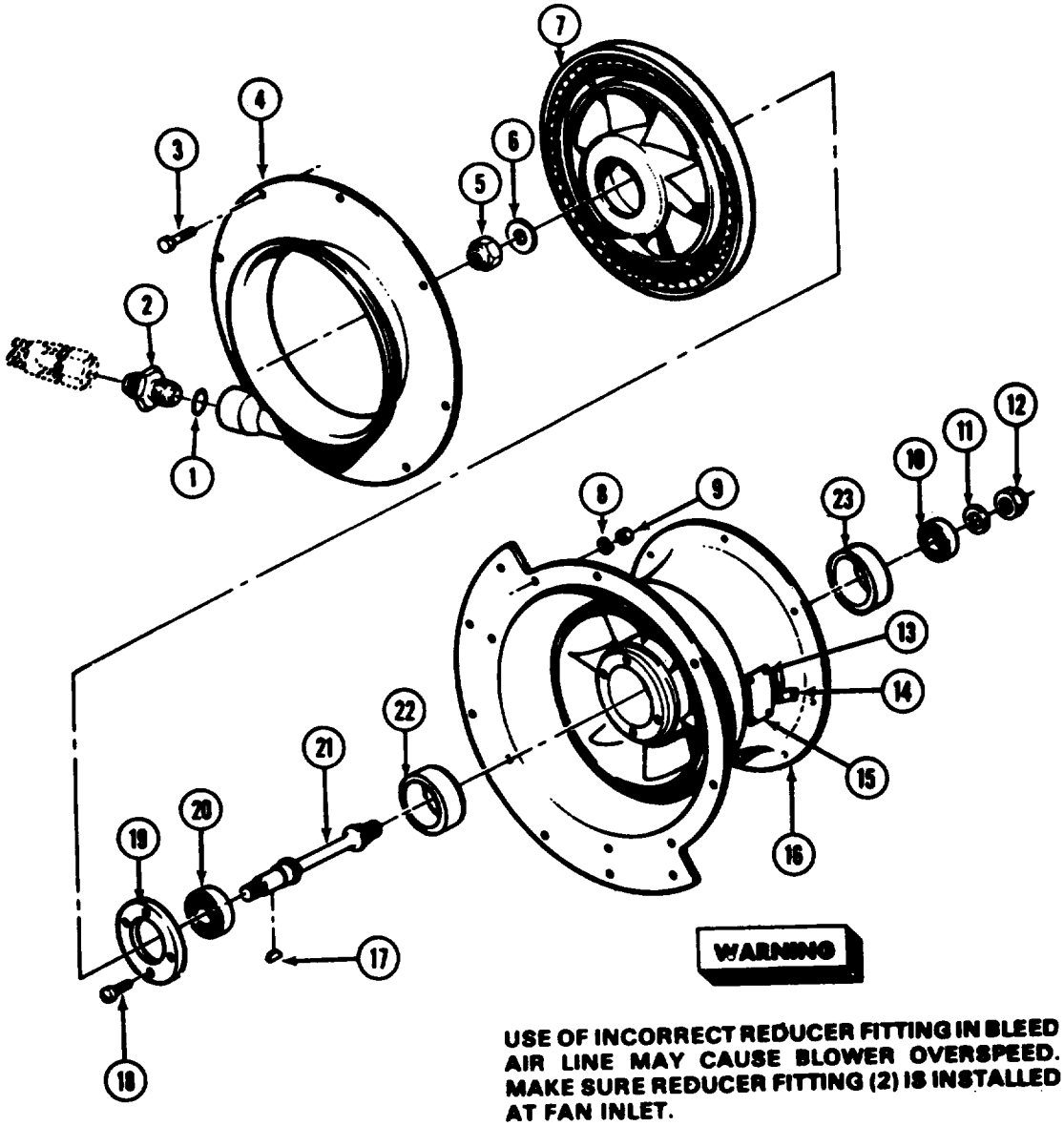
a. Clean exterior of oil cooler with steam or similar vaporpressure agent. Remove any obstructions from air fins with compressed air.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

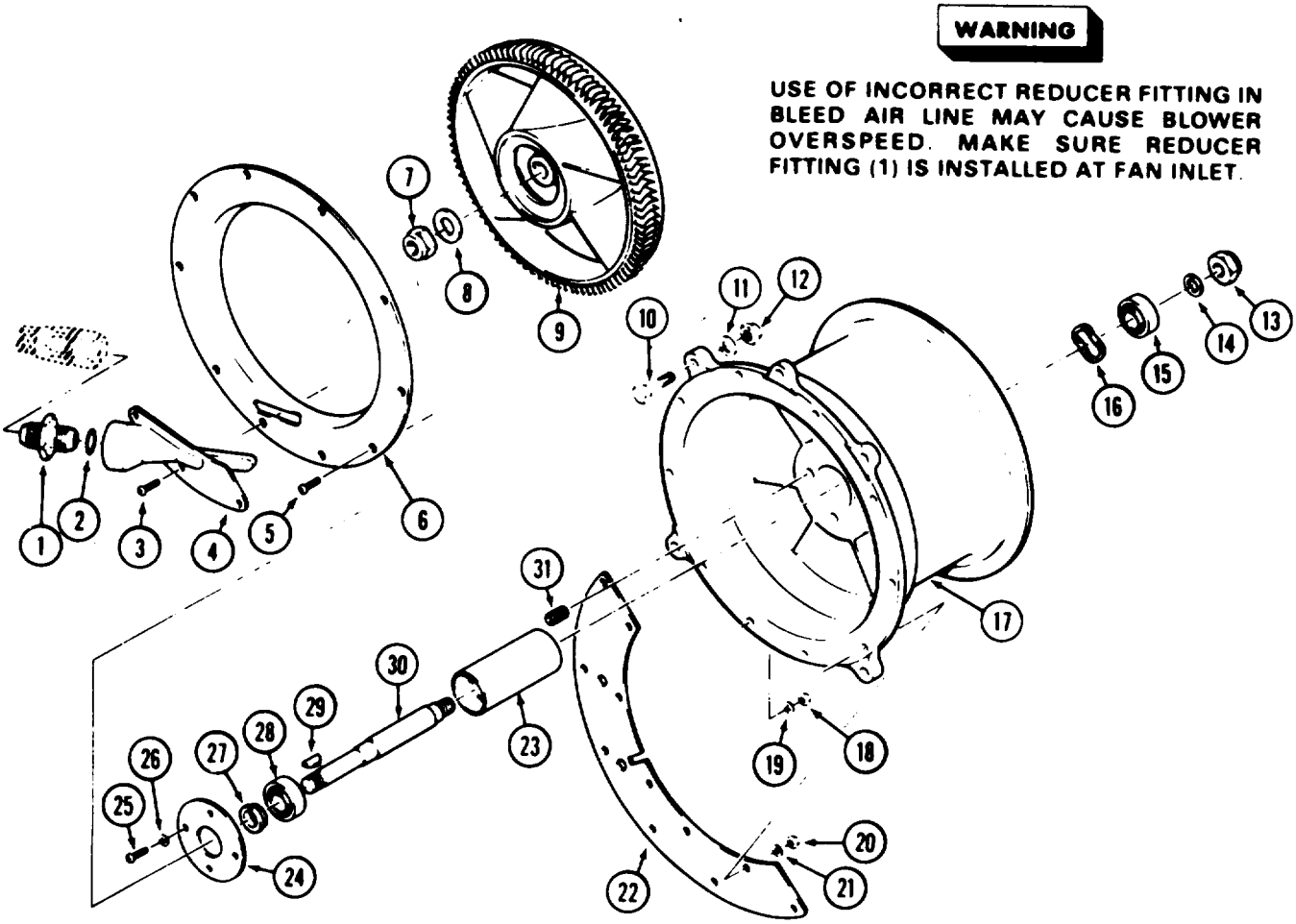
b. Clean cooler internally by pressure flushing with suitable equipment, which should include a centrifugal pump capable of a flow rate of 10 gpm at 30 psi pressure, suitable tanks and hoses, and two 100 mesh screens (Installed at Inlet and outlet ports). After each flushing operation examine filter screen. If metallic particles are found, it is an Indication that cooler was used with an engine which failed internally. Condemn the cooler.

(1) Ensure that drain valve is in closed position, then connect cleaning equipment to inlet and outlet port.



1. Packing
2. Fitting (204-060-494-1)
3. Bolt
4. Cover assembly
5. Locknut
6. Washer
7. Fan and turbine assembly
8. Washer
9. Nut
10. Bearing, rear
11. Washer
12. Locknut
13. Rivet
14. Directional arrow
15. Identification plate
16. Housing
17. Key, woodruff
18. Screw
19. Retainer
20. Bearing, front
21. Shaft
22. Liner
23. Liner

Figure 4-20. Oil Cooler Turbine Blower Assembly (P/N132101-1)



1. Fitting (204-060-494-1)
2. Packing
3. Screw
4. Nozzle
5. Screw
6. Inlet ring
7. Nut
8. Washer
9. Impeller
10. Bolt
11. Washer
12. Nut
13. Nut
14. Washer
15. Bearing
16. Spring washer (2 each)
17. Housing
18. Nut
19. Washer
20. Nut
21. Washer
22. Mounting plate
23. Liner
24. Bearing retainer
25. Screw
26. Washer
27. Bushing
28. Bearing
29. Key
30. Shaft
31. Insert

204060-1014

Figure 4-21. Air Cooler Turbine Blower Assembly (P/N20152-3)

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(2) Preclean cooler interior to remove any sludge by circulating kerosene (C143) or dry cleaning solvent (C261) through the cooler. Circulate fluid in opposite from normal flow direction for 30 minutes or until fluid appears clean after passing through cooler. Drain cooler.

(3) Remove carbon deposits, engine oil, gums, lead deposits, and other contaminants from cooler interior with oil cooler solvent cleaning compound (C74). Flush opposite normal flow direction for thirty minutes, reverse lines and flush for another 30 minutes.

(4) Rinse cooler for 10 minutes with clean kerosene, (C143) or dry cleaning solvent, item (C261). Blow cooler dry with compressed air.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

c. In event of internal failure, disassemble and clean oil, thermal valve, replace oil cooler, and flush out all connecting lines and fitting. Use dry cleaning solvent (C261).

NOTE

Aircraft modified with ODDS will not require oil cooler replacement as a consequence of an internal engine failure, provided that the by-pass valve on the affected filter assembly has not been popped.

d. Inspect and clean air passages of oil cooler in accordance with inspection requirements, or as frequently as operating conditions warrant.

e. Clean disassembled blower compartments.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(1) Clean all parts with lint-free cloths saturated with dry cleaning solvent (C261). A soft brush may be used to dislodge stubborn deposits. Wipe clean and dry with filtered compressed air.

(2) Remove corrosion deposits on shaft (21, figure 4-20) or (30, figure 4-21) and housing (16, figure 4-20) or (17, figure 4-21) bearing liners using fine crocus cloth (C68) with lubricant (C168). Clean parts after removing corrosion.

4-96. Inspection Engine Oil Cooler.

a. Inspect oil cooler for unserviceable or damaged fittings, gaskets, preformed packings, tubes, support clamps and bracket. Inspect the oil cooler for distortion in air fins and passages, damaged and bulged plates, cracked castings, broken welds, stripped threads, and core assembly for foreign matter, leakage, and scoring. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

b. Inspect oil cooler for cleanliness of air passages.

c. Inspect turboblower.

(1) Visually inspect all parts for nicks, burrs, scratches, dents, and weldment cracks and for evidence of excessive wear. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

(2) Inspect ball bearings (10 and 20, figure 4-20) or bearings (15 or 28, figure 4-21) for roughness or binding. Check that axial play does not exceed 0.010 inch.

(3) Inspect fan and turbine assembly (7 figure 4-20) or impeller (9, figure 4-21) for cracks, nicks, and scratches and for bent or cracked fan blades. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

(4) Inspect parts for dimensional tolerances (table 4-1).

Table 4-1. Turbine Blower Dimensional Tolerances

FIG. NO.	INDEX NO.	NOMENCLATURE	REMARKS
4-20	2	Fitting (Reducer)	Replace if throat diameter is over **0.255** inch.
4-20	4	Cover	Replace if throat diameter is over **0.3420** inch.
4-20	21	Shaft	Replace if front end bearing journal is not within **0.6695 TO 0.6691** inch diameter or if rear end bearing journal is not within **0.4726 TO 0.4722** inch diameter.
4-20	22	Liner	Replace if front liner I.D. is greater than **1.3791** inches.
4-20	23	Liner	Replace if rear liner I.D. is greater than **1.1034** inches.
4-21	1	Fitting (Reducer)	Replace if throat diameter is over **0.255** inches.
4-21	4	Nozzle	Replace if throat diameter is over **0.3715** inch. Replace if air inlet boss is damaged.
4-21	30	Shaft	Replace if front or rear bearing journal is not within **0.6696 TO 0.6693** inches in diameter.
4-21	23	Liner	Replace if liner I.D. is greater than **1.5765** inch diameter.

d. Inspect thermal valve for cracks and damaged threads. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

4-97. Repair or Replacement - Engine Oil Cooler.

a. Repairs to oil cooler are limited to straightening of air fins.

b. The oil cooler will be replaced if any of the following conditions exist.

(1) Tubes blown or bulged.

(2) Leaks in tube walls or seams, tubes to headers, tanks to headers, or castings.

(3) Cracked or broken flanges, shrouds, ducts or castings.

(4) Major dents and similar damage in tube edges or in tanks which do not leak but could impair oil cooler performance.

(5) Damaged air fins which cannot be straightened.

(6) Damaged threads in drain port or on inlet and outlet pad studs.

(7) Replace unserviceable fittings, packings, tube, and support clamps or bracket as required.

c. Repair or replace turbo blower.

CAUTION

Do not attempt to remove nicks or scratches from turbine blades. If the turbine blades are damaged, replace fan and turbine assembly (7, figure 4-20) or impeller (9, figure 4-21).

(1) Remove burrs and blend minor nicks and scratches with a fine India stone (C264) or carborundum stone except on turbine blades.

(2) Refinish all exposed aluminum surfaces, after repair, with chemical film (C62) and repaint with one coat epoxy primer (C206).

(3) Replace bearings (10 and 20, figure 4-20 or 15 and 28, figure 4-21) if they do not meet inspection criteria.

(4) Replace components which do not meet the dimensional tolerances set forth in table 4-1.

(5) Replace nuts (5, 9 and 12, figure 4-20 or 7, 13,18, and 20, figure 4-21) regardless of condition with new hardware.

(6) Temporary repairs of cracks are authorized only as follows and must have complete repairs as soon as possible.

(a) Repair cracked oil cooler ducts by stop drilling and patching using procedures in TM 55-1500-204-25/1.

(b) Coat edges of patch with item (C237), table 1-1 prior to installation to seal patch against air loss. Patch must not interfere with the function of the sponge rubber seal or alignment of nut plate with turbine fan installed. If interference occurs, refer to paragraph 4-79d.

d. (AVIM) Repair oil cooler ducts by inert welding, in accordance with Military Specification MIL-W-8604, using filler rod (C224). Weld bead must not interfere with the function of the sponge rubber seal or the alignment of plate nuts, with turbine fan installed.

e. Replace thermal valve if it has cracks or damaged threads.

4-98. Reassembly - Oil Cooler Turbo Blower. (figure 4-20).

a. Assemble turbo blower (P/N 132101-1).

(1) Press new bearings (10 and 20) onto shaft (21), seating bearings firmly against shoulder on shaft.

CAUTION

Do not force bearings Into housing. If they do not slip In with slight hand pressure, check besting liners for burrs or corrosion.

(2) Insert shaft (21), with bearings attached, into housing shaft bore. Position retainer (19) and secure to housing with screws (18). Lockwire (C155) screws.

(3) Install fan and turbine assembly (7) on shaft aligning keyway in fan with key (17) on shaft.

(4) Install washer (6) and lock-nut (5) on shaft while firmly holding fan and turbine assembly to prevent rotation. Tighten nut (5) to a torque of 115 TO 140 inch-pounds.

(5) Install washer (11) and lock-nut (12) on aft end of shaft and holding fan and turbine assembly against rotation, tighten nut 10 a torque of 48 TO 56 inch-pounds.

(6) Install cover assembly (4) to housing (16), using bolts (3), washers (8) and nuts (9). Tighten nuts (9) to a torque of 50 to 70 inch-pounds.

b. Assemble turbo blower (P/N A20152-3) (figure 4-21).

(1) Press bearing (28) on shaft (30) and insert busting (27) over the shaft end and seat into the bearing.

(2) Deleted.

CAUTION

Do not force bearings into liner. If the bearings do not slip into place with slight hand pressure, check bearing race for burrs and/or corrosion.

(3) Install two spring washers (16) on other end of shaft (30). Press remaining bearing (15) on shaft and seat in liner (23).

(4) Position bearing retainer (24) over shaft (30) end and secure to housing (17) with four screws (25) and washers (26). Tighten screws and secure with lockwire (C155).

(5) Install key (29) into shaft (30) and install impeller (9) on the shaft by aligning key way in the impeller with the key in the shaft.

(6) Install washer (14) and nut (13) on shaft. Hold the impeller to prevent rotation. Torque nut (13) 250 TO 270 inch-pounds.

(7) Install washer (8) and nut (7) on shaft and torque nut (7) 250 TO 270 inch-pounds.

(8) Position mounting plate (22) and inlet ring (6) on the housing (17) and secure with straws (5), washers (21) and nuts (20).

(9) Position nozzle (4) on inlet ring (6) and secure with screws (3), washers (19) and nuts (18).

(10) Install reducer fitting (1) P/N 204-060-494-1 with packing (2).

4-99. Testing – Oil Cooler. (AVIM) a. Perform air leak and hydrostatic test on oil cooler as follows:

(1) Plug either inlet or outlet port, and connect air line to the open port. Immerse cooler in water at ambient room temparature and apply 10 psig sir pressure. Heat water 120 TO 130 degrees F (49 to 54 degrees C) and gradually increase sir pressure to 100 psig. Check for air bubbles in water, indicating leaks in cooler. Remove cooler from water, vent air from system, and blow cooler dry with compressed air. If leakage is indicated, replace cooler.

(2) Plug either inlet or outlet port, and apply water at 75 degrees F (24 degrees C) at 400 psig to other port. Lock fluid in cooler for 10 minutes and examine cooler for leaks. Release water pressure, drain cooler, and dry with compressed air. If leakage is indicated, replace cooler.

NOTE

The interior of the cooler must be completely dry before final flush with oil and corrosion preventive compound.

b. Flush oil cooler thoroughly using mixture of three parts oil, (C185) and one part corrosion preventive compound, (C85).

4-100. Installation — Oil Cooler Assembly. a. Installation – Engine Oil Thermal Valve.

(1) If thermal element was removed, install a new gasket, apply anti-adze compound (C47) to threads and tighten element in valve body. Torque 1400 inch-pounds and lockwire (C155).

(2) Check for proper assembly

(a) Valve installed or lockwired in largest port of body.

(b) Reducers with performed packings and nut in remaining side port of body, with open and of elbow facing away from valve.

(c) Elbow with preformed packings and nut in remaining side port of body, with open and of elbow facing away from valve

(3) Enter compartment below engine clack through access hole in lower skin of fuselage

(4) Hold thermal bypass valve (19, figure 4-18) with valve end aft and two reducer fittings downward. Align two mounting holes of valve body with threaded inserts on right beam, approximately ten inches below deck and midway between lateral bulkheads. Install two straws with washers.

(5) Connect four oil tubes to fittings on valve body:

(a) Oil-in from engine scavenge pump to fitting on front end.

(b) Valve-to-cooler tube on forward lower fitting.

(c) Cooler-to-valve tube on aft lower fitting.

(d) Valve to-tank tube on upper elbow fitting.

b. Installation – Engine Oil Cooler.

(1) Assemble the engine and transmission oil coolers as a unit. Be sure the sponge rubber seal is installed at the top of the gap between the coolers. Secure the coolers together with four bolts, washers, and nuts; one washer must be installed between the coolers at each bolt. Install the inlet and outlet gaskets and fittings on the cooler studs and secure with washers and nuts.

NOTE

In the following step, the seals should cover the flange-to-flange width of both coolers, and should seal the duct to the cooler, and the gap between the coolers and fuselage mount opening front and rear flanges.

(2) If seals are necessary, glue four pieces of sponge rubber seal to the top, bottom, front, and rear edges of the cooler. Position the cooler assembly with the inlet and outlet forward. Se-

cure with bolts and thin aluminum washers installed through the slotted holes in the lower side flanges of the cooler and plate nuts of the support.

(3) Install the drain valve, packing, and nut in the port below the cooler port and connect the airframe drain tube to the valve.

(4) Connect the engine and transmission oil tubes to the inlet and outlet fittings on both coolers.

(5) Position duct between upper flanges of cooler and mount. Install eight bolts, with thin aluminum alloy washers under heads, through mounting flanges into plate-nuts of duct.

c. Installation - Turbo Blower.

WARNING

Use of incorrect tube reducer in bleed air line may cause blower overspeed. Install reducer (204-060-494-1) at fan inlet housing with T53-L-13 engine installed.

(1) Apply anti-seize compound (C47) to packing (19, figure 4-21.1). Install reducer (18) in blower inlet.

(2) Check that support bracket is secured with six bolts (11) washers (12, 13, 14) and nuts (15) on top side of fuselage bulkhead above oil cooler location.

(3) Position blower assembly (1) with inlet pointing forward at left side, to align mounting bracket holes with duct assembly flange (3) and support bracket (10).

(4) Attach blower (1) to duct assembly (3) with eight bolts (16) and one thin aluminum alloy washer (17) under each bolt head.

(5) Attach blower assembly (1) to support bracket (10) by installing five bolts (11) with one thin steel washer (12) next to each bolt head, one thin aluminum washer (13) against blower (1) and one thin steel washer (14) under nut (15) at each location.

(6) Connect hose (20) from bleed air valve line to reducer (18).

(7) Install screen (2) on blower flange in the following sequence: Bolt (4), washer (5), grommet (6), screen edge (2), grommet (6), washer (7), through flower flange (1), washer (8) and self-locking nut (9). Ensure nuts are tightened and grommets compressed to 0.500 inches between lower part of bolt head and top of blower flange. (See view A).

d. Close engine cooler drain valve and both transmission drain valves (5, figure 6-56) in center fuel cell access compartment. Connect transmission inlet and outlet quick-disconnect couplings (1 and 3) in compartment below pylon. Service transmission (para. 1-6) and engine oil tank (para. 1-1). Check disturbed fittings for leaks following the next engine run-up. Check both engine and transmission oil temperatures for abnormal indications (TM 55-1520-210-10).

4-101. ENGINE ACCESSORY GEARBOX MOUNTED CHIP DETECTOR.

4-102. Description - Chip Detector. A chip detector is mounted on the lower right side of the accessory drive gear box. On aircraft Serial No. 66-746 and subsequent, this unit is wired into the master caution panel. (Refer to TM 55-2840-229-23.)

NOTE

This chip detector wiring is disconnected from the engine mounted chip detector when ODDS is installed.

4-103. Removal - Chip Detector.

NOTE

Engine Chip detector on both ODDS and Non ODDS equipped aircraft require inspection when chip detector caution light illuminates.

a. Non ODDS equipped aircraft disconnect electrical wiring from chip detector.

b. Remove lock wire from chip detector.

c. Position suitable container to catch oil.

d. Unscrew and remove chip detector and preformed packing. Discard packing.

4-104. Inspection - Chip Detector. Refer to paragraph 4-106.9.

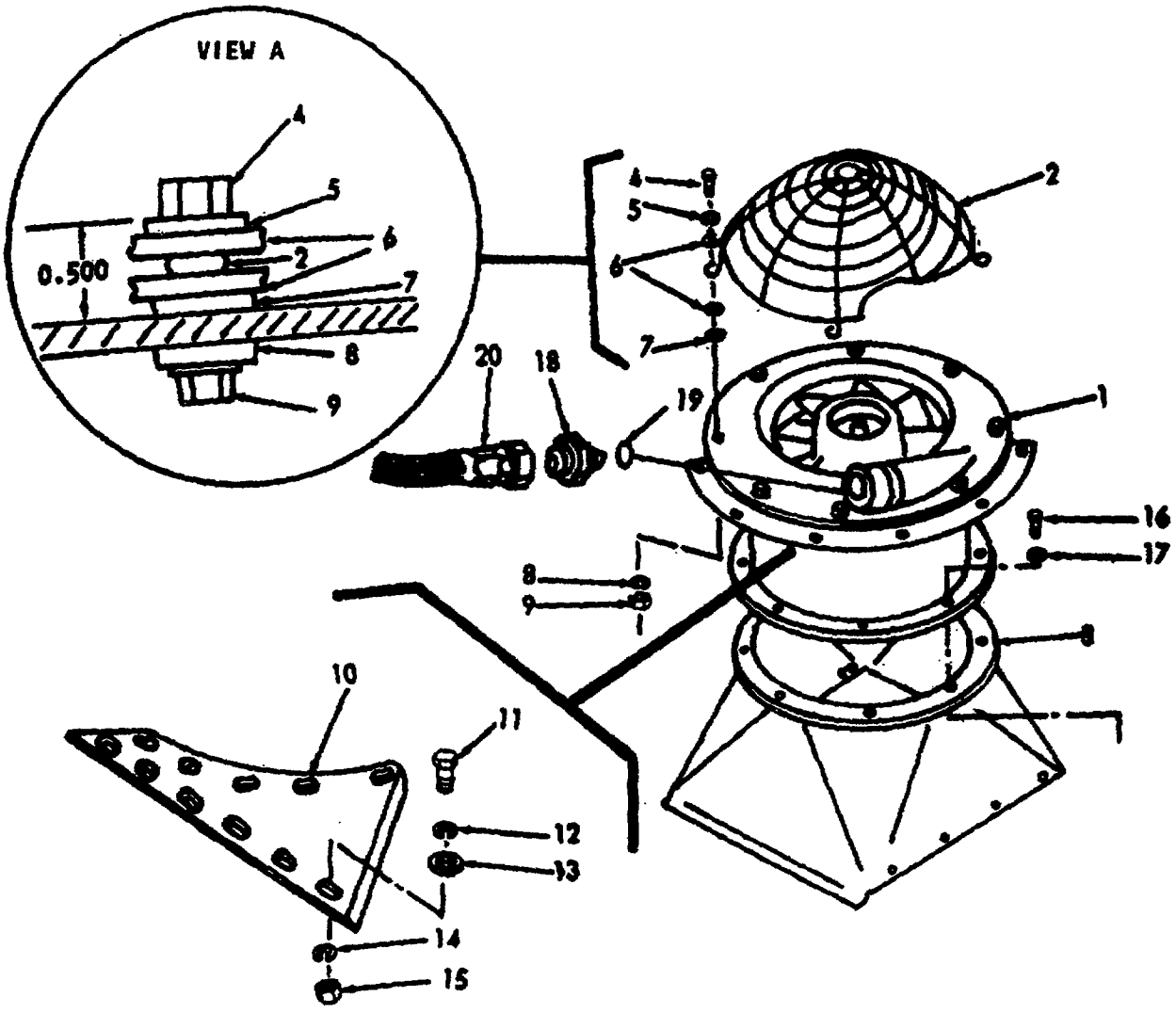
4-105. Repair or Replacement - Chip Detector.

a. Replace damaged electrical connector or damaged wires (para. 9-169, step r).

b. Replace packing on installation of chip detector.

c. Replace chip detector with damaged threads.

d. Deleted.



1. Turbine blower
2. Screen
3. Duct Assy
4. Bolt
5. Washer
6. Grommets
7. Washer
8. Washer
9. Nut Self-locking
10. Support Bracket
11. Bolt
12. Washer
13. Washer
14. Washer
15. Nut
16. Bolt
17. Washer
18. Reducer
19. Packing
20. Hose

Figure 4-21.1. Turbo Blower

(1) Remove chips from oil filter element and retain for analysis. Clean filter element and reinstall.

(2) Drain all oil from accessory drive gearbox, oil tank and oil cooler.

(3) Remove chips, if any from chip detector and retain for analysis. Clean chip detector and reinstall.

(4) Remove and inspect strainer for No. 2 bearing and strainer for No. 3 and 4 bearings for presence of metal chips. If chips are present remove and inspect three reduction gear oil transfer tube strainers and overspeed governor and tachometer drive oil throttle strainer. Forward engine to overhaul if metal chips have clogged more than one-third of flow area of any one of previously mentioned strainers. If amount of metal chips is not excessive, clean and reinstall strainers and proceed to step (5).

(5) Presence of chips in previously mentioned strainers indicates bypass of oil filter has occurred. Replace oil filter (TM 55-2840-229-23).

(6) Disconnect oil scavenge hose assembly for No. 2 bearing and for No. 3 and 4 bearings and determine whether residual oil in hose assemblies is contaminated with chips. If oil is contaminated, remove engine and forward to overhaul.

(7) Fill oil tank to capacity with new oil (paragraph 1-5).

CAUTION

Any oil pressure fluctuation in excess of plus or minus 5 psi, or any rapid rise in oil temperature at any preset power setting, is cause for immediate engine shutdown.

(8) Have qualified pilot start engine (refer to TM 55-1520-210-10) and run at flight idle until temperatures have stabilized. Check instruments for proper engine operation. Increase speed to **70 TO 80** percent N1 and maintain for **5** minutes.

(9) Shut down engine and again inspect oil filter elements, chip detector and strainers.

(10) If quantity of chips remains same after engine run, do not clean filter, strainers or chip detector. Forward engine to depot for additional inspection. Flush all airframe mounted engine oil lines, and engine oil tank. Replace engine oil cooler.

NOTE

Chips in oil filter may come from oil tank; chips on chip detector come from engine.

(11) If amount of carbon particles found on filter element is excessive proceed as follows:

(a) Drain all oil from accessory drive gearbox, oil tank and oil cooler.

(b) Remove and inspect oil strainers for No. 2 bearing and for No. 3 and 4 bearings. If carbon particles are present, oil filter has bypassed. Remove, clean, and reinstall reduction gear oil transfer tube strainers and overspeed governor and tachometer drive oil filter assembly (torquemeter). Clean and reinstall No. 2 and No. 3 and 4 bearing strainers.

(c) Clean and reinstall engine oil filter assembly (Refer to TM 55-2840-229-23).

(d) Replenish engine oil system (paragraph 1-1).

(e) Have qualified pilot start engine and run at **70 TO 80** percent N1 RPM for **15** minutes.

(f) Shut down engine. Remove, inspect, clean and reinstall oil filters and strainers.

(g) If contamination is excessive, repeat procedure until filter is clean after run.

NOTE

If threads on chip detector port were repaired, refer to TM 55-2840-229-23.

4-106. Installation - Chip Detector.

a. Place packing on chip detector. Install chip detector in accessory drive gearbox. Torque **90 TO 100** inch-pounds and lockwire (C155).

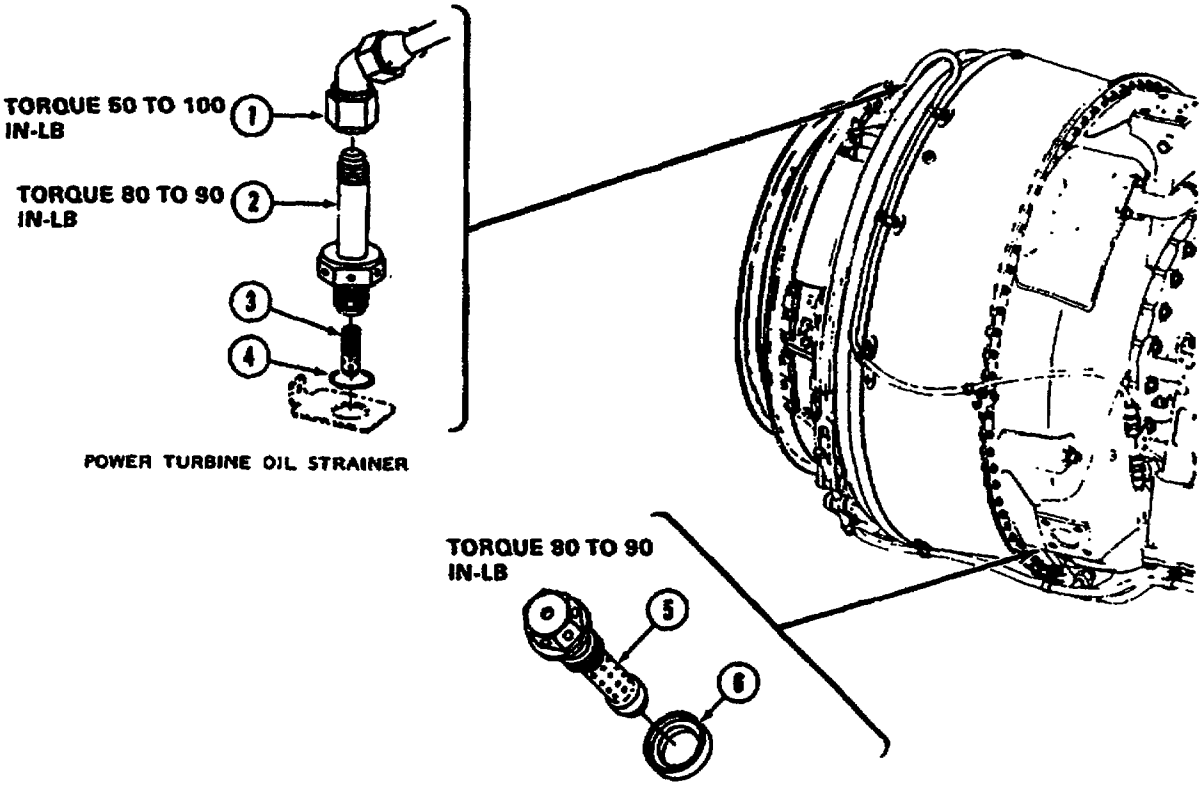
CAUTION

No more than 15 inch-pounds of torque shall be applied to the chip detector centerpost nut when installing the chip detector wire.

b. Connect electrical wire and install washers (12), lockwashers (13), and secure with nut (14). Position nipple (15) over chip detector terminal Figure 4-51, Detail C.

4-106.1. EXTERNAL OIL SEPARATOR (LUBRICLONE) (Helicopters with ODDS).

4-106.2. Description. A cyclonic oil separator and monitor (Lubriclone) (11.1, figure 4-18), is mounted on bracket assembly on forward firewall of engine compartment, left side. Oil from engine sump enters tangential port, causing vortex flow in main chamber. Flow swirls particles outward and downward to small trap which contains chip detector. Oil exits at top and flows to external filter. Magnets in chip detector draw ferrous particles into the chip gap, where they are sensed and pulsed by oil debris detection system (ODDS). Small chips are pulsed (burned) away. Larger chips bridge a gap to light CHIP DET caution capsule. Oil separator captures all particles over 100 microns and a proportion of particles between 15 and 100 microns which increases almost linearly with size.



No. 2 BEARING OIL STRAINER

1. Hose assembly
2. Power turbine oil strainer housing adapter
3. Power turbine oil strainer
4. Preformed packing
5. Oil strainer, No. 2 bearing
6. Metal gasket

Figure 4-22. Power Turbine and No. 2 Oil System

4-106.3. Replacement of Drain Valve - Oil Separator. Proceed as follows: (figure 4-21.1.1).

a. Access oil separator by opening left engine cowling.

b. Place container below oil separator to catch oil. Drain oil using drain valve (8).

c. Remove body of drain valve (8) and packings (7 and 15).

d. Install replacement body and new packing (7). Torque body **16 to 20** inch-pounds. Lockwire (C155) body.

e. Install new packing (15) on body.

f. Install cap on drain valve. Torque cap **20 to 25** inch-pounds. Lockwire (C155) cap.

g. Service system with oil (paragraph 1-5).

4-106.4. Removal - Oil Separator.

a. Access oil separator by opening left engine cowling.

b. Disconnect cable plug from chip detector probe (14, figure 4-21.1.1).

c. Place container below oil separator to catch oil. Remove lockwire and cap of drain valve (8). Drain oil.

CAUTION

Make sure torques applied to fittings and hoses are not applied to ports of oil separator. Oil separator can be damaged.

d. Disconnect hose from crashworthy coupling halves (11.5, figure 4-18) in inlet (aft) port.

e. Disconnect coupling at fitting (6, figure 4-21.1.1) in outlet (right) port and discard packing.

f. Remove three bolts (2), washers (3), and spacers (4) and remove oil separator.

g. Clean oil separator. Use solvent (C261) and clean cloths.

h. Inspect for serviceability and for cracks, particularly at ports and mounting holes. If crack in oil separator is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

i. If oil separator is to replaced, disassemble as follows:

(1) Remove fitting (6) and packing (5) from outlet port. Remove coupling halves (11.5, figure 4-18) and packing from inlet port. Discard packings.

(2) Remove body of drain valve (8, figure 4-21.1.1) and packings (7 and 15). Discard packings.

(3) Remove probe (14), body (12), cup (10), spring (9), and packings (13 and 11). Discard packings.

4-106.5. Installation - Oil Separator.

CAUTION

Make sure torques applied to fittings and hoses are not applied to ports of oil separator. Oil separator can be damaged.

a. If oil separator is a replacement, assemble as follows:

(1) Install spring (9, figure 4-21.1.1), small end first, cup (10), packing (11), and body (12). Torque body 32 to 38 inch-pounds and lockwire (C155). Install packing (13) and probe (14).

(2) Install packing (7) and body of drain valve (8). Torque body **16 to 20** inch-pounds. Lockwire (C155) body.

(3) Install fitting (6) and new packing (5) in outlet (right) port. Install packing and coupling halves (11.5, figure 4-18) in inlet (aft) port, 90° coupling pointing 45° down and inboard.

b. Position oil separator below mount bracket (1, figure 4-21.1.1) outlet fitting pointing inboard.

c. Install three spacers (4) (beneath bracket), washers (3), and bolts (2). Torque bolts **74 to 82** inch-pounds.

d. Install packing on fitting and connect coupling of oil filter to fitting (6) in outlet port.

e. Install packing (15) on body of drain valve (8) and install cap. Torque cap **20 to 25** inch-pounds. Lockwire (C155) cap.

f. Connect cable plug to chip detector probe (14).

g. Connect engine oil outlet hose (11, figure 4-18) to coupling halves in inlet (aft) port.

h. Lockwire (C155) mounting bolts and cable plug.

i. Service system with oil (paragraph 1-5) and check for leaks at first runup (TM 55-1520-210-10).

4-106.6. OIL SEPARATOR CHIP DETECTOR (Helicopters with ODDS).

4-106.7. Description - Chip Detector. A magnetic chip detector (14, figure 4-21.1.1) is installed in self-closing valve in bottom of oil separator. Chip detector is connected to power module which pulses away nuisance chips and to CHIP DET caution capsule in caution panel.

4-106.7.1. Removal - Chip Detector.

a. Disconnect cable plug from chip detector probe (14, figure 4-21.1.1).

b. Remove chip detector probe by pressing and turning counter clockwise.

4-106.8 Inspection - Chip Detector.

NOTE

Chip detector is inspected when CHIP DET caution light comes on.

a. Refer to paragraph 4-106.9.

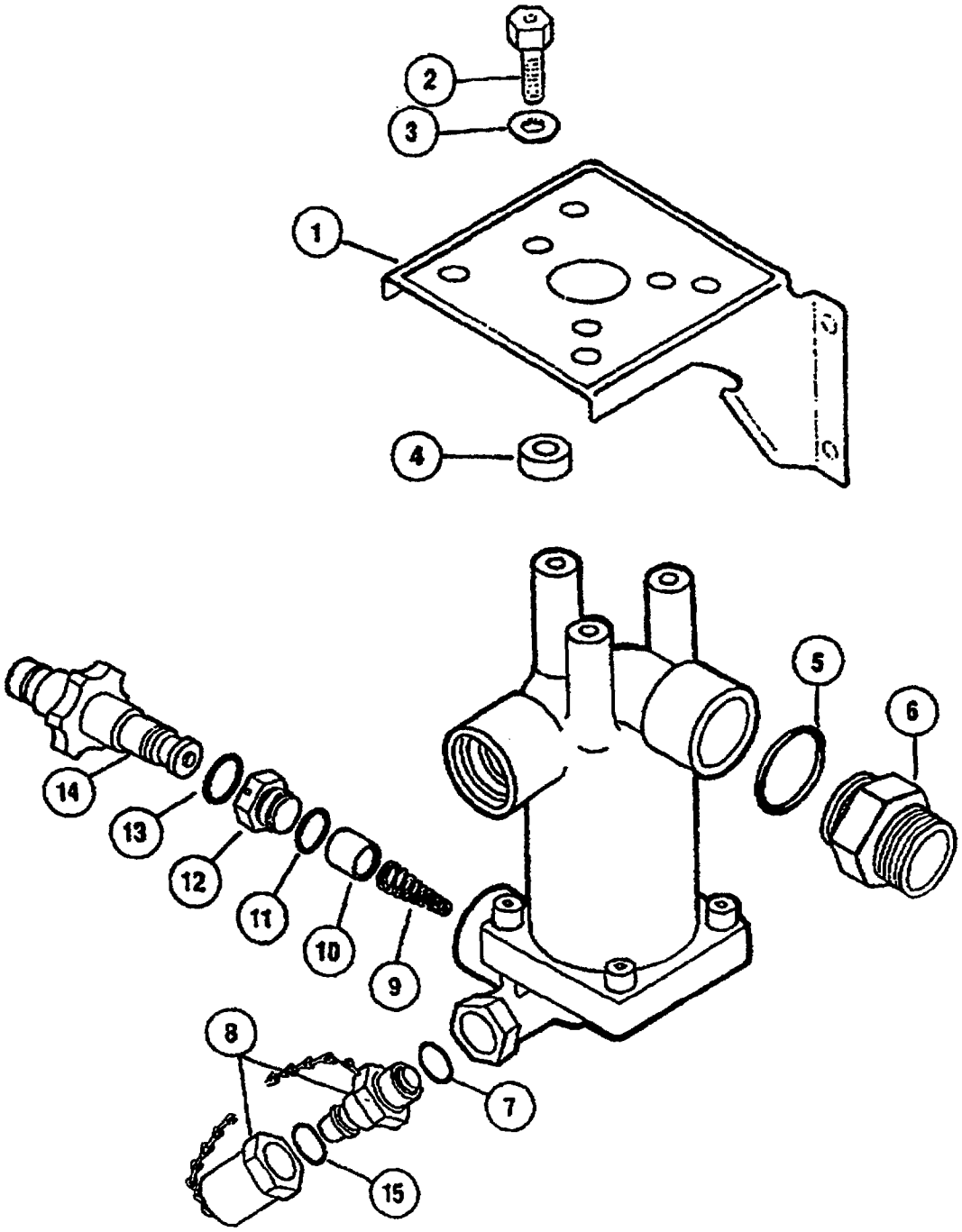
4-106.8.1. Installation - Chip Detector.

a. Clean probe. Use clean cloth and cleaning solvent (C261).

b. Install new packing (13) on chip detector probe (14).

c. Install chip detector probe and packing in valve by pressing and turning clockwise.

d. Connect cable plug to chip detector and lockwire (C155).



1. Bracket
2. Bolt
3. Washer
4. Spacer
5. Packing
6. Fitting
7. Packing
8. Drain valve
9. Spring
10. Cup
11. Packing
12. Body
13. Packing
14. Chip detector probe
15. Packing

Figure 4-21.1.1. Oil Separator (Lubriclone) Installation

KIND OF METAL	QUANTITY AND/OR SIZE	ACTION REQUIRED	NOTES
Magnetic (Steel)	Fuzz - fine hair-like particles.	None	Result of normal wear. May have exaggerated appearance because of oil.
	Particles in granular form. Quantity less than 100.	Drain and flush engine and airframe mounted oil lines, cooler, and tank.	Minor wear - usually not indicative of impending failure.
	Thin flakes, chunks, or splinters exceeding 1/16 (0.060) inch in thickness and 1/16 (0.060) inch in length. Quantity not to exceed 10 flakes or splinters.	Drain and flush engine and airframe mounted oil lines, cooler, and tank.	Minor wear - usually not indicative of impending failure.
	Thin flakes, chunks, or splinters exceeding 1/16 (0.060) inch in thickness or 1/16 (0.060) inch in length. Quantity exceeding 10 flakes or splinters.	For non-ODDS helicopters, complete serviceability check 4-106.10. For ODDS helicopters, perform serviceability check 4-106.10.3	May indicate an impending failure.
	Granular particles, quantity greater than 100.	For non-ODDS helicopters, complete serviceability check 4-106.10. For ODDS helicopters, perform serviceability check 4-106.10.3.	May indicate an impending failure.
Non-magnetic (aluminum, magnesium, copper, bronze, etc.)	No more than 30 particles of any size.	For non-ODDS helicopters, complete serviceability check 4-106.10. For ODDS helicopters, perform serviceability check 4-106.10.3.	Granular powder like particles; may appear as miniature lathe turnings.
Carbon particles	No maximum quantity/size. If more than 20 particles of any size are present, check seals and take appropriate maintenance action.	For non-ODDS helicopters, complete serviceability check 4-106.10.1. For ODDS helicopters, perform serviceability check 4-106.10.4.	Black usually granular or powder, may include chunks or silvers.

Figure 4-21.2. Engine Contamination Particle Classification

Table 4-1.1. Oil Debris Classification

	DEBRIS TYPE	DESCRIPTION	QUANTITY/SIZE	CAUSE/ACTION REQUIRED
A.	Flake (steel) (significant)	Thin, flat oblong particles with rounded or scalloped sides. Like corn flakes.	SIZE: Up to 0.040 long and very thin. QUANTITY: Generally more than 10 particles per chip event.	Typically result from spalling of bearings. Usually indicates bearing wear and, sometimes, gear wear. (Note 1)
B.	Chunk/ Fragment (steel) (significant)	Sometimes identifiable as fragment from specific component in engine or transmission. Shape varies widely. Sometimes shows distinct fracture surface.	SIZE: Varies greatly. QUANTITY: Usually 1 to 5 per chip event.	Indicates possibility of major failure of part e.g., rears, bearings or other dynamic elements. Can sometimes be maintenance/induced or residual debris from previous failure. (Note 1.)
C.	Granule (steel) (significant)	Fine powder like clumps, irregular shaped debris. Like coffee grounds.	SIZE: Length and width are similar and generally 0.010. Thickness varies but is generally one half length width. QUANTITY: Usually more than 50 per chip event.	Usually bearing or gear wear scoring. Generally associated with fretting or components spinning in housings or in shafts. May be mixed with flakes or fragments. (Note 1.)
D.	Bronze (significant)	Granular, chunks, fragments or powder like golden particles.	To be significant, 25 particles, any size, per chip event.	Bearing cage wear or failure and usually proceeded by chip light event with small quantities of magnetic debris. (Note 1.)
E.	Wire/hair Splinter/silver (possibly significant)	Long, thin wire or hair-like particles. May have jagged edges and exhibit fracture planes. Like steel wool or wood splinters.	SIZE: Length generally does not exceed 0.080, width and thickness 0.010 to 0.012 inch. QUANTITY: Generally 1 to 20 particles per chip event.	Generally not a significant wear mode. Often associated with maintenance induced debris. In T-53 engine, may come from torquemeter cylinder (Note 1.)
F.	Cutting/Turning (possibly significant)	Curled, twisted debris of varying length and thickness Like lathe turnings.	SIZE: Length to 0.08, width 0.01 to 0.08. Thickness varies greatly. QUANTITY: 5 to 20 particles per chip event.	Usually maintenance induced and not significant. However, recurrence of large quantity usually indicates abrasive wear by bearings or seals rotating in housing. (Note 1 .)
G.	Chrome/Silver (possibly significant)	Large flat particles Like shavings, peelings.	To be significant, must be greater than 3 particles which are more than 0.08 long	Platings or coatings separating from parts: e.g., Bearings. (Note 1.)
H.	Aluminum/ Magnesium (possibly significant)	Granular, powder-like chunk or turning particles. Can be bright silver-white to gray if very fine.	To be significant, 20 to 30 large pieces.	Not usually significant. Wear of housings or failure of shims, spacers, cased. (Note 1.)
I.	Carbon (possibly significant).	Black usually granular, powder, may include chunks or slivers.	Usually requires large quantity to be significant.	Engine only. Generally due to wear of carbon seals. Usually, other operational symptoms occur, such as increased oil consumption, smoking, filter bypass, or leaking. (Note 1.)
J.	Epoxy/Phenolic (possibly significant)	Varies in color and can be fibers or peelings or plating like particles.	Variable.	Manufacturing debris or coating peeling. (Note 1.)

NOTES

1. **Refer to oil contamination troubleshooting for the system**
2. **Use this table in conjunction with Figure 4-21.2**
3. **Dimensions are in inches.**

4-106.9. Inspection - Chip Detector.

NOTE

Chip detector is inspected when CHIP DET caution light comes on.

NOTE

Document the findings of the chip detector inspection on DA Form 2308-20, Block 7.

a. On ODDS and non-ODDS helicopters, remove accessory gearbox chip detector. On ODDS-equipped helicopters, also remove oil separator (lubriclone) chip detector. Remove chips, if any, from chip detector(s) and retain for analysis.

NOTE

More frequent chip lights may be encountered in the first 50 hours of operation of a component which has undergone an overhaul or major repair, as well as break-in wear debris being present in the lubrication system. This type of debris is normal and not indicative of a problem with the ODDS system.

NOTE

Although chip detector gap may contain particles in sufficient quantities to have caused a chip light, the light may not remain lit after the chip detector is removed. If unsure about the proper operation of the chip detector, perform a continuity check to insure the chip detector system is functioning properly.

WARNING

If a fragment can be identified as a piece from a specific internal component, replace the engine.

b. Evaluate chips found and perform required actions per Figure 4-21.2 and Table 4-1.1.

c. Reinstall chip detector.

4-106.10 Serviceability Check (Chip Light) - Non-ODDS Helicopters.

NOTE

If helicopter is at a remote location (away from adequate maintenance facilities), perform serviceability check in paragraph 4-106.10.2.

NOTE

If carbon particles are found in excess of that shown in Figure 4-21.2, perform serviceability check (paragraph 4-106.10.1).

a. Attempt to rotate the output reduction carrier and gear assembly. If rotation is difficult, if binding or roughness is felt, or if unusual noises are heard, remove the engine for teardown and analysis.

b. If output reduction carrier has freedom of movement and no unusual noises are heard, remove the #2 bearing housing oil strainer and the power turbine oil strainer. If chips are present, remove three reduction gear oil transfer tube oil strainers and overspeed governor and tachometer strainer. Remove and retain particles for analysis. If more than one-third of flow area of any strainer is clogged with particles, remove the engine for teardown and analysis. Otherwise, clean and reinstall the strainers.

c. Remove the engine accessory gearbox mounted oil filter. Visually inspect filter elements for particles. Retain particles for analysis. If particles were found in the strainers, replace oil filter elements. Otherwise, clean filter elements and reinstall. Tighten oil filter housing attachment bolt and torque 20 to 35 inch-pounds and lockwire (C155) (Refer to TM 55-2840-229-23).

d. Disconnect scavenge hose assemblies for #2 bearing and #3 and #4 bearings and determine if residual oil in hose assemblies is contaminated with chips. If so, ship engine to depot for bearing replacement.

e. Drain all oil from accessory drive gearbox, oil cooler, and oil tank through clean cheesecloth. Retain particles for analysis. Reservice engine with new oil.

f. If chips were found in the filter or strainers, re-evaluate all chips found (including those found on the chip detector) per Figure 4-21.2 and Table 4-1.1. If chips exceed removal limits, remove the engine.

CAUTION

Any fluctuation in oil pressure in excess of +/- 5 psi, or rapid rise in oil temperature at any preset power setting, is cause for immediate engine shutdown.

g. Start engine and run at flight idle until temperatures have stabilized. Check instruments for proper engine operation. Increase speed to 70-80% N1 rpm and maintain for 30 minutes.

h. Hover aircraft for 30 minutes. Shut down engine and again inspect chip detector, oil filter elements, and strainers.

i. If no chips are found, return the helicopter to service.

NOTE

In some cases, the 30 minute ground run and 30 minute hover may not completely clean out the lube system. If very small amounts of debris or fuzz remains after the ground run and hover, the serviceability check may be repeated one time. If chips remain after the second serviceability check, remove the engine.

j. If chips are found, do not clean filters, strainers, or chip detector. Remove engine and return to depot for teardown and analysis. Flush airframe oil system, oil cooler, and oil tank.

4-106.10.1. Serviceability Check (Carbon Particles Found in Filters) - Non-ODDS Helicopters.

a. Attempt to rotate the output reduction carrier and gear assembly. If rotation is difficult, if binding or roughness is felt, or if unusual noises are heard, remove the engine for teardown and analysis.

b. If output reduction carrier has freedom of movement and no unusual noises are heard, remove the #2 bearing housing oil strainer and the power turbine oil strainer. If chips are present, remove three reduction gear oil transfer tube oil strainers and overspeed governor and tachometer strainer. Remove and retain particles for analysis. If more than one-third of flow area of any strainer is clogged with particles, remove the engine for teardown and analysis. Otherwise, clean and reinstall the strainers.

c. Remove the engine accessory gearbox mounted oil filter. Visually inspect filter elements for particles. Retain particles for analysis. If particles were found in the strainers, replace oil filter elements. Otherwise, clean filter elements and reinstall. Tighten oil filter housing attachment bolt and torque 20 to 35 inch pounds and lockwire (C155). (Refer to TM 55-2840-229-23).

d. Drain all oil from accessory drive gearbox, oil cooler, and oil tank through clean cheesecloth. Retain particles for analysis. Reservice engine with new oil.

e. If chips were found in the filter or strainers, reevaluate all particles found (including those found on the chip detector(s) per Figure 4-21.2 and Table 4-1.1. If particles exceed removal limits, remove the engine.

CAUTION

Any fluctuation in oil pressure in excess of +/- 5 psi, or rapid rise in oil temperature at any preset power setting, is cause for immediate engine shutdown.

f. Start engine and run at flight idle until temperatures have stabilized. Check instruments for proper engine operation. Increase speed to 70-80% N1 rpm and maintain for 15 minutes.

g. Shut down engine and again inspect oil filter elements, and strainers.

h. If carbon particles are in excess of that shown in Figure 1-32, repeat procedure until filter is clean after run.

4-106.10.2. Serviceability Check (Chip Light) - Non-ODDS Helicopters - Remote Location.

a. Attempt to rotate the output reduction carrier and gear assembly. If rotation is difficult, if binding or roughness is felt, or if unusual noises are heard, remove the engine for teardown and analysis.

b. If output reduction carrier has freedom of movement and no unusual noises are heard, remove the #2 bearing housing oil strainer and the power turbine oil strainer. If chips are present, remove three reduction gear oil transfer tube oil strainers and overspeed governor and tachometer strainer. Remove and retain particles for analysis. If more than one-third of flow area of any strainer is clogged with particles, remove the engine for teardown and analysis. Otherwise, clean and reinstall the strainers.

c. Remove the engine accessory gearbox mounted oil filter. Visually inspect filter elements for particles. Retain particles for analysis. Reinstall filter elements. Tighten oil filter housing attachment bolt and torque 20 to 35 inch pounds and lockwire (C155) (Refer to TM 55-2840-229-23).

d. Disconnect scavenge hose assemblies for #2 bearing and #3 and #4 bearings and determine if residual oil in hose assembly is contaminated with chips. If so, ship engine to depot for bearing replacement.

e. If chips were found in the filter or strainers, re-evaluate all chips found (including those found on the chip detector) per Figure 4-21.2 and Table 4-1.1. If chips exceed removal limits, remove the engine.

CAUTION

Any fluctuation in oil pressure in excess of +/- 5 psi, or rapid rise in oil temperature at any preset power setting, is cause for immediate engine shutdown.

f. Start engine and run at flight idle until temperatures have stabilized. Check instruments for proper engine operation. Increase speed to 70-80% N1 rpm and maintain for 15 minutes.

g. Hover aircraft for 5 minutes. Shut down engine and again inspect chip detector, oil filter elements, and strainers.

h. If no chips are found, release the helicopter for a one-time flight (not to exceed 1 hour) to an adequate maintenance facility. Perform a complete serviceability check (paragraph 4-106.10) after completion of one time flight.

NOTE

In some cases, the ground run and hover may not completely clean out the lube system. If very small amounts of debris or fuzz remains after the ground run and hover, the serviceability check may be repeated one time. If chips remain after the second serviceability check, remove the engine.

i. If chips are found, do not clean filters, strainers, or chip detector. Remove engine and return to depot for teardown and analysis. Flush airframe oil system, oil cooler, and oil tank.

j. If carbon particles are found in excess of that shown in Figure 4-21.2 and Table 4-1.1, perform serviceability check (paragraph 4-106.10.1) within 2 flight hours of the initial chip light.

4-106.10.3. Serviceability Check (Chip Light) - ODDS-Equipped Helicopters.

NOTE

If helicopter is at a remote location (away from adequate maintenance facilities), perform serviceability check in paragraph 4-106.10.5.

NOTE

If carbon particles are found in excess of that shown in Figure 1-32, perform serviceability check (paragraph 4-106.10.4).

a. Attempt to rotate the output reduction carrier and gear assembly. If rotation is difficult, if binding or roughness is felt, or if unusual noises are heard, remove the engine for teardown and analysis.

b. If output reduction carrier has freedom of movement and no unusual noises are heard, check the airframe mounted 3-micron oil filter impending bypass button. If extended, do the following.

(1) Replace the 3-micron filter. Retain any particles found on the filter element for analysis.

(2) Remove the #2 bearing housing oil strainer and the power turbine oil strainer. If chips are present, remove three reduction gear oil strainers and overspeed governor and tachometer strainer. Remove and retain particles for analysis. If more than one-third of flow area of any strainer is clogged with particles, remove the engine for teardown and analysis. Otherwise, clean and reinstall the strainers.

(3) Drain all oil from accessory drive gearbox, oil cooler, and oil tank through clean cheesecloth. Retain particles for analysis. Reservice engine with new oil.

(4) Remove the engine accessory gearbox-mounted oil filter. Visually inspect filter elements for particles. Retain particles for analysis. If particles were found in the strainers, replace accessory gearbox-mounted oil filter elements. Otherwise, clean filter elements and reinstall. Tighten oil filter housing attachment bolt. Tighten oil filter housing attachment bolt and torque 20 to 35 inch pounds and lockwire (C155) (Refer to TM 55-2840-229-23).

c. Remove the accessory gearbox chip detector. Remove chips, if any, from chip detector and retain for analysis. Reinstall chip detector.

d. Disconnect scavenge hose assemblies for #2 bearing and #3 and #4 bearings and determine if residual oil in hose assemblies is contaminated with chips. If so, ship engine to depot for bearing replacement.

e. If chips were found in the filters or strainers, reevaluate all chips found (including those found on the chip detector(s)) per Figure 4-21.2 and Table 4-1.1. If chips exceed removal limits, remove the engine.

CAUTION

Any fluctuation in oil pressure in excess of +/-5 psi, or rapid rise in oil temperature at any preset power setting, is cause for immediate engine shutdown.

f. Start engine and run at flight idle until temperatures have stabilized. Check instruments for proper engine operation. Increase speed to 70-80% N1 rpm and maintain for 30 minutes.

g. Hover aircraft for 30 minutes. Shut down engine and again inspect chip detector and strainers. Do not inspect filters unless the impending bypass button is extended.

h. If no chips are found, return the helicopter to service.

NOTE

In some cases, the 30 minute ground run and 30 minute hover may not completely clean out the lube system. If very small amounts of debris or fuzz remains after the ground run and hover, the serviceability check may be repeated one time. If chips remain after the second serviceability check, remove the engine.

i. If chips are found, do not clean filters, strainers, or chip detector. Remove engine and return to depot for teardown and analysis. Flush airframe oil system, oil cooler, and oil tank.

4-106.10.4. Serviceability Check (Carbon Particles Found in Filters) - ODDS-Equipped Helicopters.

a. Attempt to rotate the output reduction carrier and gear assembly. If rotation is difficult, if binding or roughness is felt, or if unusual noises are heard, remove the engine for teardown and analysis.

b. If output reduction carrier has freedom of movement and no unusual noises are heard, remove the airframe mounted 3-micron oil filter. If carbon particles are found, replace the 3-micron filter. Retain any particles for analysis.

c. If the airframe mounted 3-micron oil filter impending bypass button was extended, do the following:

(1) Replace the 3-micron filter. Retain any particles found on the filter element for analysis.

(2) Remove the #2 bearing housing oil strainer and the power turbine oil strainer. If chips are present, remove three reduction gear oil transfer tube oil strainers and overspeed governor and tachometer strainer. Remove and retain particles for analysis. If more than one-third of flow area of any strainer is clogged with particles, remove the engine for teardown and analysis. Otherwise, clean and reinstall the strainers.

(3) Drain all oil from accessory drive gearbox, oil cooler, and oil tank through clean cheesecloth. Retain particles for analysis. Reservice engine with new oil.

(4) Remove the engine accessory gearbox-mounted oil filter. Visually inspect filter elements for particles. Retain particles for analysis. If particles were found in the strainers, replace accessory gearbox-mounted oil filter elements. Otherwise, clean filter elements and reinstall. Tighten oil filter housing attachment bolt and torque 20 to 35 inch pounds and lockwire (C155) (Refer to TM-55-2840-229-23).

d. If chips were found in the filters or strainers, reevaluate all particles found (including those found on the chip detector(s)) per Figure 4-21.2 and Table 4-1.1. If particles exceed removal limits, remove the engine.

CAUTION

Any fluctuation in oil pressure in excess of +/-5 psi, or rapid rise in oil temperature at any preset power setting, is cause for immediate engine shutdown.

e. Start engine and run at flight idle until temperatures have stabilized. Check instruments for proper engine operation. Increase speed to 70-80% N1 rpm and maintain for 15 minutes.

f. Shut down engine and again inspect airframe-mounted 3-micron oil filter element.

g. If carbon particles are in excess of that shown in Figure 4-21.2. repeat procedure until filter is clean after run.

4-106.10.5. Serviceability Check (Chip Light) - ODDS-Equipped Helicopters - Remote Location.

a. Attempt to rotate the output reduction carrier and gear assembly. If rotation is difficult, if binding or roughness is felt, or if unusual noises are heard, remove the engine for teardown and analysis.

b. Check the airframe mounted 3-micron oil filter impending bypass button. If extended, do the following:

(1) Replace the 3-micron filter. Retain any particles for analysis.

(2) Remove the #2 bearing housing oil strainer and the power turbine oil strainer. If chips are present, remove three reduction gear oil transfer tube oil strainers and overspeed governor and tachometer strainer. Remove and retain particles for analysis. If more than one-third of flow area of any strainer is clogged with particles, remove the engine for teardown and analysis. Otherwise, clean and reinstall the strainers.

(3) Remove the engine accessory gearbox-mounted oil filter. Visually inspect filter elements for particles. Retain particles for analysis. If particles were found in the strainers, replace accessory gearbox-mounted oil filter. Otherwise, clean filter elements and reinstall. Tighten oil filter housing attachment bolt and torque 20 to 35 inch pounds and lockwire (C155) (Refer to TM 55-2840-229-23).

(4) Disconnect scavenge hose assemblies for #2 bearing and #3 and #4 bearings and determine if residual oil in hose assemblies is contaminated with chips. If so, ship engine to depot for bearing replacement.

c. If chips were found in the filters or strainers, reevaluate all chips found (including those found on the chip detector(s)) per Figure 4-21.2 and Table 4-1.1. If chips exceed removal limits, remove the engine.

CAUTION

Any fluctuation in oil pressure in excess of +/-5 psi, or rapid rise in oil temperature at any preset power setting, is cause for immediate engine shutdown.

d. Start engine and run at flight idle until temperatures have stabilized. Check instruments for proper engine operation. Increase speed 70-80% N1 rpm and maintain for 5 minutes.

e. Hover aircraft for 5 minutes. Shut down engine and again inspect chip detector and strainers. Do not inspect filters unless the impending bypass button is extended.

f. If no chips are found, release the helicopter for a one-time flight (not to exceed one hour) to an adequate maintenance facility. Perform a compete serviceability check (paragraph 4-106.10) after completion of one time flight.

NOTE

In some cases, the ground run and hover may not completely clean out the lube system. If very small amounts of debris or fuzz remains after the ground run and hover, the serviceability check may be repeated one time. If chips remain after the second serviceability check, remove the engine.

h. If chips are found, do not clean filters, strainers, or chip detector. Remove engine and return to depot for teardown and analysis. Flush airframe oil system, oil cooler, and oil tank.

i. If carbon particles are found in excess of that shown in Figure 4-21.2 and Table 4-1.1, perform serviceability check (paragraph 4-106.10.4) within 2 flight hours.

4-106.11. Replacement of Self-Sealing Valve. Replace defective parts only. (figure 4-21.1.1).

a. Remove chip detector probe (paragraph 4-106.10).

b. Remove body (12), packing (11), cup (10), and spring (9). Discard packing.

c. Install spring (9), smaller end first, and cup (10). Install packing (11) on body (12) and install body. Torque body **32 to 38** inch-pounds and lockwire (C155).

d. Install chip detector probe (paragraph 4-106.11).

4-106.12. Installation - Chip Detector Probe. Install chip detector as follows: (figure 4-21.1.1).

a. Install new packing (13) on probe (14).

b. Install probe by pressing and turning cw.

c. Connect cable plug to chip detector and lockwire (C155).

4-106.13. EXTERNAL OIL FILTER (Helicopters with ODDS).

4-106.14. Description.

a. Oil filter (11.2, figure 4-18) is mounted on bracket on forward firewall of engine compartment, left side. Filter is in external oil circuit between oil separator and oil cooler. Filter includes 3-micron disposable element and popout differential pressure indicator. It bypasses at 7 to 9 psi; low temperature lockout prevents actuation below **120° to 160° F**. Filter design prevents reentry of trapped debris into system during bypass.

b. Drain valve on bottom of filter can be used to drain filter bowl for removal. Filter head is marked ENGINE.

4-106.15. Cleaning - External Oil Filter. Clean the filter bowl and head with clean cloth and solvent (C261). Dry with compressed air.

4-106.16. Inspection - External Oil Filter.

a. Make sure filter head (6, figure 4-21.3) is marked ENGINE.

b. Check bypass indicator. Reset if extended. If reset, check for proper operation at next runup.

c. Inspect filter head and bowl (9) for corrosion, cracks, and evidence of leaks. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

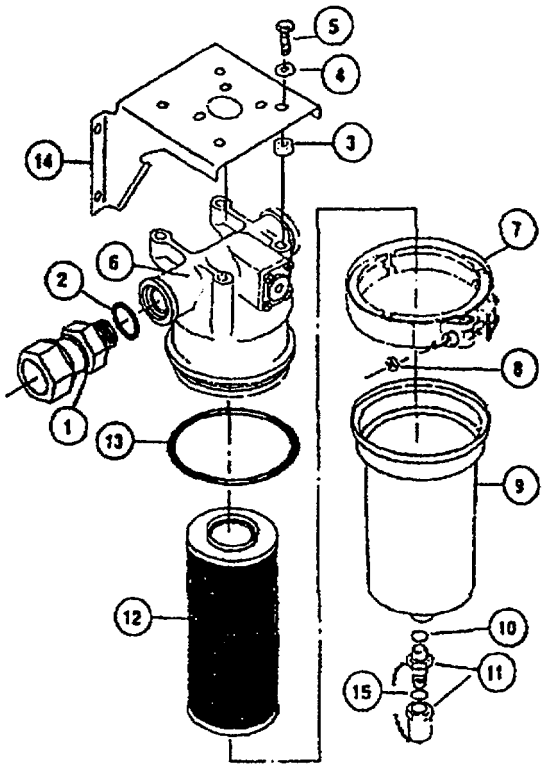
d. Replace cracked or corroded parts. Correct leaks.

4-106.17. Replacement of Element or Bowl-External Oil Filter. Proceed as follows: (figure 4-21.3).

NOTE

Replacement of engine external oil filter is "on condition" change only when associated impending bypass indicator button is extended (second reset) or when engine is replaced. Since fine filtration cleans the lubricant in the component, do not change lubricant when replacing filter. Flushing and filtering of system lubricant (unless the engine is being replaced) is not required or authorized, as it may mask problems and prevents trending of data.

a. Access oil filter by opening left engine cowling.



1. Fitting
2. Packing
3. Spacer
4. Washer
5. Bolt
6. Filter Head
7. Coupling Clamp
8. Nut
9. Filter Bowl
10. Packing
11. Drain Valve
12. Element
13. Packing
14. Bracket
15. Packing

Figure 4-21.3. Engine External Oil Filter

b. Place container below filter to catch oil. Remove lockwire from cap of drain valve (11). Remove cap to drain oil.

c. Remove lockwire and coupling clamp (7).

d. Remove filter bowl (9) and element (12) downward.

e. Remove packing (13) from head (6).

f. Clean head and bowl. Use cloths and cleaning solvent (C261). Inspect bowl for cracks and serviceability.

g. Install new packing in head.

h. Install new or serviceable element in filter bowl.

CAUTION

Ensure V-band coupling is properly seated for the full circumference of the filter bowl and filter head flange. The V-band coupling should not appear cocked. Improperly installed clamps will result in damage to the filter head, filter bowl, coupling, and will cause leaks.

i. Position bowl in head.

j. Install and tighten coupling clamp. Torque coupling nut (8) **40 to 50** inch-pounds. Lockwire (C155)

clamp.

k. Install packing (15) and cap of drain valve (11). Torque cap **20 to 25** inch-pounds. Lockwire (C155) cap.

l. Service system with oil (paragraph 1-5).

4-106.18. Replacement of Drain Valve - External Oil Filter. Proceed as follows: (figure 4-21.3).

a. Access oil filter by opening left engine cowling.

b. Place container below filter to catch oil. Drain oil using drain valve (11).

c. Remove body of drain valve (11) and packings (10 and 15) from bowl (9).

d. Install body and new packing (10) in bowl. Torque body **16 to 20** inch-pounds. Lockwire (C155) body.

e. Install new packing (15) on body. Install cap on drain valve. Torque cap **20 to 25** inch-pounds. Lockwire (C155) cap.

f. Service the system with oil (paragraph 1-5).

4-106.19. Removal - External Oil Filter. Access oil filter by opening left engine cowling.

a. Place container below filter to catch oil. Remove lockwire from cap of drain valve (11, figure 4-21.3). Remove cap to drain oil.

b. Disconnect hose (11.3, figure 4-18) from 45° elbow (11.4, figure 4-18) in OUT port.

c. Disconnect fitting (1, figure 4-21.3) from oil separator.

d. Remove four bolts (5), washers (4), and spacers (3) from brackets (14) and remove filter. Inspect filter head an bowl for serviceability.

e. If filter or head will be replaced, remove fitting (1) and packing (2) from IN port of head (6). Remove 45° elbow (11.4, figure 4-18) and packing from OUT port. Retain fitting and elbow. Discard packings.

4-106.20. Replacement of Filter Head-External Oil Filter. (See figure 4-21.3).

a. Remove filter (paragraph 4-106.19).

b. Remove lockwire and coupling clamp (7).

c. Remove filter bowl (9) and element (12) down-ward. Remove and discard packing (13) from head. Inspect element.

CAUTION

Make sure replacement filter head is marked ENGINE. Otherwise, oil system performance will be degraded and pressure bypass mechanism will not function as required.

d. Install new packing (13) in replacement head (6).

e. Install serviceable element and bowl.

f. Install and tighten coupling clamp. Torque coupling nut (8) **40 to 50** inch-pounds.

g. Install filter (paragraph 4-106.19).

4-106.21. Installation - External Oil Filter.

a. If filter or head is a replacement, install fitting (1, figure 4-21.3) and new packing (2) in IN port. Install 45° elbow (11.4, figure 4-18) and new packing in OUT port.

b. Position oil filter below bracket (14, figure 4-21.3), IN port fitting toward oil separator fitting.

CAUTION

Make sure filter head is marked ENGINE and that filter is installed with IN port toward oil separator. Otherwise, oil system performance will be degraded and pressure bypass mechanism will not function as required.

c. Install four bolts (5), washers (4), and spacers (3) (below bracket). Torque bolts **87 to 93** inch-pounds.

d. Connect fitting (1) to oil separator.

e. Connect oil hose (11.3, figure 4-18) (from fitting at service deck) to elbow in OUT port.

f. Install packing (15, figure 4-21.3) on body of drain valve (11).

g. Install cap on drain valve (11). Torque cap **20 to 25** inch-pounds. Lockwire (C155) cap.

h. Service system with oil (paragraph 1-5) and perform maintenance operational check for leaks and proper operation at first runup (TM 55-1520-210-10).

4-107. OIL STRAINERS.

4-108. Description -Oil Strainers. Five oil strainers in the engine assembly can be inspected and cleaned. The No. 2 bearing housing oil strainer is located in a fitting on lower right side of the engine diffuser housing, at the pressure oil inlet to No. 2 main bearing. The power turbine oil strainer is located in a fitting at top left on the engine exhaust section, at the pressure oil inlet to No. 3 and 4 main bearings. Three oil strainers are mounted on internal ends of three transfer oil tubes located on the forward face of the output reduction carrier.

4-109. Maintenance of Oil System. (Refer to TM 55-2840-229-23). (Figure 4-22).

4-109.1. Troubleshooting High Engine Oil Temperature Condition. If engine oil temperature is higher than operational limits specified in TM 55-1520-210-10, proceed as follows:

a. Troubleshoot the oil temperature indicator (table 8-3).

b. If the engine oil temperature indicator is operational, replace the engine oil thermal valve (paragraph 4-100).

SECTION VI. IGNITION SYSTEM

NOTE

Refer to TM 55-2840-229-23 and paragraph 9-130 for applicable Ignition System Data.

SECTION VII. POWER CONTROLS

4-110. POWER LEVER CONTROLS.

4-111. Description – Power Lever Controls. A mechanical linkage system, actuated by twist-grips on collective pitch control sticks, provides manual control of power lever on fuel control unit, modulating engine from zero to full power by controlling gas producer (N1) turbine rpm Linkage is a series of connecting links, bellcranks, and a torque tube, with adjustable tubes at each end of series and between control sticks One bellcrank has an adjustment to provide correct travel of entire airframe-mounted linkage. Power lever shaft is serrated and grooved to accept a control arm, and has a quadrant marked with power settings in travel range between stops pre-adjusted by engine manufacturer or overhaul facility. (figure 4-23.) An adjustable stop, on bellcrank below engine deck, contacts plunger of a solenoid to arrest travel of control linkage at flight idle position when power IS reduced from higher settings. Stop release IS accomplished by use of ENGINE IDLE STOP REL pushbutton switch on collective stick to retract solenoid plunger

4-112. Adjustment — Power Lever Controls. a. Be sure engine idle stop (20, figure 4-23) is removed and that adjustable tube (12) is disconnected from power lever control arm (1) on power lever shaft of fuel control, but connected to bellcrank at opposite end, If adjustable tube (48) IS removed, set to nominal length of 21.4 inches between bearing centers and reinstall, connecting to bellcranks at both ends,

NOTE

The rod-end adjustments must be kept as near nominal as possible to ensure safe thread engagement.

b. Install Control Arm (1) in lever shaft of fuel control, positioned as nearly parallel to power lever pointer (30) as serrations will permit. Install retaining screw through control arm (see figure 4-23 detail A), engage in groove around shaft. Lockwire (C155) screw head.

c. Rotate control arm (1) until the pointer IS against either stop, turn twist grip to its stop in the corresponding direction Check free rod-end over travel dimension between centers of bearing and control arm bolt hole Repeat with pointer and twist grip each turned to opposite stop Adjust length of adjustable tubes (12 and 48) to obtain a small amount of free rod-end over travel past control arm bolt hole, equal in both directions as limited by stops Attach adjustable tube (12) to control arm (1) with bolt (13), washers (3), nut (4), and cotter pin (5) Tighten rod-end jamnut.

CAUTION

If binding occurs, recheck entire installation for correct linkage and length of adjustable tubes. Refer to TM 55-2840-229-23 for fuel control binding.

d. Adjust serrated attachment of upper control rod on bellcrank (65) so that power lever pointer (30) will bottom out on stops at fuel control, short of extreme positions of twist-grip by approximately 5±2 degrees for T53-L-13 series engine, DETAIL A

NOTE

Ridge to ridge on the knurled friction knob is 30 degrees, which represents 10 degrees of travel on the fuel control arm. Cushion is to be set at the fuel control arm and not at the twist grip.

e. Adjust engine idle stop (para. 4-113).

4-113. Adjustment Engine Idle Stop and Release Solenoid — Power Lever Controls.

NOTE

With linkage disconnected from fuel control, the torque required to rotate twist grip shall not exceed 5 inch-pounds.

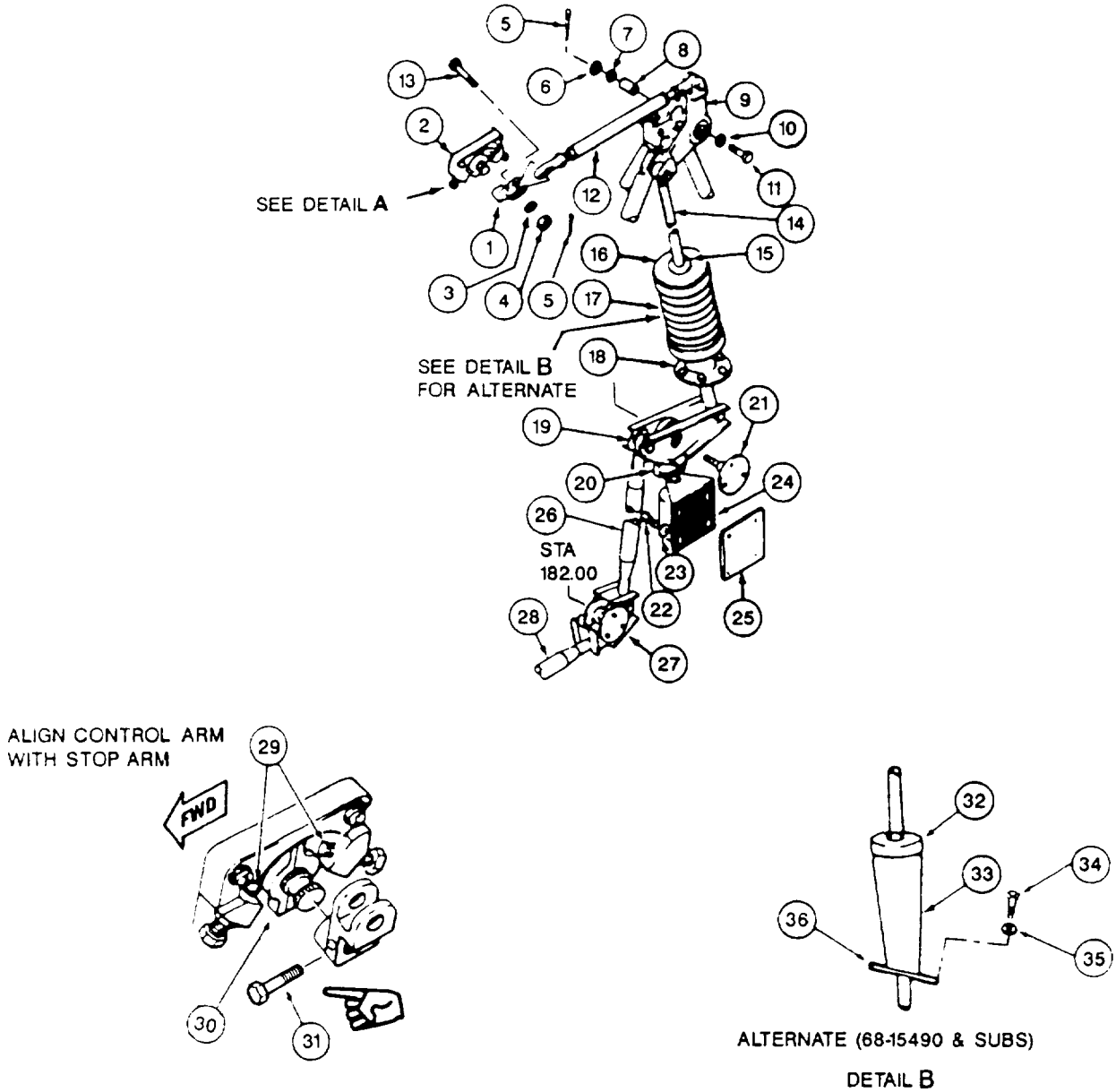


Figure 4-23. Power Lever Control System (Sheet 1 of 5)

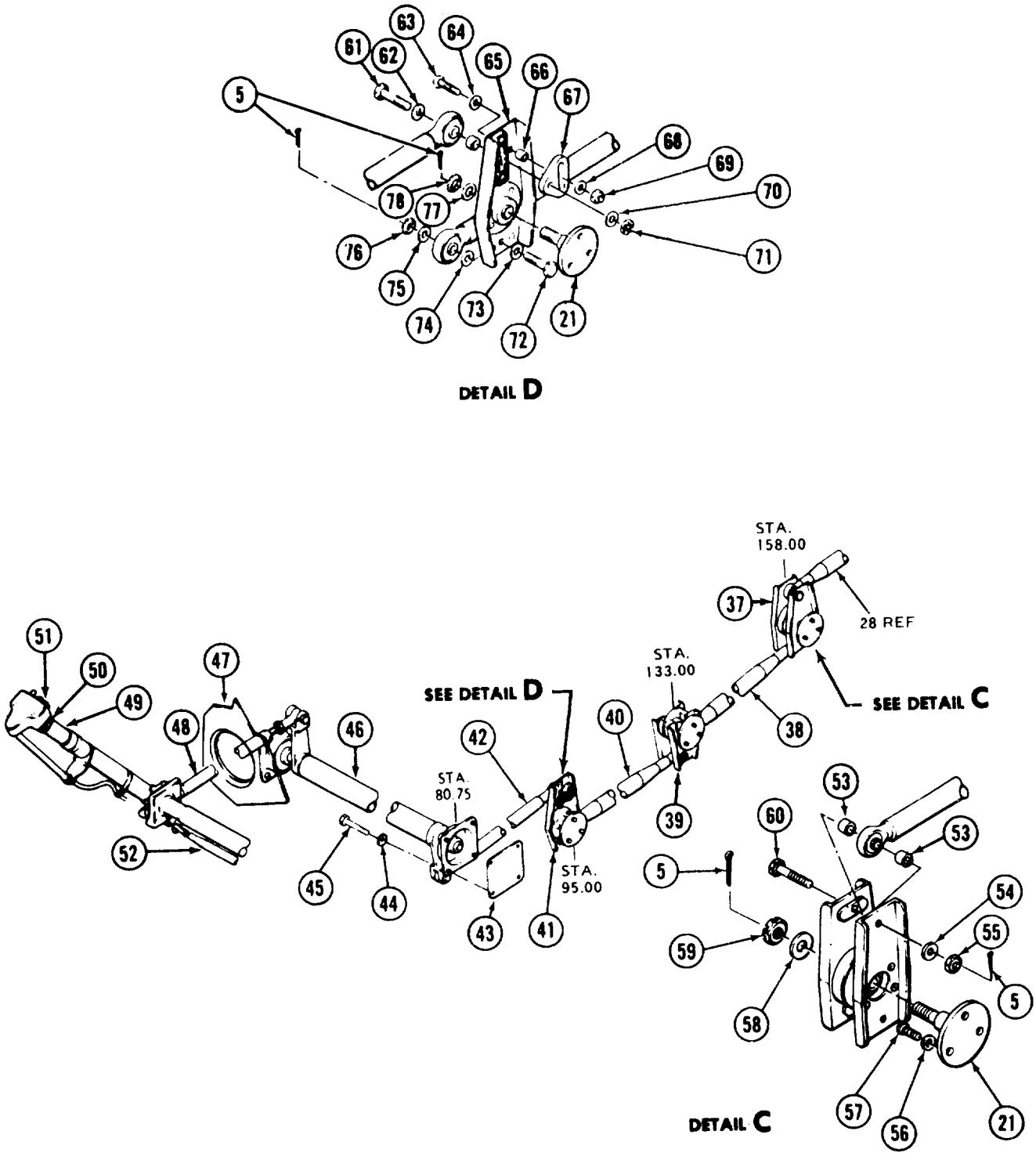


Figure 4-23. Power Lever Control System (Sheet 2 of 5)

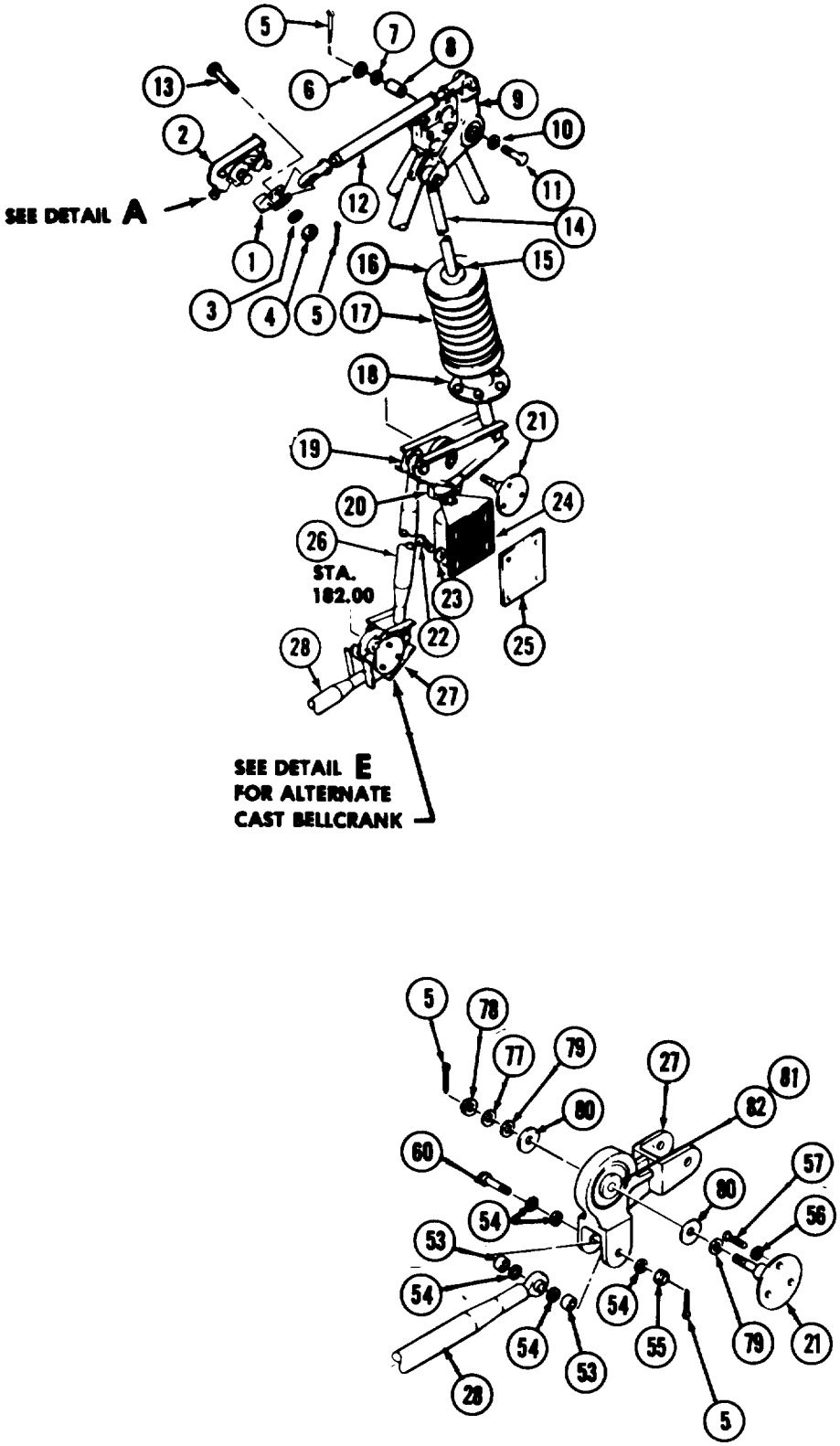


Figure 4-23. Power Level Control System (Sheet 3 of 5)

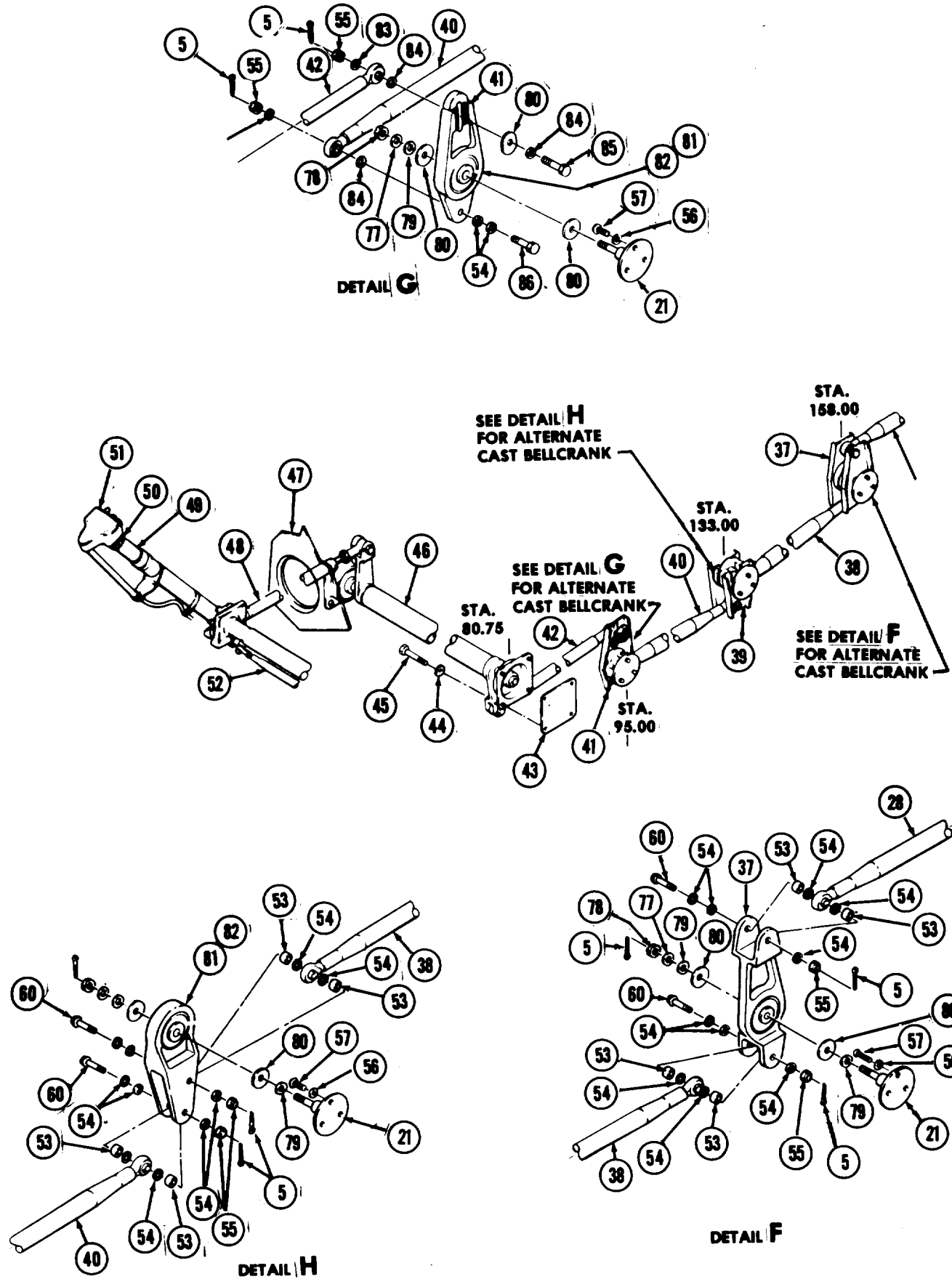


Figure 4-23. Power Lever Control System (Sheet 4 of 5)

1. Control arm
2. Fuel control power lever shaft and stops
3. Washer
4. Nut
5. Cotter pin
6. Nut
7. Washer
8. Spacer
9. Bellcrank (on engine mount)
10. Washer
11. Bolt
12. Tube (adjustable)
13. Bolt
14. Connecting link
15. Split bushing and ring
16. Retainer
17. Boot
18. Housing
19. Bellcrank
20. Engine idle stop
21. Mount
22. Bolt
23. Washer
24. Bracket, solenoid
25. Serrated base
26. Connecting link
27. Bellcrank
28. Connecting link
29. Stop power lever
30. Power lever pointer
31. Retaining screw
32. Clamp
33. Boot
34. Bolt
35. Washer
36. Plate
37. Bellcrank
38. Connecting link
39. Bellcrank
40. Connecting link
41. Bellcrank
42. Connecting link
43. Shims
44. Washer
45. Screw
46. Torque tube
47. Bulkhead (station 74.25)
48. Tube (adjustable)
49. Twist grip control
50. Friction adjustment
51. Switch, idle stop release
52. Tube, interconnect
53. Spacer
54. Washer
55. Nut
56. Washer
57. Screw
58. Washer
59. Nut
60. Bolt
61. Bolt
62. Washer
63. Screw
64. Washer
65. Bellcrank (adjustable)
66. Spacer
67. Serrated plate
68. Washer
69. Nut
70. Washer
71. Nut
72. Bolt
73. Washer
74. Washer
75. Washer
76. Nut
77. Washer
78. Nut
79. Washer
80. Washer
81. Bushing
82. Bearing
83. Washer
84. Washer
85. Bolt
86. Bolt

Figure 4-23. Power Lever Control System (Sheet 5 of 5)

NOTE

Shims are required when bracket P/N 204-060-797-1 is installed. Shims are not required when bracket P/N 204-060-797-5 is installed.

a. Check that plunger of solenoid operates freely through bracket bushing (figure 4-24). If necessary, shim on four mounting screws between solenoid and bracket to obtain plunger alignment.

b. Attach engine idle stop (20, figure 4-23) on extended spacer of bellcrank (19), with stop projection aft. Secure stop with two bolts and serrated washers.

c. Position solenoid on serrated base plate to obtain 0.040 ± 0.010 inch clearance between tip of plunger and surface of stop projection when solenoid is in actuated position (Figure 4-24). Secure by tightening four bolts, with thin aluminum washers under heads, through slotted holes in bracket into mounting pad.

d. Use twist-grip to position power lever pointer at 38 degree mark on fuel control quadrant. This is approximate engine idle position.

e. Adjust stop so that projection rests against side of solenoid plunger. Tighten bolts to engage mating serration of lockwashers and stop face.

CAUTION

Do not attempt to obtain proper engine idle speeds through adjustment of engine fuel control. Aircraft engine idle speed does not necessarily correspond to fuel control engine idle position.

f. Check operation of engine idle stop during ground run in accordance with TM 55-1520-210-10. If necessary, readjust stop on T53-L-13 series engines to obtain **68 to 72** percent rpm. Check the release by actuating the solenoid. Recheck clearance dimension of **0.040 ± 0.010** inch between the tip of the plunger and the stop projection with the solenoid in the actuated position (figure 4-24).

NOTE

Check engine idle rpm by rolling the twist grip against the stop and applying friction.

g. Inspect throttle friction lock for positive locking.

4-114. Removal - Power Lever Controls. Parts of control system can be removed as necessary for inspection, lubrication or replacement. To aid reinstallation, identify removed parts as to location and keep attaching hardware in place or in sets.

NOTE

Some aircraft may have solid, cast bellcranks installed. Refer to figure 4-23, sheets 3 and 4 for illustration.

a. Obtain access to forward linkage by removing access doors along center of cabin floor, and on structural pylon island. Obtain access to linkage aft of cabin through openings in lower side of fuselage, and by opening engine compartment cowling on left side.

b. To remove torque tube (46, figure 4-23) disconnect control tubes from both arms. At each end of tube, remove four screws and washers which secure bearing cup and shims (43) to mounting pad on structural beam. Remove torque tube assembly. Separate bearing cup and shims from left end of tube.

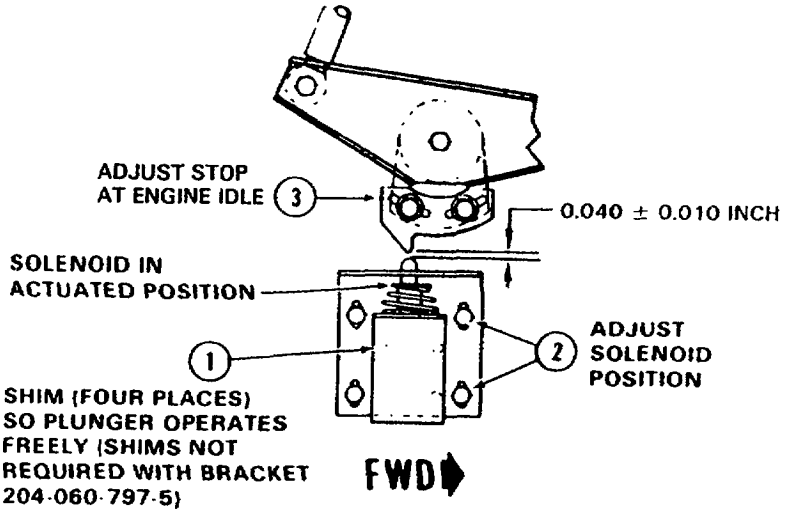


Figure 4-24. Engine Idle Stop Adjustment

Remove shims, retaining nut, washer, and bearing cup from right end.

c. To remove any bellcrank in fuselage, disconnect control tubes by removing bolts, nuts, washers, and spacer (53). Remove cotter pin, nut, and washer to pull bellcrank (37) (typical) from mount (21). To detach mount from structure, remove three screws and washers.

d. To remove boot (17), disconnect connecting links from bellcrank on engine mount. Loosen clamp and detach boot (17) from housing (18), and retainer (16). Remove snap ring and split bushing (15), and slip retainer and boot off upper end of connecting link.

e. To remove bellcrank (9), disconnect both adjustable tube and connecting link. Remove pivot bolt and nut to detach bellcrank and spacer from bracket on pillow block of engine mount.

f. To remove control arm (1) from power lever shaft on fuel control, cut lockwire and remove retaining screw. Pull control arm off splined shaft. Reinstall screw in control arm.

4-115. Inspection - Power Lever Controls. a. Inspect controls linkage for cracks, scratches, dents, and corrosion (refer to figures 4-25, 4-26, and 4-27 for damage and repair limits). If crack in the power control lever linkage is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

b. Inspect control linkage bearings for excessive wear and roughness (refer to table 4-2 for wear limits).

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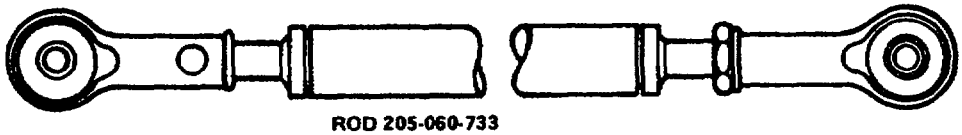

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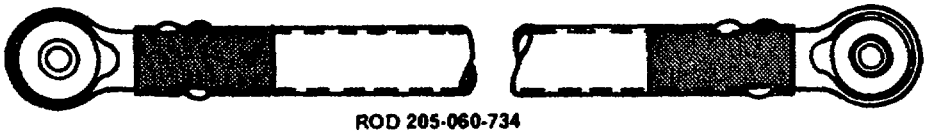

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DAMAGE AREA REPAIR SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
NICK, SCRATCHES, AND CORROSION	0.003 IN. AFTER REPAIR	NO DAMAGE ALLOWED
CRACKS	NONE ALLOWED	NONE ALLOWED

NOTE: Corrosion damage must be polished out to twice the depth of damage.

Figure 4-25. Power Lever Control Rod Damage and Repair Limits

Table 4-2. Power Lever Control Bearings Wear Limits

BEARING PART NUMBER	MAXIMUM RADIAL WEAR	MAXIMUM AXIAL WEAR
MS27644-4	0.006 IN.	0.015 IN.
MS21153-1	0.005 IN.	0.015 IN.
MS21153-2	0.005 IN.	0.015 IN.
MS20200KP4	0.006 IN.	0.030 IN.
RE3S7	0.005 IN.	0.015 IN.

c. Inspect mounting brackets and plates for cracks, corrosion, security, and elongated bolt holes. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

d. Inspect solenoid (1, figure 4-24) for loose or missing hardware and cracks or dents. Check electrical connection for security and broken wires.

e. Inspect boot assembly (17 or 33, figure 4-23) for tears, cuts, deterioration and security.

4-116. Repair or Replacement - Power Lever Controls.

a. Scratches, and corrosion in rods, torque tube, bellcranks, and/or serrated washers that are not in excess of the limits of figures 4-25, 4-26, and 4-27 may be polished out as follows:

(1) Remove corrosion and scratches that are within limitations with abrasive cloth (1), to obtain a smooth scratch-free surface.

(2) Apply one coat of epoxy primer (C206) to repaired area.

b. Replace any cracked control tube.

c. Replace any, mounting bracket or plates that are cracked or have elongated bolt holes. Remove corrosion or scratches. (Refer to step a.)

d. Replace damaged electrical connector, or damaged wires (paragraph 9-6).

e. Replace solenoid when cracked or dented.

f. Replace boot assembly (17 or 33, figure 4-23) when torn, cut or excessively deteriorated.

g. Replace rod end bearings when wear exceeds limits of Table 4-2. (Refer to para. 11-187 for procedure).

h. Replace rod assembly if any movement exists between the rod and riveted rod end.

4-117. Installation - Power Lever Controls.

NOTE

Some aircraft may have solid, cast bellcranks installed. Refer to figure 4-23, sheets 3 and 4 for illustration.

a. Deleted.

NOTE

Clearance of 0.032 inch is a minimum requirement. Greater clearance is acceptable if no end play exists which results in lost throttle motion. If such ends play is noted, additional shims will be required to maintain 0.032 to 0.060-inch clearance. The clearance reading shall be taken with the torque tube chucked against the opposite end while clearance is being measured.

b. Place bearing cup on each end of torque tube (46, figure 4-23). Position torque tube between mounting pads an structural beams with short lever on the right hand (pilot's) side, in up position. Install shims as required, to a maximum of six at each end of tube (figure 4-28). Secure each bearing cup and shims to beam inserts with four screws and thin washers

NOTE

On helicopters prior to serial no. 68-15518 check bellcrank mounts for looseness and proper length screws. Screws should be 5/8-inch long, except for top-aft mount which requires 1/2-inch screws. Replace screws shorter

than 5/8-inch. Replace top-aft mount screws shorter than 1/2-inch. (If mounts have not been removed during disassembly of power control linkage check screw length by removing one screw from each mount.)

c. If removed, install mounts (21, figure 4-23) and bellcranks (65, 39, 37, 27 and 19) as shown. Install bellcrank (9), with arm marked "up" in the up position, use spacer on pivot bolt between bracket and pillow block of engine mount tripod and install bolt (11) and safety washer (10) under bolt head. Secure with nut and cotter pin on bolt at inboard side of pillow block.

d. Reinstall any connecting links using spacers between bellcranks and rod-ends as shown. Install boot (17) and retainer (16) before connecting both ends of tube between bellcranks (19 and 9). Insert split bushing through retainer and secure with snap ring at upper side. On helicopters prior to Serial No. 68-15490, secure boot on retainer (16) and housing (18) with clamps (32). On helicopters Serial No. 68-15490 and subsequent, secure boot on retainer (16) with clamp and install to plate with five washers and bolts. Connect rod-ends to bellcrank (9 and 19) using proper bolts with heads positioned outboard. Connect connecting link (14) to bellcrank (9) with bolt head positioned inboard.

NOTE

With linkage disconnected from fuel control, the torque required to rotate twist grip shall not exceed 5 inch-pounds.

e. Set pilot's twist grip control at mid-travel. Set copilot's control at same position, checking that gear on lower end of control stick is centered on mating gear sector. Install interconnect tube (52) between control stick lever arms. Actuate controls through full range to check for correct gear engagement and freedom of operation.

f. Connect adjustable tubes (48 and 12) and install control arm (1) during adjustment procedure (paragraph 4-112).

4-118. LINEAR ACTUATOR.

4-119. Description - Linear Actuator. An electrically operated linear actuator, remotely

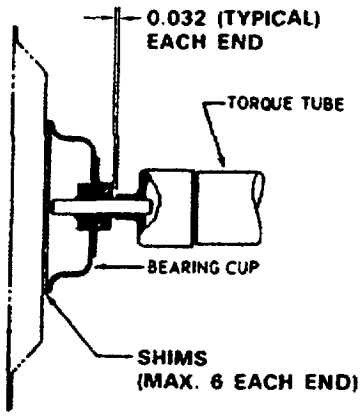


Figure 4-28. Power Lever Controls Torque Tube Shimming Procedures

controlled by a GOV RPM INCR/DECR switch on each collective pitch control stick, moves a lever on overspeed governor of fuel control unit to accomplish settings of power turbine rpm (N2) indicated on dual tachometer.

4-120. Inspection -Linear Actuator. a. Inspect hardware that attaches linear actuator to cambox assembly (5, figure 4-29) and control lever (3) for security, cracks, corrosion, wear, elongation, and damaged threads. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

b. Inspect linear actuator housing for cracks, corrosion, nicks, scratches, and security. Check attached parts for security.

c. Inspect electrical terminals for security, corrosion, cracks and proper installation on wires.

d. Inspect rod-end bearing for binding, wear, corrosion, cracks, and security. Replace rod-end bearing if wear exceeds **0.010** inch axial or **0.005** inch radial.

e. Inspect motor housing for security, corrosion, cracks, nicks, and scratches.

f. Inspect linear actuator to determine if actuator shaft will turn on its axis.

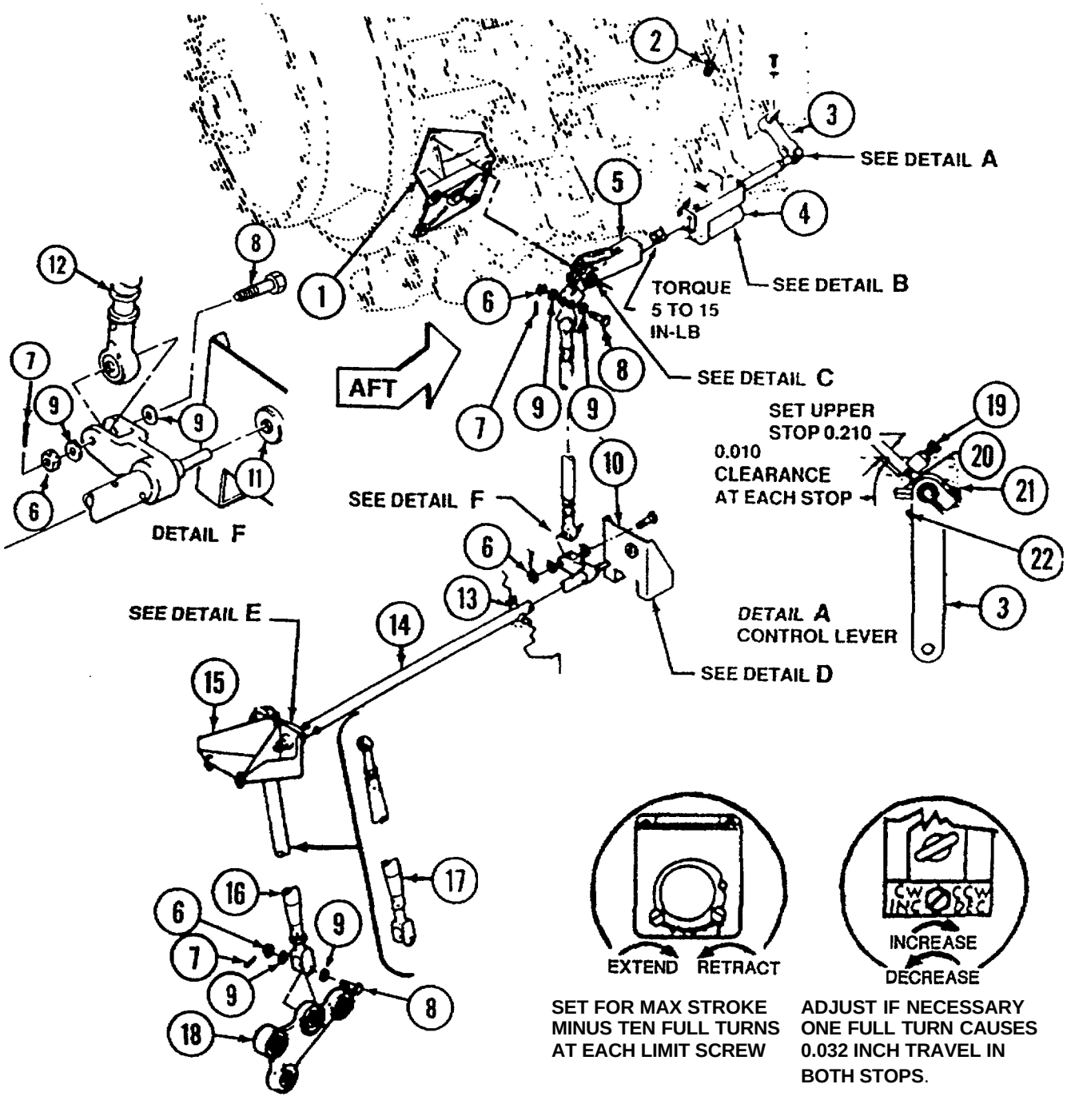
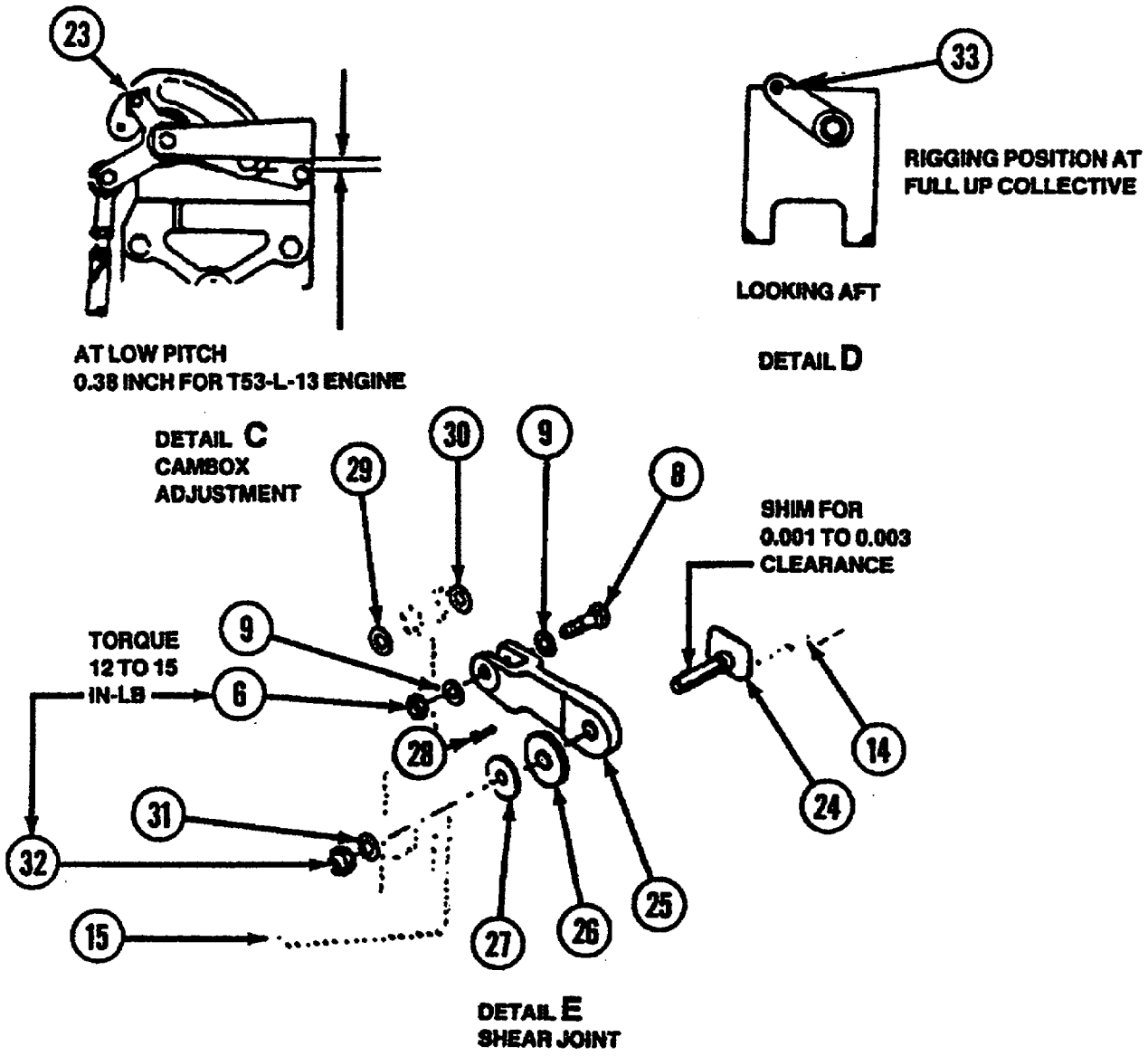


Figure 4-29. Power Turbine Governor RPM Controls (Sheet 1 of 2)



1. BRACKET, CAMBOX
2. GOVERNOR CONTROL SHAFT
3. CONTROL LEVER
4. LINEAR ACTUATOR
5. CAMBOX ASSEMBLY
6. NUT
7. COTTER PIN
8. BOLT
9. WASHER
10. SUPPORT
11. BEARING
12. CONTROL TUBE
13. FIREWALL SEAL
14. TORQUE TUBE
15. BRACKET ASSEMBLY
16. CONTROL TUBE
17. CONTROL TUBE
18. BELLCRANK, COLLECTIVE PITCH
19. STOP, HIGH RPM
20. STOP ARM
21. BOLT AND WASHER
22. STOP, LOW RPM
23. CAM ADJUSTMENT
24. SHEAR FITTING
25. BELLCRANK
26. SHIMS
27. RETAINING WASHER
28. SHEER PIN
29. WASHER ■
30. WASHER
31. WASHER
32. NUT ■
33. BELLCRANK
34. CLEVIS ARM

Figure 4-29. Power Turbine Governor RPM Controls (Sheet 2 of 2)

g. Inspect adjustment shaft of single screw actuator for not more than 4 threads showing beyond the lock nut.

4-121. Adjustment — Linear Actuator.

CAUTION

Adjustment of the linear actuator requires an engine run-up to insure that proper RPM range is obtained.

a. Disconnect actuator shaft from governor control lever (3, figure 4-29) by removing bolt.

CAUTION

To prevent internal damage, stop screw adjustment must be performed with actuator at midpoint of stroke.

b. Electrically position actuator shaft to approximate midpoint of stroke and set actuator travel to 1.20 inch for T53-L-13 series engines.

(1) If actuator with two adjusting screws is Installed, turn both positive stop adjusting screws to obtain maximum stroke (see detail B). Reduce stroke by turning each screw ten full turns away from maximum adjustment to obtain actuator nominal position.

NOTE

One full turn of the adjusting screw on actuator with single adjusting screw will cause change in both the retract and extend position of 0.032 inch. (See detail B.)

(2) If actuator with single adjusting screw is installed, positive stops can be adjusted, if necessary, for travel of 0.500 T0 1.75 inch without change in nominal position.

b. 1. Adjustment of single screw actuator, PN25140-65A124 (TRW/Globe Motor Div.)

(1) Remove locknut; lockwasher.

(2) Turn adjustment shaft CW to increase stroke. (1 turn changes total stroke 0.032 inch).

CAUTION

DO NOT OVER TORQUE LOCKNUT. If locknut is overtorqued, failure of the stop adjust mechanism will occur, allowing the engine to overspeed.

NOTE

If adjustments are reversed, release locknut and lockwasher and run actuator thru full extend and retract stroke. Then secure lockwasher and repeat steps 1 and 2.

(3) Place lockwasher on pin and retighten locknut. Tighten locknut only enough to snug lockwasher in place.

c. Fully retract actuator shaft by holding GOV RPM switch to INCR. Move collective stick to full up position.

CAUTION

When tightening jamnut on actuator shaft, center rod-end in clevis of lever so that self-aligning bearing will absorb any rotation of shaft. If actuator is allowed to turn, failure of the shaft retainer mechanism will occur, allowing the actuator shaft to separate from the jackscrew and resulting in loss of N2 control.

d. Install bolt connecting actuator to governor control lever, adjusting actuator shaft rod-end to obtain 0.010 inch clearance between governor stop arm and upper stop screw, measured with a feeler gage (see Detail A). If necessary, reposition control lever on governor shaft to accomplish this adjustment while keeping safe thread engagement of rod-ends. If governor stop clearance still cannot be obtained, the stop-arm (20) may be moved 2 serrations either way to complete rigging. Attach actuator shaft rod-end with washer (P/N AN960-10L) on each side of bearing into clews of governor control lever, with bolt, washer and nut. Torque nut 12 to 15 inch pounds. Install cotter pin.

e. Refer to paragraph 4-128, steps and k for lower stop screw adjustment.

4-122. Operational Check -- Linear Actuator. a. Turn electrical power on

NOTE

Travel time should not exceed 5 to 10 seconds.

b. Position GOV RPM switch on pilot's collective stick to INCR Check that governor's rpm actuator on the engine retracts

c. Position GOV RPM switch to DECR Check that actuator extends.

d. Repeat steps b and c using copilot's GOV RPM switch.

4-123. Removal — Linear Actuator. a. Open engine compartment cowling at left side.

b. Remove terminal cover with attaching screws from top of actuator (4, figure 4-29). Disconnect and mark electrical leads for installation, Reinstall cover

CAUTION

Use care to avoid losing spring washer, installed between actuator clevis and cambox slider.

c. Detach actuator jackshaft end-fitting from control lever (3) on governor, and forward end-fitting from slider of cambox assembly (5), by removing bolts with nuts and washers.

4-124. Repair or Replacement Linear Actuator. a. Attaching hardware.

(1) Replace missing, cracked, worn or elongated hardware.

(2) Remove corrosion with abrasive cloth (C1) to obtain a smooth scratch free surface Treat parts In accordance with Specification QQ-P-416

(3) Tighten loose hardware

(4) Replace parts that halve damaged threads

b. Housing

(1) Remove corrosion, nicks and scratches (Refer to step a (2))

(2) Replace linear actuator when housing is cracked

(3) For further repair forward housing to Depot

c. **Electrical Terminals**

(1) Remove corrosion with abrasive cloth (C1) to obtain a smooth scratch free surface

(2) Tighten terminals when loose at attaching point

d. Rod-end bearings.

(1) Purge binding rod end bearing with grease (C129) while rotating bearing.

(2) Replace rod-end bearing if worn, binding, cracked, or damaged threads.

(3) Tighten lock nut if rod-end bearing shaft is loose in drive tube.

(4) Replace linear actuator if actuator shaft turns on its axis.

(5) Replace linear actuator if over 4 threads of adjustment shaft show beyond the locknut, or if shaft can be pulled out of actuator.

e. Motor.

(1) Remove corrosion, nicks, and scratches from motor housing. (Refer to step a (2).)

(2) Replace linear actuator when motor housing is cracked or when motor is inoperative.

(3) Tighten attaching screws when motor is loose on housing.

NOTE

When tightening jamnut on actuator shaft, center rod-end in clevis of lever so that self-aligning bearing will absorb any rotation of shaft.

(4) Deleted

4-125. Installation — Linear Actuator. a. Place control lever (3, figure 4-29) on governor control shaft (2) as near to 90 degrees to stop arm (20) as the serrations will permit. Manually move control lever (3) to full increase. If the lever contacts the overspeed governor, body, remove the lever and install it one or two serrations to the rear from the 90 degree position Move control lever to full increase again to be sure it does not contact the overspeed governor body. Install retaining bolt and washer (21) from the aft side through the lever and shaft groove. Torque bolt, and lockwire (C155) bolt head to lever shank.

b. Align actuator front end-fitting clevis on end of cambox slider. Insert spring washer between clevis and underside of cambox slider. Install bolt from top - secure with washer and nut Torque nut 5 TO 15 inch-pounds. Install cotter pin.

c. Attach actuator shaft cod-end with one washer AN960-10L on each side of rod-end bearing into clevis of governor control lever (3) with bolt; secure with washer, and nut. Torque nut 12 TO 15 inch-pounds. Omit cotter pin until rigging incomplete. If necessary, loosen bolts attaching cambox bracket (1) on engine to align actuator (4) to lever (3). After installing actuator, tighten and lockwire (C155) bracket bolt.

d. Remove actuator terminal cover. Connect electrical leads on terminals. (See wiring diagrams, Appendix F.) Reinstall terminal cover.

e. Check linear actuator for proper adjustment and operation (paragraph 4-121 and 4-122).

f. Adjustment of the linear actuator requires an engine run-up to insure the proper RPM range is obtained.

4-126. DROOP COMPENSATOR CONTROLS.

4-127. Description — Droop Compensator Controls. Droop compensation, to stabilize rpm as engine load fluctuates with changes in main rotor pitch, is provided by mechanical control linkages which translate motion from a collective pitch control bellcrank through the compensator cambox and linear actuator assemblies to the fuel control N2 governor lever (figure 4-29). Compensator linkage consists of two control rods and a torque tube, which has a shear pin in its forward arm to assure unhindered operation of collective pitch controls if compensator linkage should be come fouled.

4-128. Adjustment — Droop Compensator Controls. a. Ensure that collective pitch control system rigging has been completed (para. 11-6).

b. Lock collective pitch control stick in full up position, and adjust droop compensator control tube (16, figure 4-29) to align center of bolt hole in bellcrank (33) approximately level with top of support bracket (10). Due to shimming and manufacturer's tolerance, a variation of 0.250 inch from top of support bracket is possible and acceptable. (see detail D,)

c. Set cam adjustment (23) to middle of slot. (See detail C).

d. Move collective pitch control stick to full down position and lock.

NOTE

This is a nominal setting and is subject to change, if necessary, in following steps.

e. Adjust control tube (12) attached to cam bellecranks so that approximately 0.38 inch of cam slot is visible below cam housing.

f. Check Installation of governor control lever (3) as nearly at 90 degree angle to stop arm as serration alignment permits (Refer to figure 4-29 Detail A).

NOTE

The adjustment of the upper stop screw to 0.210 inch is the initial adjustment and may be subject to change to maintain proper clearance in the following steps.

NOTE

Never shorten either stop screw on governor to less than 0.060 inch length from inner side of boss. If this dimension cannot be obtained, remove governor stop arm from serrated shaft and move one (1) serration counter-clockwise, reinstall and safety.

g. Adjust upper governor stop screw to 0.210 inch for T53L-11 series and T53L-13 engines, measured from inner side of mounting boss. (See detail A.) Remove and discard lead seal on lockwire, if existing.

h. Disconnect actuator from governor control lever (3) by removing bolt.

i. Adjust linear actuator (paragraph 4-121). Accomplish operational check of linear actuator (para. 4-122).

j. Fully extend actuator shaft by holding GOV RPM switch to DECR. Lock collective pitch control stick in full down position,

k. Adjust lower stop screw for 0.010 inch clearance with governor stop arm, measured with a feeler gage Remove and discard lead seal on lockwire, if existing, Observe minimum length limitation, (Refer to Note preceding step g.) Check operation time on actuator, time from full increase to full decrease should be five (5) to ten (10) seconds If actuator fails to meet these requirements replace actuator.

l. Check for 6000 TO 6700 ·50 RPM range on initial ground run with collective stick full down. If above parameters are not met, proceed as follows:

CAUTION

To prevent internal damage. stop screw adjustment must be performed with actuator at midpoint of stroke.

CAUTION

If the following procedure is done with the engine running, the pilot must take manual control of the throttle and reduce N1 RPM to flight idle any time the control lever is disconnected from the linear actuator.

(1) Adjust the linear actuator adjusting screw(s) to obtain a 700 RPM spread. Once the required 700 RPM spread is obtained, fully decrease the linear actuator and check for 6000 RPM plus or minus 50 RPM

(2) To obtain the required 6000 RPM, loosen the jam nut that secures the linear actuator rod end bearing and remove the nut from the bolt securing the rod end bearing to the control lever. When preceding cautions are met, remove the bolt attaching the linear actuator to the control lever (3, figure 4-29) using care not to actuate the control lever during the removal process Turn the rod and bearing as required; one full turn of the rod end bearing changes the RPM 40 TO 50 RPM. (Clockwise increases RPM and counter-clockwise decreases RPM.)

(3) Connect the linear actuator rod end bearing to the control lever with the bolt and check for **6000 RPM**. After the **6000 RPM** is obtained, increase the linear actuator to insure that the linear actuator controls the RPM from **6000 RPM** to **6700** plus or minus **50 RPM**. After final adjustment is made, lockwire (C154) both stop screws.

m. Make final adjustments of droop compensator cam as required by flight checks. Set cam to maintain 6600 N2 RPM plus or minus 40 from full low pitch to full power. If RPM droop occurs, loosen adjustment bolt (23, figure 4-29), and rotate cam counterclockwise towards maximum compensation. If maximum compensation adjustment does not correct droop, lengthen control tube (12) to increase amount of cam slot showing below housing. Be sure roller does not bottom out at end of cam slot in either extreme travel.

4-128.1. Inspection of the Magnesium ClevisArm of the Droop Compensator Jackshaft Assembly.

NOTE

Magnesium clevis arms can be distinguished from aluminum clevis arms by the letter "M" for magnesium and "A" for aluminum vibro etched on the clevis. If no letter is found, refer to TM 11500204236, Paragraph 43.B, to determine if the clevis is magnesium or aluminum.

a. Check clevis arm (item 34, detail F, figure 4-29) for security by grasping the clevis arm and applying moderate force in several directions. If the clevis arm appears loose in the jackshaft tube it has probably failed. Replace jackshaft assembly as necessary.

b. Disconnect the control tube (12), atthe upperend, from the cambox assembly. Remove four screws that secure the support (10) and move support as far aft as possible while still engaging the jackshaft assembly.

c. Adjust the collective position so that the clevis arm of the jackshaft assembly is in the horizontal position.

CAUTION

If severe corrosion is present, the clevis arm could break off during the inspection below. Care should be taken to prevent personal injury while using the spring scale.

d. Using a short length of lockwire, form a loop through the rod end on the upper end of the control tube (12). Connect a spring scale to the lockwire and apply a 30 pound pull vertically on the control tube. Any visible movement of the clevis end in the jackshaft tube is cause for replacement of the jackshaft assembly.

e. Position collective to the full up position. Remove support (10).

f. Attach spring scale to clevis arm of the jackshaft assembly and apply a 30 pound pull in the aft direction. Any visible movement of the clevis end in the jackshaft tube is cause for replacement of the jackshaft assembly.

4-129 Removal Droop Compensator Controls.

a. Disconnect control tube (12, figure 4-29) from bellcrank of cambox assembly (5) by removing bolt (8) with nut (6) and washers (9). Disconnect control tube from torque tube arm at support (10).

NOTE

If cambox is removed from bracket, be sure shims remain in place on bellcrank pivot bolt between Inner race of bearing and sides of housing.

b. Remove cam assembly and bracket as an assembly by removing lockwire and two bolts at top of forward engine mount trunnion. Reinstall bolts to secure mount trunnion.

NOTE

Helicopters S/N 62-2106 through 63-13002 use control tube (16) that has an adjustable clevis end and a fixed rod-end. Helicopters S/N 64-13492 and subsequent use control tube (17) that has an adjustable rod-end and a fixed clevis end.

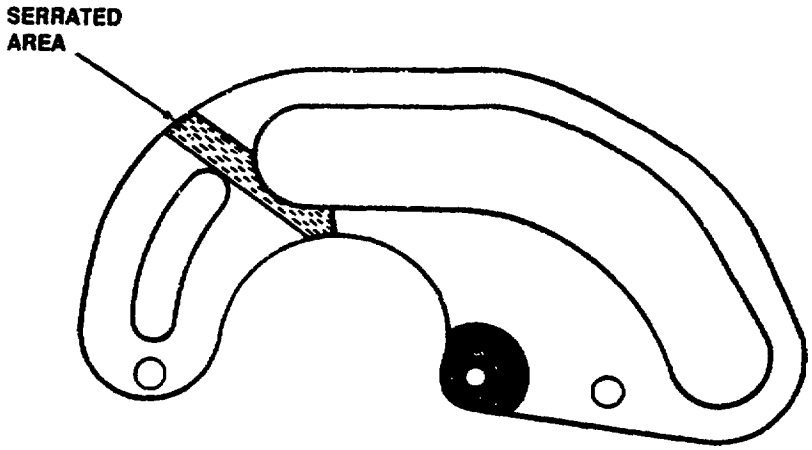
c. To remove control tube (16 or 17), enter fuselage through opening below pylon to disconnect tube clevis from collective pitch control bellcrank by removing bolt (8) with nut (6), washers (9) and cotter pin (7). Disconnect upper end of tube from torque tube bellcrank (25) in same manner.

d. To remove bellcrank and shear pin (28) from torque tube. Remove retaining nut and washer from torque tube fitting at forward side of bracket assembly (15). Remove screws and washers to detach bracket assembly from structure. Remove bracket assembly, washer, retaining washer (27), shims (26), bellcrank, and shear pin (28) from shear fitting (24) of torque tube (14).

e. When complete removal of torque tube (14) is necessary. Remove screws to detach support (10) from deck. Place an index mark, with suitable crayon or marking material, on shear fitting (24) and end of tube. Remove two bolts, with nuts and washers, and pull fitting from forward end of tube. Remove tube aft through firewall seal (13).

4-130. Inspection Droop Compensator Controls.

a. Inspect cam assembly and bracket attaching parts for evidence of damage, fouling, corrosion and for loose, missing or improperly installed hardware. Inspect cam for wear, binding and smooth operation. Replace part when damage exceeds repair limits provided on figure 4-30. If crack in cam assembly is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.



CAM 204-061-705 (T53-L-13 ENGINE)

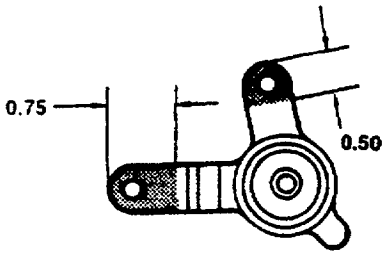
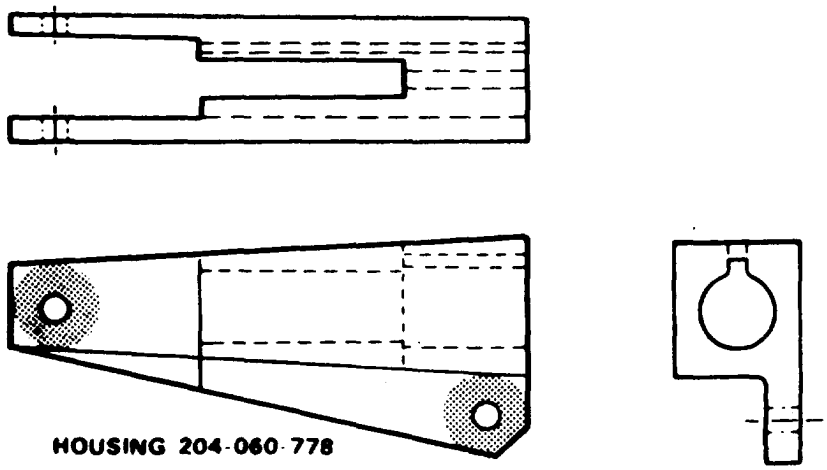


Figure 4-30. Cambox Assembly Damage and Repair Limits (Sheet 1 of 2)



DAMAGE AREA REPAIR SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
	▭	▬
NICKS AND SCRATCHES (AFTER REPAIR)	0.015 IN	0.005 IN.
CORROSION		
BEFORE REPAIR	0.0075 IN	0.005 IN.
AFTER REPAIR	0.015 IN	0.010 IN.
MAXIMUM AREA OF FULL DEPTH REPAIR	1.0 IN SQ.	0.10 IN. SQ.
NUMBER OF REPAIRS	ONE PER AREA	ONE PER AREA
EDGE CHAMFER	0.05 IN	0.04 IN.
CRACKS	NONE ALLOWED	NONE ALLOWED
BORE DAMAGE:	0.002 INCH DEPTH FOR ONE-FOURTH CIRCUMFERENCE	

NOTES:
1. No repairs allowed in area of serrations or on surfaces contacted by cam follower.
2. Maximum allowable radial play is 0.005 inch for both the AN201KP 3A and MS27644 3 bearings.
3. Maximum permissible repair on 23S5-3A sleeve is 0.002 inch for one fourth of circumference on inner or outer surfaces but not on both surfaces in the same quadrant.
4. Corrosion damage must be polished out to twice the depth of damage.

204061-1000-2

Figure 4-30. Cambox Assembly Damage and Repair Limits {Sheet 2 of 2)

b. Inspect linkage for damage, evidence of fouling, corrosion or other faulty condition. Inspector loose, missing or improperly installed hardware.

c. Inspect torque tubes, control rod, bellcranks, rod ends, and attaching parts for lost motion, excessive looseness, damage and corrosion. Inspect for missing or improperly installed hardware.

d. Inspect Droop Compensator Sheer Pin (28, Figure 4-29) for sheared condition. Nicks or scratches, not to exceed 0.01 inch deep. Pin Diameter to be not less than 0.11 inch on any part along its 0.45 inch long axis (Discount Chamfer).

4-131. Repair or Replacement - Droop Compensator Controls.

NOTE

Cam assembly, 204-060-787-9 (with cam, 204-061-705-1), must be used with T53-L-13 series engines.

a. Replace cam assembly, bracket, or attaching parts when repair limits of figure 4-30 are exceeded.

b. If necessary ,replace cam assembly (13, figure 4-37).

(1) Remove cotter pin (16), nut (10), washers (9), shims (11), and bdt (8). Remove bellcrank assmbly (12), cam (13) and assembly (1) from housing (7) and bracket as an assembled group.

CAUTION

Use cam 204-061-705, on T53-L-13 series engine.

(2) Remove pin (2) and separate cam (13). bearing (3) and slider assembly (1).

(3) Remove nut (15), serrated lockwasher (14), flat washer (4) and bolt (5). Remove rivet (6) and detach bellcrank assembly (12) from cam (13).

(4) Position bellcrank assembly (12) on cam (13) and install rivet (6).

(5) Install bolt (5) with flat washer (4) under head and serrated side of lockwasher (14) facing cam (13) under nut (15). Insure serrations on lockwasher are aligned with and engage narrations on cam.

(6) Assemble cam (13), bearing (3) and slider assembly (1) with pin (2).

(7) Position assembled bellcrank assembly, cam and slider assembly in housing (7). Install bolt (8), shims (11), washers (9), and nut (10). Use a maximum of four shims to obtain 0.001 TO 0.003 inch clearance before torquing nut. Torque nut (10) 12 TO 15 inch-pounds and secure with cotter pin (16).

c. Replace shear pin (28, figure 4-29) in forward arm of torque tube in event of failure. Investigate cause of failure, and correct any fouling of linkage or other faulty condition.

d. Replace damaged torque tubes, control rods, removable rod ends or attaching parts.

e. Minor scratches and corrosion in rods, torque tubes, bellcranks, brackets, fittings and levers may be polished out as follows:

(1) Remove corrosion and scratches that are within limitations using abrasive cloth (C1), to obtain a smooth scratch free surface.

NOTE

Do not prime mating surfaces of parts.

(2) Apply one coat of epoxy primer (C206) to repaired external surfaces.

f. Check rigging adjustment and operation of system after replacement of parts.

4-132. Installation — Droop Compensator Controls. a. Install cambox bracket (1, figure 4-29) on two upper bolts of forward mount trunnion at left side of engine inlet housing.

NOTE

Upper forward or lower aft bolt hole of bracket is oversize for alignment of actuator to governor control lever. Accomplish final tightening and lockwiring of bracket mounting bolts after connecting actuator to lever (paragraphs 4-11v and 4-125c, and figure 4-29).

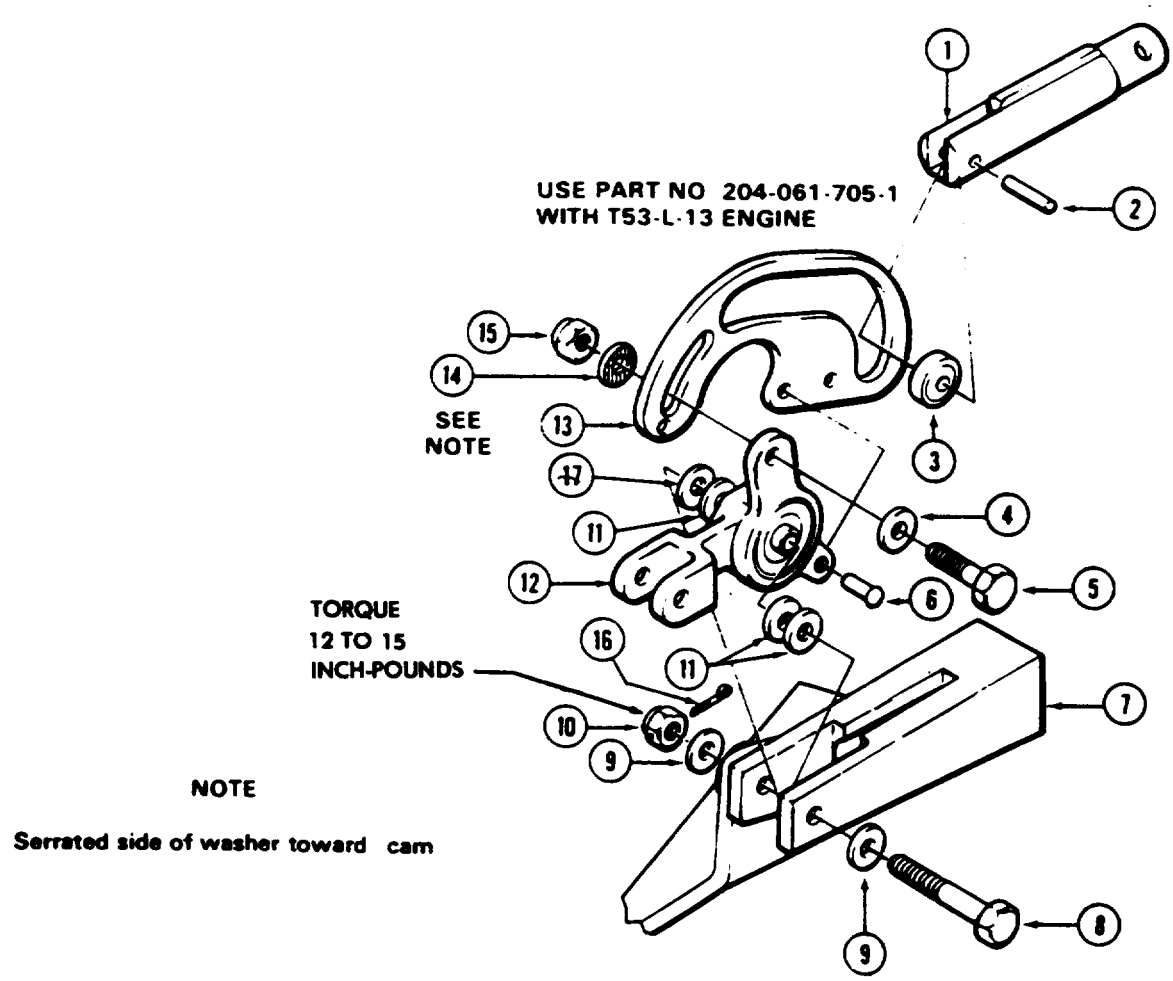
b. If cambox assembly (5) is separated from bracket (1), attach cambox assembly with two bolts installed through housing and bracket, and secure with nuts at inboard side. Use-shims (11 and 17, figure 4-37) on bellcrank pivot bolt (8) between bearing and housing at each side to provide 0.001 TO 0.003 inch clearance before torquing nut (10). Torque nut (10)12 TO 15 inch-pounds and secure with cotter pin (16).

c. If torque tube (14) was completely removed: Insert end of tube through firewall seal (13) from rear side. Place shear fitting (24) in end of tube, align index marks and bolt holes, and install two bolts secured by washers and nuts. Position support (10) to mounting holes in ermine service deck and secure with torque tube in support bearing.

CAUTION

Shear pin (28) substitution is not authorized.

d. If replacement shear fitting is received without the two holes drilled for attachment to torque tube, the two holes should be drilled at the time of assembly. Hole size 0.1895 TO 0.1915 match holes in torque tube. Holes to be drilled as shown in figure 4-38.



1. Slider assembly
2. Pin
3. Bearing
4. Washer
5. Bolt
6. Rivet
7. Housing
8. Bolt
9. Washer
10. Nut
11. Shim
12. Bellcrank
13. Cam
14. Serrated lockwasher
15. Nut
16. Cotter pin,
17. Shim

Figure 4-37. Droop Compensator Cam Replacement

e. Place bellcrank (25, figure 4-29) on end of shear fitting (24) align holes, and install shear pin (28) with head seated in counterbore recess on front of bellcrank.

f. Assemble shims (26) and retaining washer (27) on threaded stud of shear fitting (24) into bracket assembly (15). Install washer (31) and retaining nut (32). Check for 0.001 TO 0.003 inch clearance between bellcrank (25) and shear fitting (24). Change shim thickness if necessary.

Torque nut (32) 12 TO 15 inch-pounds.

g. Position bracket assembly (15) to mounting holes at left side of pylon supporting structure, and secure with screws, washers, and nuts.

h. Connect clevis end of control tube on collective pitch system bellcrank (18), using washers (9) under bolt head (8) and nut (6). Install cotter pin (7).

NOTE

If any side play is noted between the control tube and the bellcrank, shimming washers AN96010 may be used between the bearing inner race and the clevis to prevent over stressing the clevis.

i. Adjust control tube (16 or 17) to position torque tube arm correctly. Connect tube to bellcrank (25), using thin steel washers between bearing and sides of bellcrank clevis and thin alloy washers (9) under bolt head (8). Install nut (6), torque 12 TO 15 inch-pounds, and install cotter pin (7).

j. Connect nonadjustable end of control tube (12) to arm at rear of torque tube. Insert bolt (8), with head facing aft, two washers (9), nut (6), and cotter pin (7). Connect upper end of control tube to cam bellcrank after adjustment procedures.

k. Adjust droop compensator controls (paragraph 4-128).

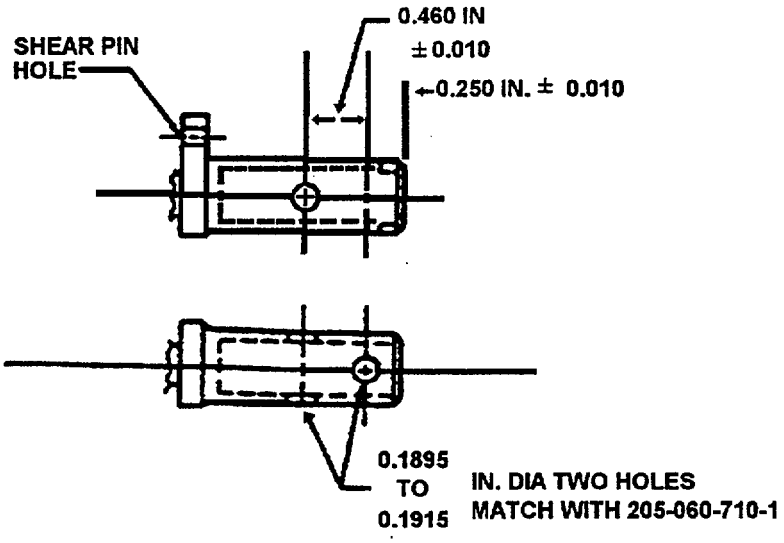


Figure 4-38. Shear Fitting Hole Location

SECTION VIII. QUICK CHANGE ASSEMBLY (AVIM)

4-133. ENGINE QUICK CHANGE ASSEMBLY.

4-134. Description - Engine Quick Change Assembly. Procedures contained herein include all information required for the build-up of the L13 series Lycoming engine quick change assemblies. These procedures include the following; removal of bare engine from shipping container, installation of engine in work stand, installation of all components and accessories necessary for preparation of engine for installation on helicopter or storage presentation, and inspection of completed engine quick change assemblies. Also included in this section is a listing of special tools, test equipment, and special instructions, as necessary, required for the build-up operations.

4-135. Special Tools – Engine Quick Change Assembly. All special tools required in the buildup of the Lycoming series engines, as quick change engine assemblies, are called out and identified by T number in Premaintenance Requirements for Engine Quick Change Assembly.

Premaintenance requirements for engine quick change assembly

Conditions	Requirements
Model	All
Part No. or Serial No,	All
Special Tools	(T10), (T71), (T17),(T18)
Test Equipment	None
Support Equipment	Hoist 800 lbs capacity minimum
Minimum Personnel Required	Two
Consumable Meterials	(C25), (C47), (C155), (C161), (C259), (C295), (C312)
Special Environmental Condition	None

4-136. Special Instructions — Engine Quick Change Assembly. in locating various engine components, the parts are described in their relation to the position of the engine as installed in the airframe, The air intake is to the front of engine and exhaust at the rear of engine. Reference to the left side and the right side of the engine is made with the observer standing at the rear of the engine looking forward. Components such as the cambox end actuator are on the left side of engine. The starter-generator is on the bottom right side of engine. Information regarding engine model number, serial number, etc., can be obtained from data plate attached to engine case at left topside of engine just above cambox assembly.

4-137. Standard Torque Values — Engine Quick Change Assembly. Consult Table 1-4, for the torque values of items in this section requiring standard torques.

4-138. Part Numbers and Usable on Codes. a. Instructions contained in this section define procedures for build-up of T53-L-13 series engine assemblies.

b. When necessary to identify usable on codes or part numbers of parts illustrated in this section, refer to TM 55-1520-210-23P, and TM 55-2840-229-23P.

c. Helicopters 72-21465 and subsequent, and helicopters modified by MWO 55-1520-210-30-39 have crashworthy breakaway couplings on the engine fuel and oil hoses. On these engines ensure that breakaway couplings and correct hoses are installed.

4-139. ENGINE BUILD-UP PREPARATION.

4-140. Inspection. Visual inspection of the engine should be accomplished prior to accomplishing any build-up procedures. inspect the engine upon receipt from manufacturer or storage as follows:

a. Ensure that container is unpressurized prior to removal of cover.

b. After container is opened, but before engine is removed from container, check the following:

(1) Check that engine records are enclosed and current.

(2) Check that humidity indicator indicates SAFE (blue).

(3) Visually inspect engine as mounted in container for possible shipping damage, i.e., bent or broken lines, and overall engine surfaces for evidence of nicks, pitting, and corrosion.

4-141. Engine Removal From Shipping Container.

a. Remove engine records from receptacle on outside of shipping container (figure 4-39).

b. Check humidity indicator.

c. Release air pressure in container by removing filler valve core.

WARNING

Do not open container until completely depressurized.

d. Remove shipping container cover bolts, after all air pressure has been dissipated.

e. Position a suitable lift cable or chain on suitable hoist and attach cable or chain to container cover. Cable capacity minimum **200** pounds. Hoist capacity minimum **800** pounds (figure 4-39).

CAUTION

Lift cover straight up to avoid striking or damaging the engine.

f. Remove cover from container.

g. Attach lifting sling assembly (T10) to engine attach points (figure 4-40). Remove eight engine - container bolts and lift engine clear of container. Remove safetywire from sixteen bolts securing four shipping mounts to engine. Remove sixteen bolts and four mounts from engine.

h. Remove plastic cover from engine.

i. Install engine on build-up stand (T71) (figure 4-41).

NOTE

Use of a build-up stand which will allow the engine to be placed in vertical position will facilitate installation of engine accessories.

(1) Remove engine inlet cover (1, figure 4-40).

(2) Adjust hoist as necessary and guide engine into stand. (See figure 4-41.)

(3) Loosen nuts that secure clamps to ring of stand and slide clamps toward outside diameter of plate. Secure clamps in this position.

(4) Guide front end of engine into opening of plate so that inlet housing is flush against rear of plate.

(5) Position clamps over inlet housing flange and tighten nuts to secure engine to plate.

(6) Remove hoist and lifting sling.

j. Remove shipping trunnions from engine mount pads.

k. Disconnect electrical lead (1, figure 4-42) from ignition unit (2). Install danger tag stating, "DO NOT CONNECT UNTIL GROUND RUN" I. Rotate engine in maintenance stand until in the vertical position.

m. Remove all plastic plugs from around engine inlet housing.

n. Remove existing tape from igniters and leads. Apply anti-seize compound (C47) or equivalent on igniter threads. Install four or two igniters on engine and connect leads. Lockwire (C154) leads to existing screws on engine. ■

o. If another engine is not to be installed in shipping container, proceed with the following:

(1) Reinstall shipping trunnions in bottom half of shipping container.

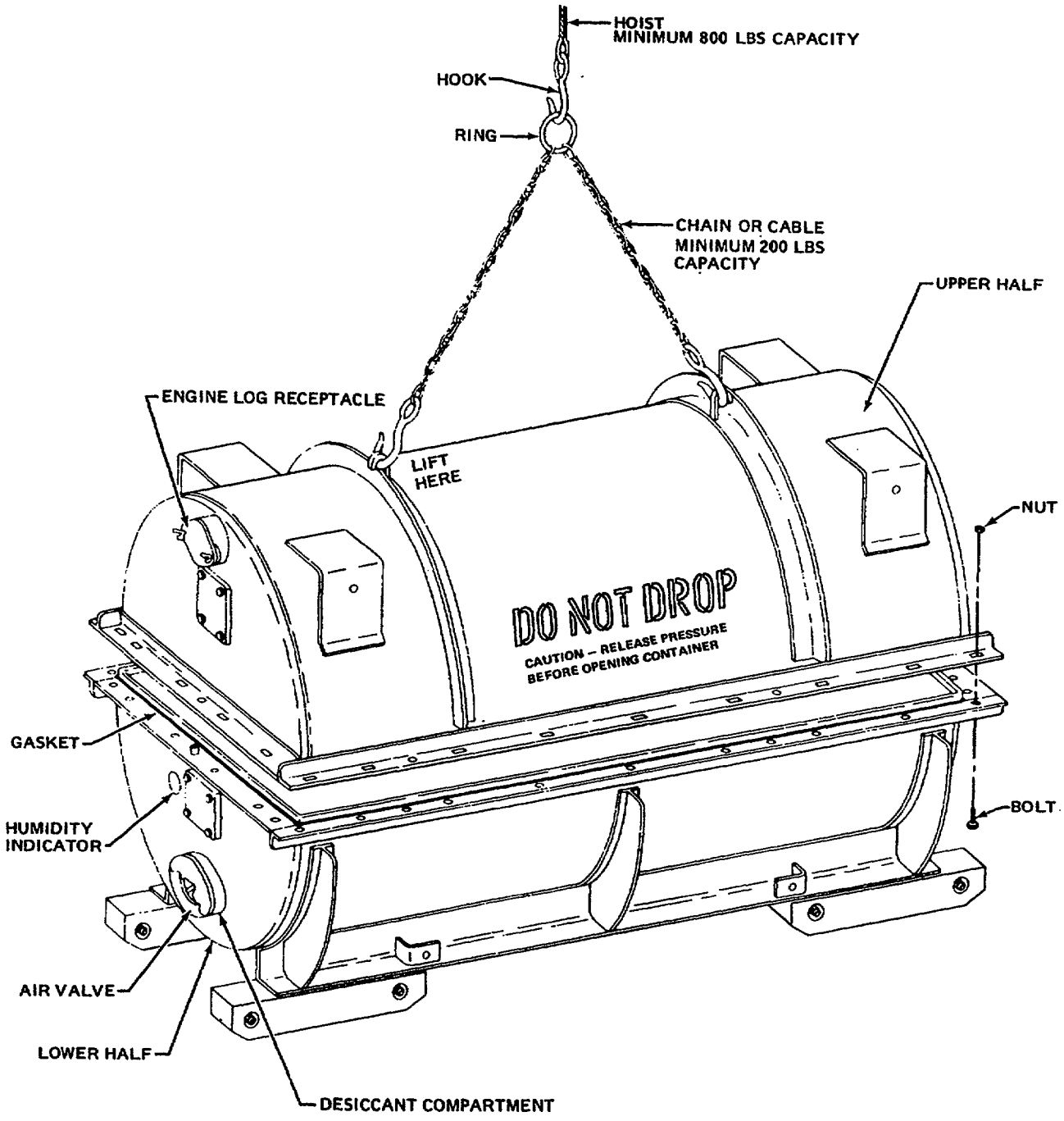


Figure 4-39. Removing Shipping Container Cover

(2) Place top half of shipping container on bottom half. Install four bolts and nuts, one at each corner, tighten finger tight. Shift upper half of container as necessary to align flange bolt holes in top and bottom halves of container.

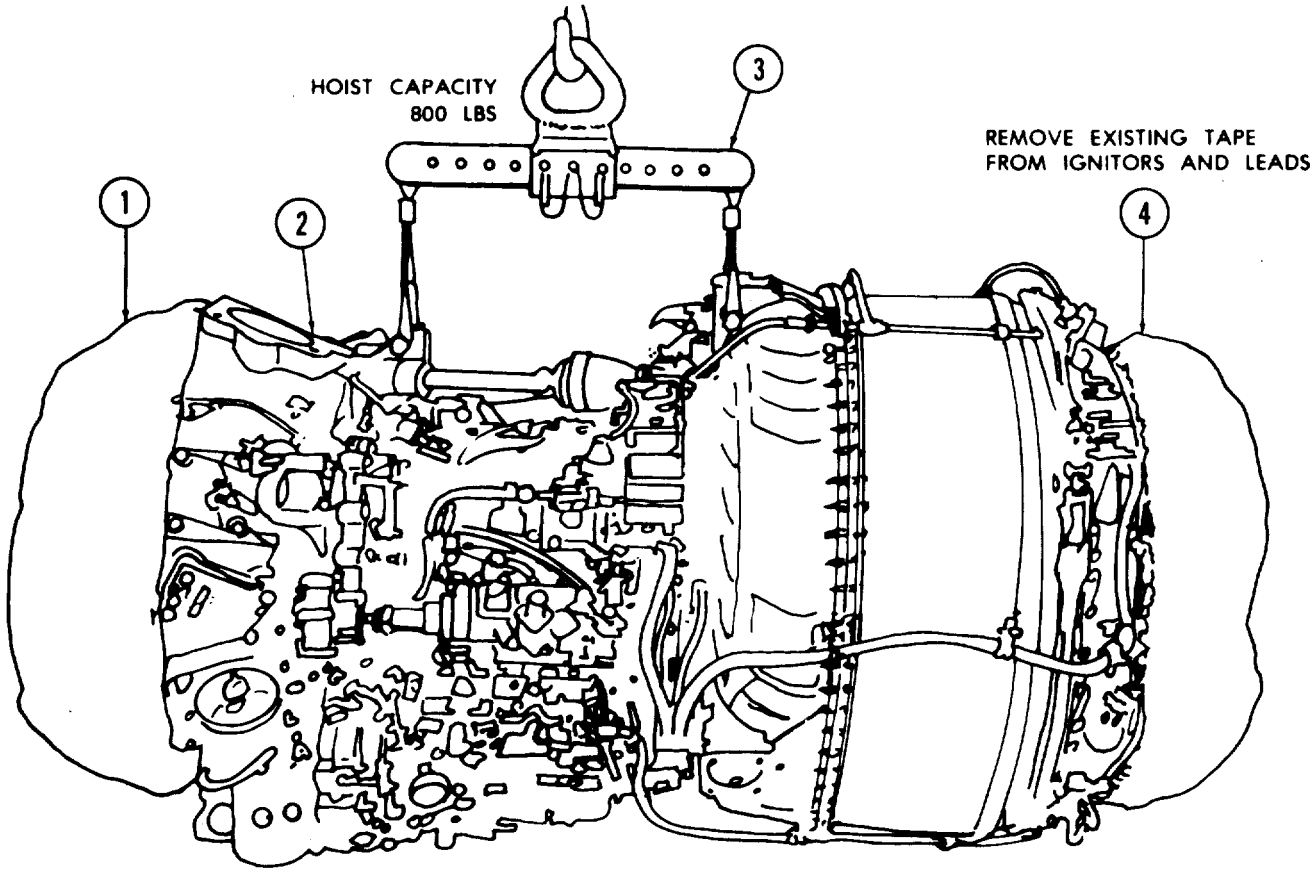
(3) Install bolts and nuts at midpoints of sides and ends of shipping container. Install all remaining bolts and nuts. Torque nuts, in order of installation, 500 TO 640 inch-pounds.

(4) Deleted.

(5) Using clean dehydrated air, pressurize container 4 to 6 psi. Check container seals for leaks by applying liquid soap (C259) and observing for air bubbles.

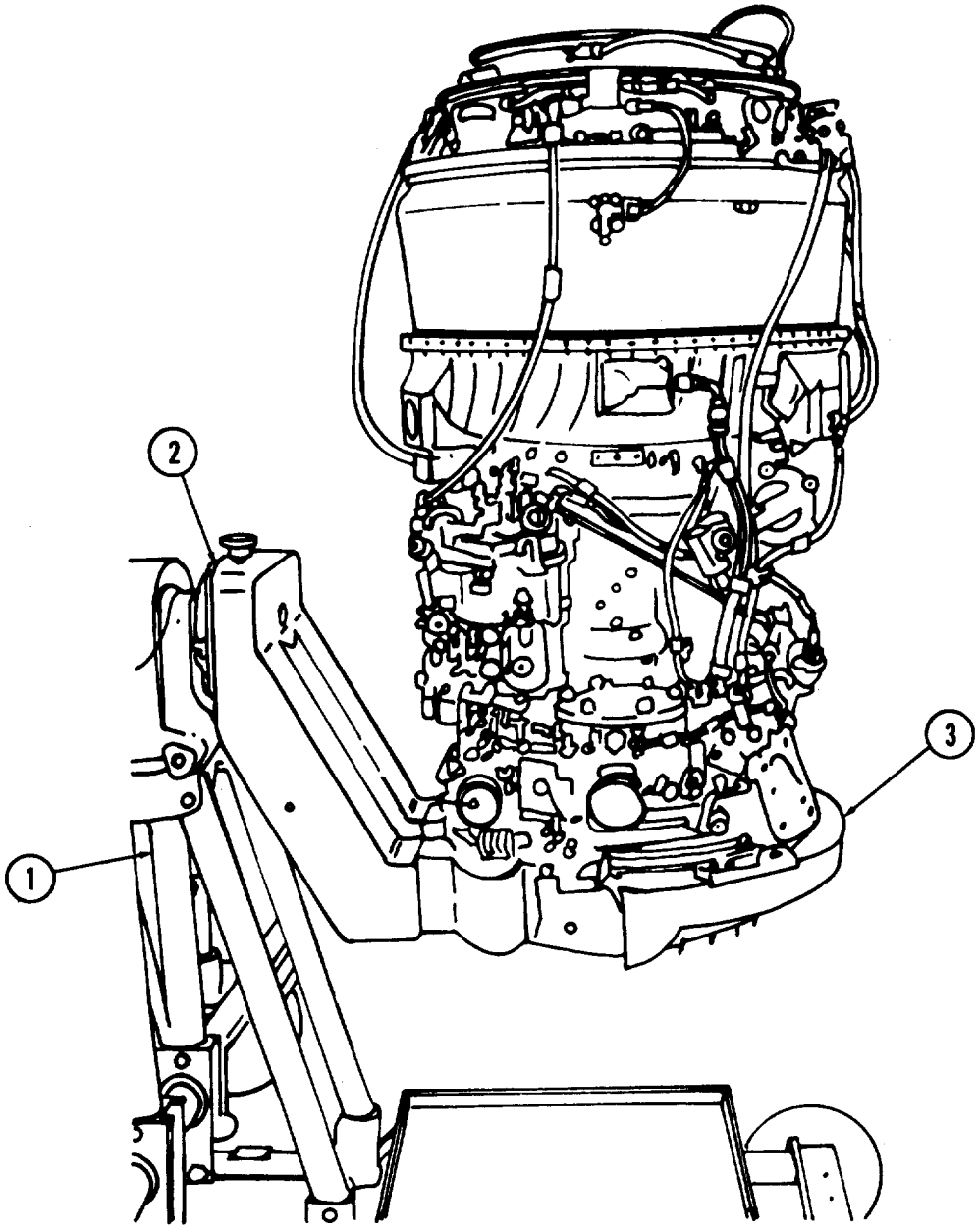
4-142. ENGINE QUI CK CHANGE ASSEMBLY BUILD-UP.

4-143. Firewall and Tailpipe Assembly Installation. a. Inspect condition of parts to be installed on engine.



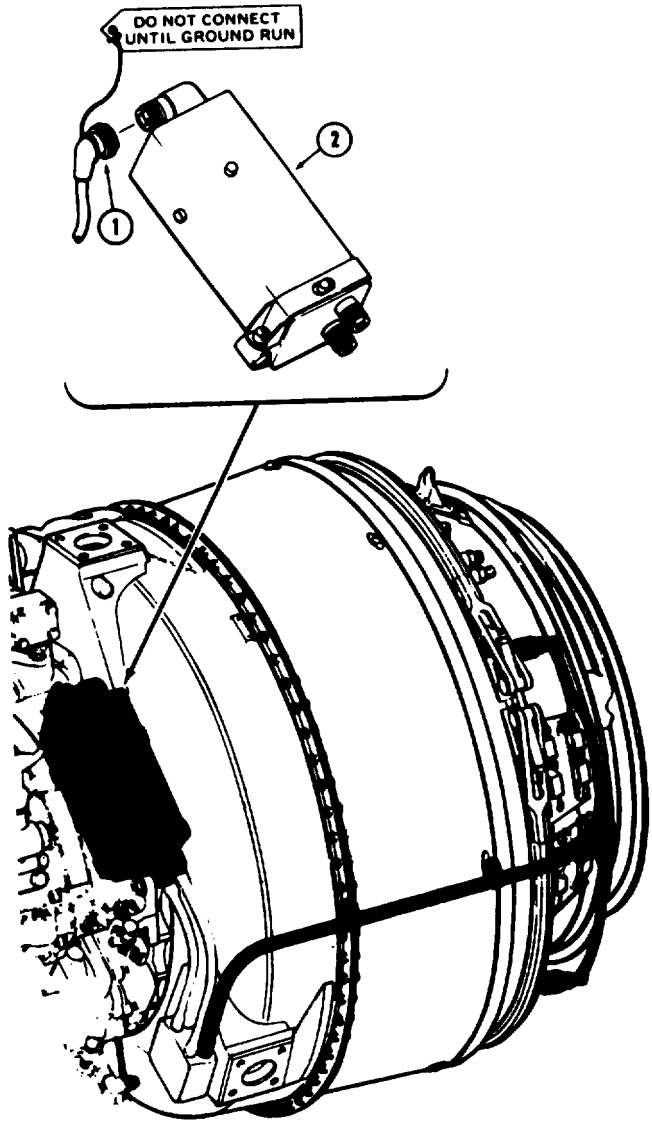
1. Inlet cover
2. Engine assembly
3. Engine ding (T10)
4. Exhaust cover, item 13, table 1-3

Figure 4-40. Engine Sling Installation



1. Engine and transmission stand (T71)
   (Note: Stand being replaced by stand (T70))
2. Engine arm (T17)
3. Engine adapter (T18)

Figure 4-41. Engine Build-Up Stand



1. Electrical lead
2. Ignition unit

Figure 4-42. Ignition Unit

b. Position clamp (2, figure 4-43) and firewall (4) on engine flange with flat side of firewall down.

c. Align cowling beam support bracket (3) with the tap center line of engine.

CAUTION

Use new self-locking nuts when installing V-band coupling clamps.

NOTE

Position clamp so there is no interference with exhaust diffuser support cone.

d. Tighten nuts on clamp (2) evenly. Torque clamp 100 TO 130 inch-pounds.

e. Tap around clamp (2) with soft faced mallet to ensure clamp is properly seated. Retorque nuts 100 TO 130 inch-pounds. Recheck torque after test flight or engine ground check.

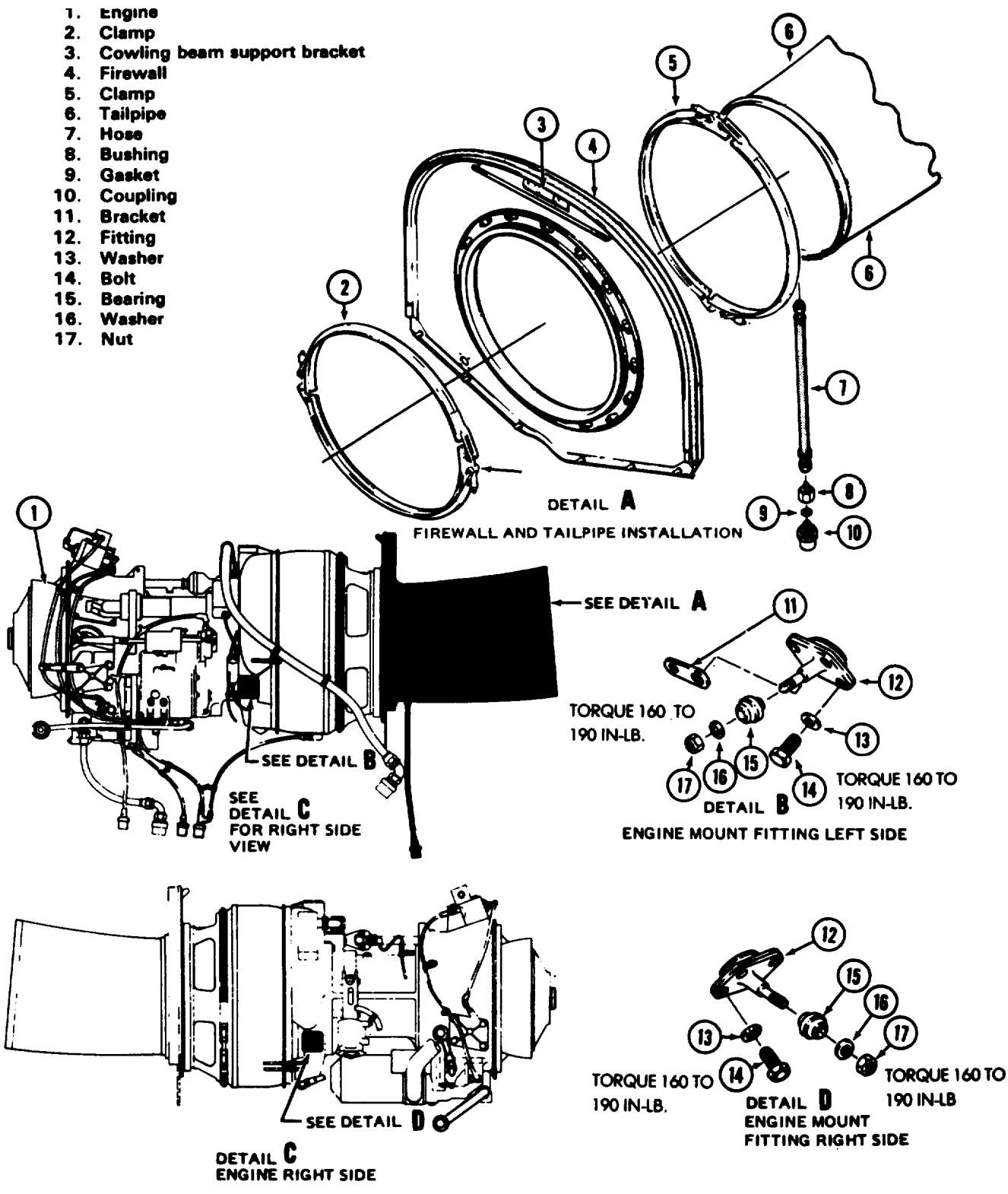


Figure 4-43. Firewall. Tailpipe and Engine Mount Fittings Installation

NOTE

Install tailpipe removed from old power plant, follow steps f. through h. If a new tailpipe is being installed, follow steps f. through i.

f. Position clamp (5) with Vband split located at 6 o'clock position and tailpipe (6) on engine flange with dowel pins in tailpipe aligned with indentions in engine flange.

g. Tighten nuts on clamp evenly. Torque clamp 100 TO 130 inch-pounds.

h. Tap around clamp with soft faced mallet to ensure clamp is properly seated. Retorque nuts 100 TO 130 inch pounds. Check torque after test flight or engine ground check.

i. Install hose (7) on fitting in bottom of tailpipe. Install bushing (8) in lower end of hose. Place gasket (9) on coupling half (10) and install coupling half in bushing (8).

4-144. Engine Mount Fittings Installation.

a. Position fitting (12, figure 4-43) on left and right side of engine and install bolts (14) with washers (13) under heads. Place bracket (11) on lower forward bolt of left fitting only.

b. Torque bolts (14) and lockwire (C155). Torque 160 TO 190 inch-pounds.

c. Place bearing (15), washers (16) and nut (17) on fittings (12), torque nut 160 TO 190 inch-pounds.

4-145. Governor Arm and Fuel Control Shaft Lever Installation.

NOTE

Install bolts for securing lever and arm with bolts through unthreaded portion of lever and arm.

a. Remove lockwire securing existing stop arm to adjustment screw on fuel governor control shaft. Move stop arm against top stop screw.

b. Install lever (1, figure 4-44) on governor control shaft at ninety degree angle to centerline of shaft stop arm, as serrations permit. Place washer (2) under head of bolt (3) and tighten bolt. Lockwire (CI55) bolt (3) to lever (1).

c. Remove lockwire securing existing stop arm to adjustment screw on fuel control shaft. Install arm (59) on shaft in line with existing stop arm, with existing stop arm set against aft stop screw. Secure arm to shaft with screw (60). Secure screw to arm with lockwire (C155).

4-146. Trunnion, Cam Assembly, and Linear Actuator Installation.

a. Apply primer (C312) to trunnion (21, figure 4-44) and engine mounting pad. Let dry completely.

NOTE

Properly align trunnion prior to fully seating it in mounting pad.

b. Position trunnion (21) on left side of engine. Install bolts (15), one in upper forward corner and one in lower aft comer of trunnion, snug bolts down evenly until trunnion is fully seated.

c. Remove bolts (15) from trunnion, place thin washer (16) on short bolt and install bolt through lower forward comer of trunnion.

d. Place thin washer (16) on short bolt (15) and install through bracket (20) and lower aft holes of trunnion (21). Torque bolts 480 TO 690 inch-pounds and lockwire (C155), refer to paragraph 2-272.(4).

NOTE

Cambox assembly 204060787 (with cam 204061705) will be used with T53L13 series engines. (Paragraph 4-131.)

e. Position cambox assembly (14) over top mounting holes of trunnion (21). Place washer (19) on bolt (17) and install through upper aft holes of cambox assembly (14) and trunnion (21).

NOTE

Bracket (18) washer (19) and bolt (17) can not be installed in the upper forward trunnion holes at this time. Due to the lack of space between the engine inlet housing and the maintenance stand, these items must be installed during engine installation into the aircraft or after installation on maintenance trailer.

f. Position engine governor control shaft to mid position between stops.

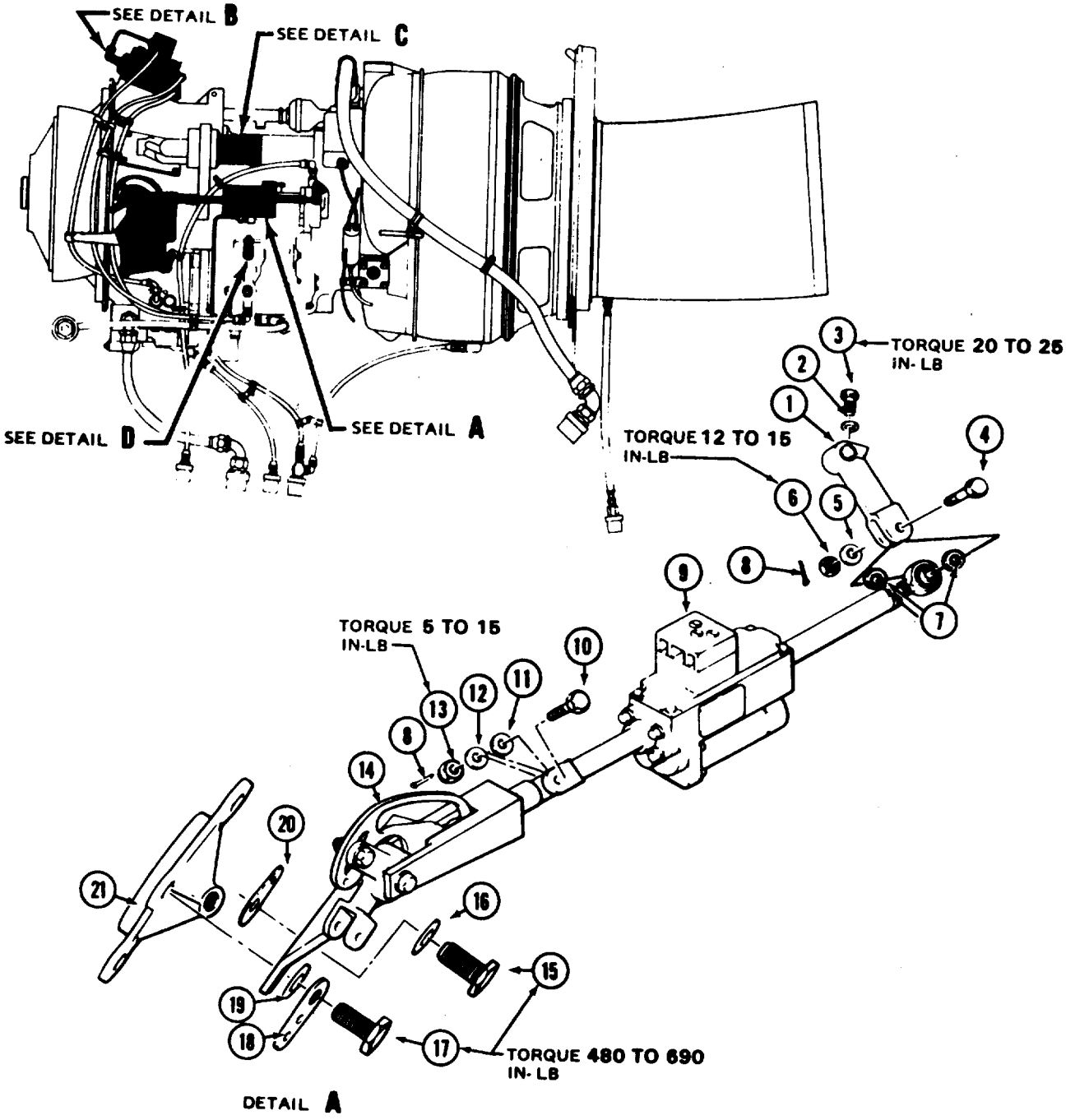
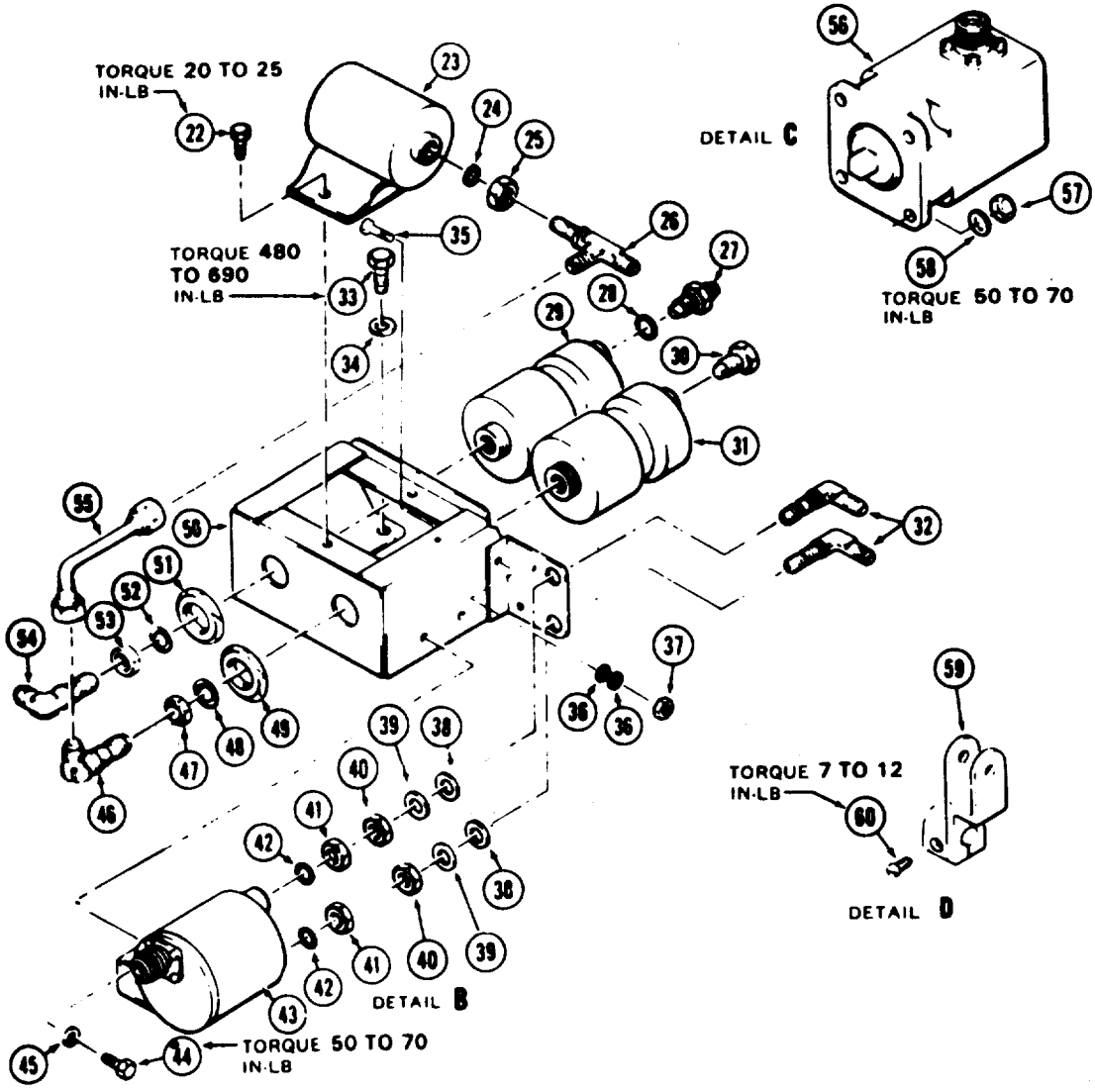


Figure 4-44. Engine Accessory Installation - Left Side (Sheet 1 of 2)



1. Lever
2. Washer
3. Bolt
4. Bolt
5. Washer
6. Nut
7. Washer
8. Cotter pin
9. Actuator, linear
10. Bolt
11. Washer
12. Washer
13. Nut
14. Cambox assembly
15. Bolt
16. Washer
17. Bolt
18. Bracket
19. Washer
20. Bracket
21. Trunnion, left hand
22. Bolt
23. Switch, oil pressure
24. Preformed packing
25. Nut
26. Tee
27. Union
28. Preformed packing
29. Transmitter, torquemeter
30. Plug
31. Transmitter, oil pressure
32. Elbow
33. Bolt
34. Washer
35. Bolt
36. Washer
37. Nut
38. Washer
39. Washer
40. Nut
41. Nut
42. Preformed packing
43. Switch, fuel pressure
44. Bolt
45. Washer
46. Elbow
47. Nut
48. Preformed packing
49. Nut
50. Support
51. Nut
52. Preformed packing
53. Nut
54. Elbow
55. Tube assy.
56. Tachometer generator, power turbine (N2)
57. Nut
58. Washer
59. Power lever control arm
60. Screw

Figure 4-44. Engine Accessory Installation - Loft Side (Sheet 2 of 2)

g. Attach linear actuator (9) to lever (1) as follows:

(1) Position linear actuator with terminal block facing up. Position rod end of linear actuator (9) in clevis of lever (1) with thin washer (7) on each side of rod end.

(2) Install bolt (4) through rod end and clevis. Place washer (5) and nut (6) on bolt (4). Torque nut 12 TO 15 inch-pounds and install cotter pin (8).

h. Attach linear actuator (9) to cambox assembly as follows:

(1) Position slider of cambox assembly in clevis of linear actuator (9) with spring washer (11) positioned against lower side of slider.

(2) Install bolt (10) through slider and clevis. Install washer (12) and nut (13). Torque nut 5 TO 15 inch-pounds. Install cotter pin (13).

4-147. Torquemeter Transmitter, Oil Pressure Transmitter. Oil Pressure Switch and Fuel Differential Pressure Switch Installation.

NOTE

Ensure that all openings are covered and that all unconnected hoses and lines are covered or capped, after each installation.

a. Position one elbow (32, figure 4-44) through hole in bracket on support (50). Place thin washer (38) and washer (39) on elbow. Install nut (40) on elbow with inside chamfer against washer; do not torque nut. Place nut (41) and packing)42) on elbow.

b. Repeat step a to install remaining elbow (32).

c. Position fuel differential pressure switch (43) to bracket on support and install elbow (32) onto switch until mounting holes in switch align with mounting holes in support (50).

d. Install washers (45) and bolts (44).

e. Position end of elbows (32) pointing outboard and torque nuts (40).

f. Place packings (42) against mating surface of switch (43) and torque nuts (41).

NOTE

If bolt (AN3-4A) between upper edge of bracket and support (60) is not installed, install bolt, two washers (AN960C10) and self-locking nut (MS21042L3).

Coat mating surfaces of engine and support (50) with primer (C312) and allow to completely dry. Position support over matching holes in engine. Place washers (34) on bolts (33) and install, lockwire (C155) bolts in pairs.

h. Place nut (47) and packing (48) on elbow (46). Screw elbow (46) into oil pressure transmitter (31). Install vented plug (30) in oil pressure transmitter (31). Position oil pressure transmitter through mounting hole of support (50) and install nut (49) to secure in place, with elbow (46) pointing up.

i. Place packing (28) on union (27) and install union in torquemeter transmitter (29). Place nut (53) and packing (52) on elbow (54) screw elbow into transmitter.

j. Position transmitter through support (50) with union {27) at top and install nut (51) to secure in place, with elbow (54) pointing to right.

k. Secure elbow to transmitter by torquing nut (53). Lockwire (C155) nuts (49 and 51) together.

l. Place nut (25) and packing (24) on tee (26) and install tee in oil pressure switch (23). Position switch on support (50) with tee to left and install bolts (22).

m. Attach tube assembly (55) to elbow (46) and tee (26). Torque nuts (25 and 47) to secure elbows and tee.

4-148. Hoses, Tubes, and Attaching Parts Installation on Engine Left Side. a. Install bleed air hose (13, figure 4-45) as follows:

(1) Remove bolts, cover and gasket from bleed air adapter on engine. Detail B, figure 4-45.

(2) Position gasket (20) on adapter (19) with fitting up and slanted 46 degrees toward the front of the engine, to engine bleed air adapter. Install four washers (18) and bolts (17) with lockwire (C155).

(3) Install bleed air hose (13) on coupling half (19).

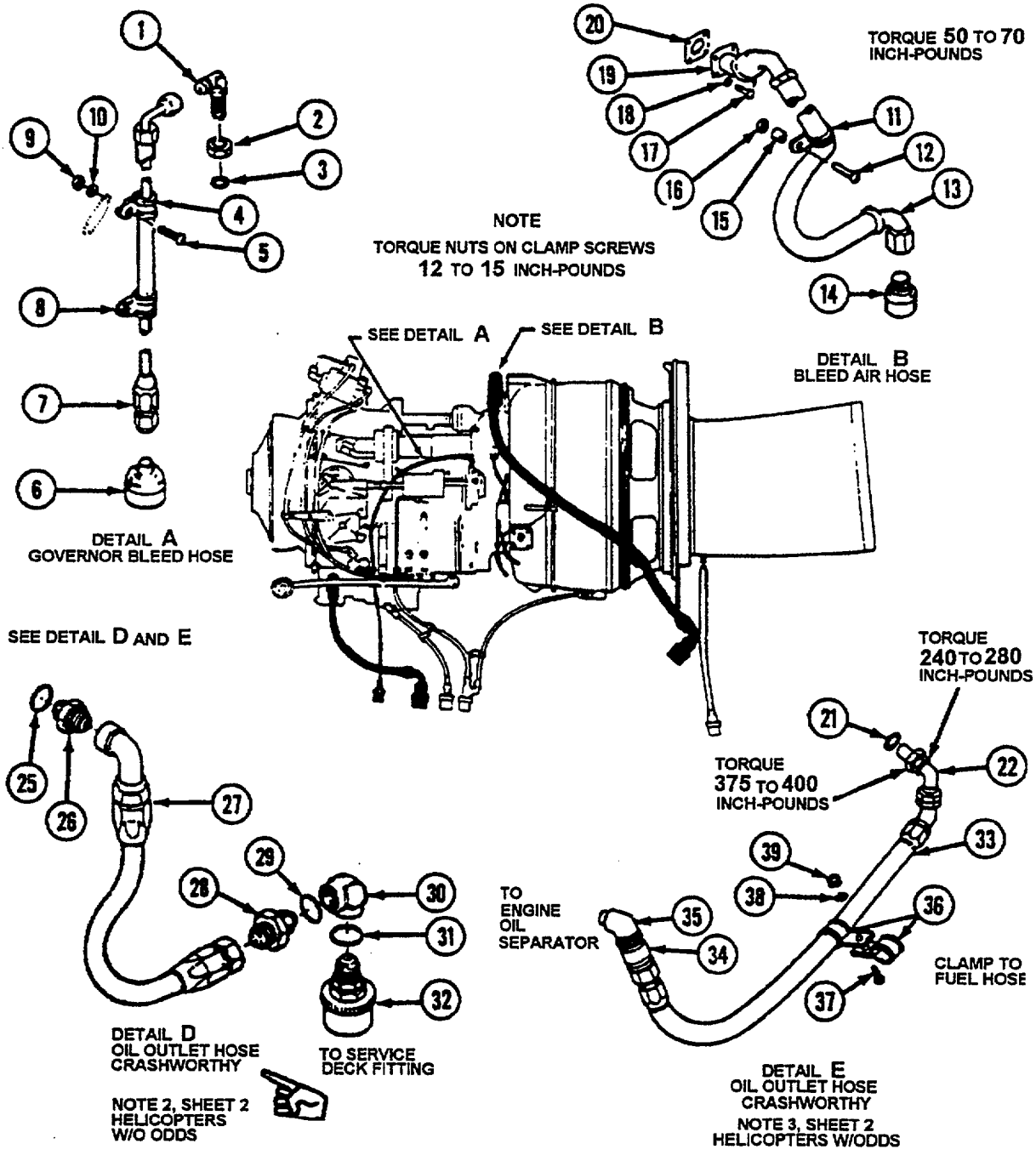


Figure 4-45. Bleed Air and Inlet Hoses Installation (Sheet 1 of 2)

NOTES.

1. Deleted.

2. Oil outlet hose (detail D) may be used on crashworthy systems. In crashworthy systems hose (27) is P/N 205-062-650-23 and coupling (32) is P/N 205-063-602-5

3. Ballistic-sealing oil outlet hose and crashworthy coupling halves (Detail E) used on helicopters with ODDS

1. Elbow
2. Nut
3. Packing
4. Clamp
5. Screw
6. Coupling
7. Governor bleed hose
8. Clamp
9. Nut
10. Washer
11. Clamp
12. Screw
13. Bleed air hose
14. Coupling
15. Spacer
16. Nut
17. Bolt
18. Washer
19. Adapter
20. Gasket
21. Deleted
22. Deleted
23. Deleted
24. Deleted
25. Packing
26. Reducer
27. Oil outlet hose
28. Union
29. Packing
30. Elbow
31. Packing
32. Coupling
33. Oil outlet hose (ODDS)
34. Coupling half (ODDS)
35. 90-Degree coupling half (ODDS)
36. Clamp
37. Bolt
38. Washer
39. Nut

Figure 4-45. Bleed Air and Oil Inlet Hose Installation (Sheet 2 of 2)

(4) Install coupling half (14) on other end of bleed air hose (13).

(5) Remove existing screw and nut, attaching clamp on ignition lead to bracket on flange of combustion turbine. Retain nut for use on clamp installation.

(6) Position clamp (11) on bleed air hose (13). Install screw (12) through clamp, spacer (15) and clamp on ignition lead; install nut (16).

b. Install governor bleed hose (7) as follows:

(1) Remove shipping plug from overspeed governor post above governor control shaft.

(2) Place nut (2, figure 4-45, detail A) and packing (3) on elbow (1). Install elbow in port and tighten nut to secure in position.

(3) Install governor bleed hose (7) on elbow route hose down between the overspeed governor body and next to the compressor case.

(4) Place clamp (4) on hose and attach to support on, engine mount trunnion support with screw (5), washer (10) and nut (9).

(5) Place clamp (8) on hose; do not secure at this time.

c. Install oil outlet hose (23 or 27) as follows:

(1) Remove shipping plug from engine oil pump port.

NOTE

Some engines will have oil outlet hose installed as shown in Detail D. Accomplish step (3) for hoses shown in Detail D.

(2) Install oil outlet hose (23, Detail C) as follows.

(a) Place packing (21) on elbow (22) and install elbow in oil pump port. Torque swivel adapter 375 to 400 inch-pounds, and jam nut 240 to 280 inch-pounds.

(b) Install oil outlet hose (23) on elbow (22).

(c) Install coupling (24) on oil inlet hose (23).

(3) Install oil outlet hose (27, Detail D) as follows:

(a) Place packing (25) on reducer (26) and install reducer in oil pump port.

(b) Install oil inlet hose (27) on reducer (26).

(c) Place packing (29) on union (28) and install in elbow (30). Place packing (31) on coupling (32) and install elbow (30) on coupling (32).

(4) Install oil outlet hose (33, Detail E) as follows:

(a) Place packing (21) on elbow (22) and install elbow in oil pump port. Torque swivel adapter 375 TO 400 inch-pounds, and jam nut 240 TO 280 inch-pounds.

(b) Connect oil outlet hose (33)(45° end) to elbow (22).

(c) Connect oil outlet hose (33) (straight end) to 90° and straight coupling halves (34 and 35) in oil separator inlet port.

d. Install fuel pump and combustion chamber drain hoses (figure 4-46) as follows:

(1) Remove shipping plugs from overspeed governor and fuel control drain ports.

(2) Place packing (10, figure 4-46) on reducer (9) and install reducer in overspeed governor drain port.

(3) Place nut (6) and packing (5) on tee (7) and install tee in fuel control drain port.

(4) Install tube assembly (8) between reducer (9) and tee (7), turning tee to align. Tighten nut (6) to secure tee in position.

(5) Install hose (17) on tee (7) and install reducer (18), packing (19), tee (20), packing (23), and coupling half (24) on lower end of hose.

(6) Install hose (16) on drain port on bottom of combustion chamber.

(7) Install packing (21) on reducer (22) and install in tee (20). Connect hose (16) to reducer (22).

(8) Remove shipping plug from starter-generator pad left hand drain port. Place packing (4) on restrictor (3) and install in port. Connect hose (2) to restrictor and install coupling half (1) in lower end of hose.

(9) Position clamp (13) on hose (2) and clamp (15) on hose (17) and secure with screw (14), washer (12) and nut (11). (See Detail A, figure 4-46.)

(10) Position clamp (15) on hose (16) and clamp (13) on hose (17) and secure with screw (14), washer (12) and nut (11). Torque nut 12 to 15 inch-pounds. (See Detail A, figure 4-46.)

e. Install fuel differential and oil pressure hoses as follows:

(1) Connect hose (1, figure 4-47) to oil pressure switch, hose (3) with 45 degree elbow to upper elbow in fuel differential switch and hose (2) with 45 degree elbow, to lower elbow.

(2) Remove lower forward mount bolt (19) and washer (18) from overspeed governor tachometer drive assembly. Place support (17) on bolt and reinstall bolt and washer, lockwire (C155) bolt. (See Detail B, figure 4-47.)

(3) Remove plugs from lower set of ports in fuel control directly above fuel control data plate. Place packing (5) on restrictor (4) and install in forward port. Place packing (6) on restrictor (7) and install in aft port. Install hose (2) on restrictor (7) and install hose (3) on restrictor (4).

(4) Remove shipping plug from port in oil filter, Place nut (9) and packing (10) on elbow (8) and install elbow in port. Position elbow pointing upward and secure with nut (9). Install hose (1) on elbow (8).

(5) Position clamp (40) on hose (2) and clamp (38) on hose (3). Secure clamps together with screw (39), washer (41) and nut (42). (See Detail F, figure 4-47.)

NOTE

Steps (6) through (9) can not be completed at this time due to the lack of space between the engine inlet housing and the maintenance stand. These items must be installed during engine installation.

(6) Position clamp (22) on hose (3) and clamp (21) on hose (2). Secure clamps to support (17) with screw (20), washer (16) and Nut (15). (See Detail B, figure 4-47.)

(7) Position clamp (35) on hose (2). Position damp (34) on hose (1). Secure to inboard hole in support on engine mount with screw (36), washer (33) and nut (32). (See Detail E, figure 4-47.)

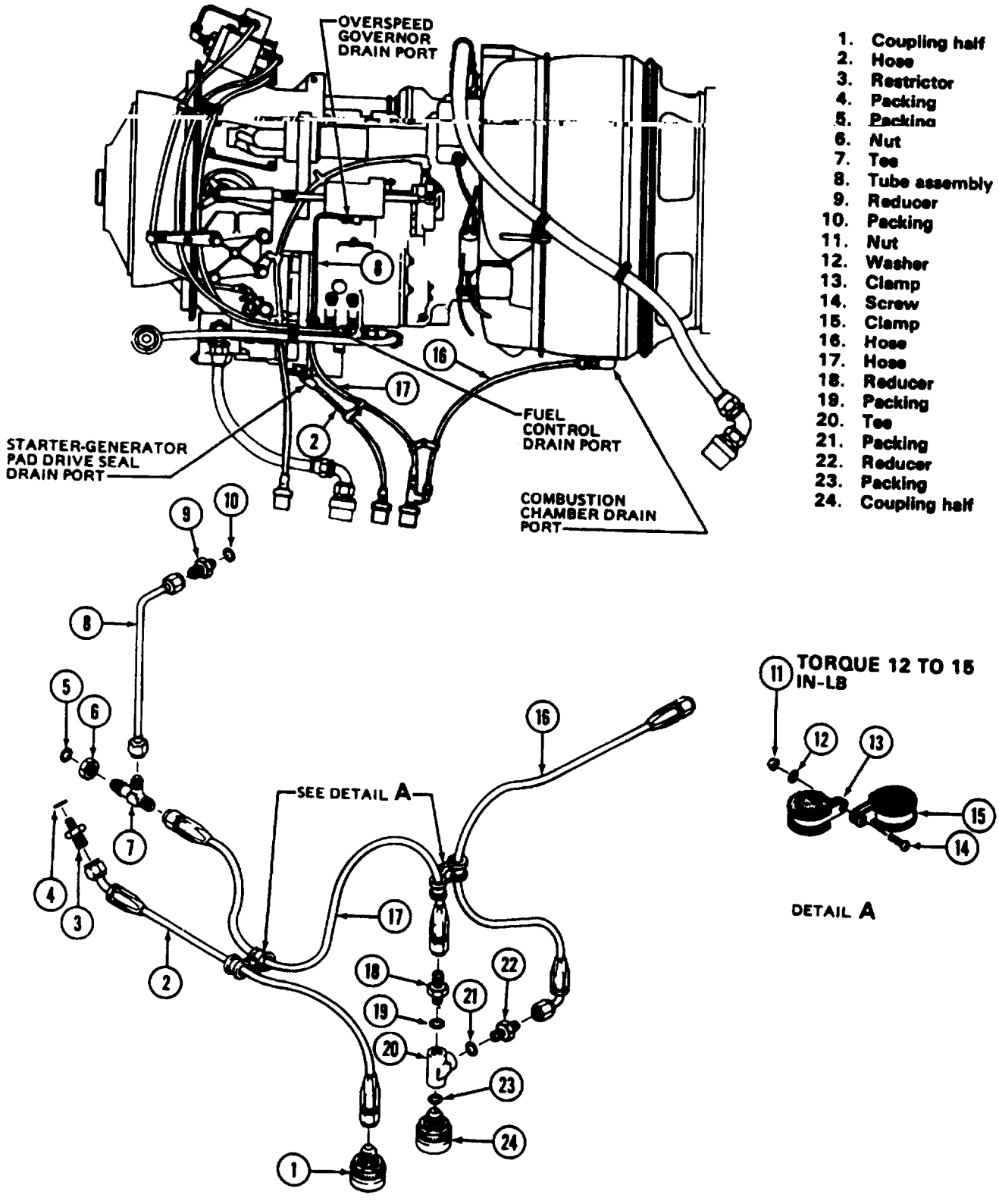


Figure 4-46. Fuel and Oil Drain Hose Installation

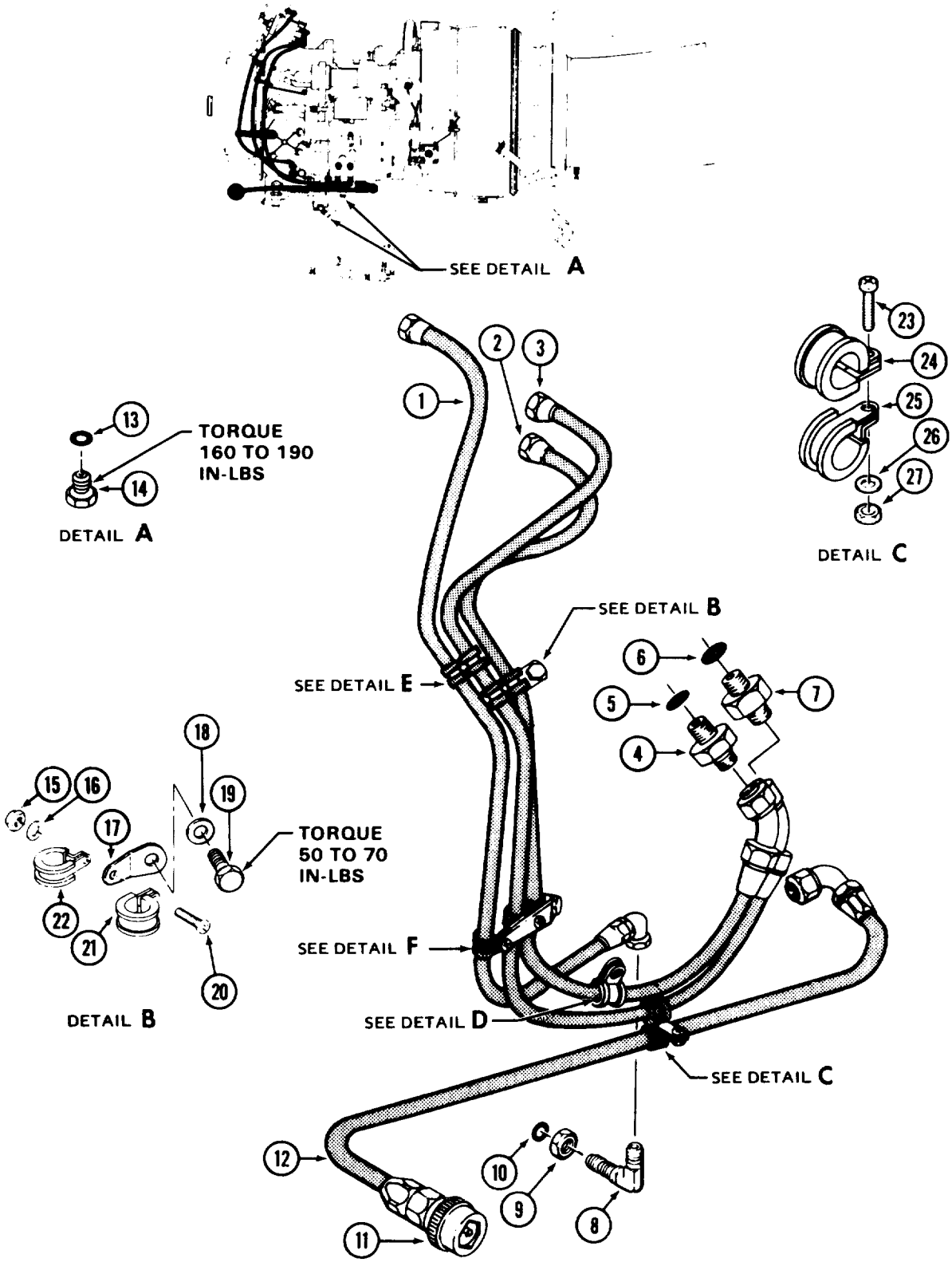
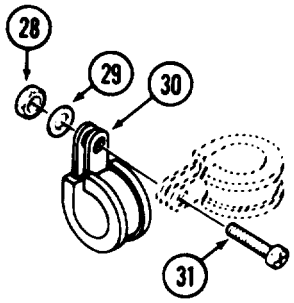
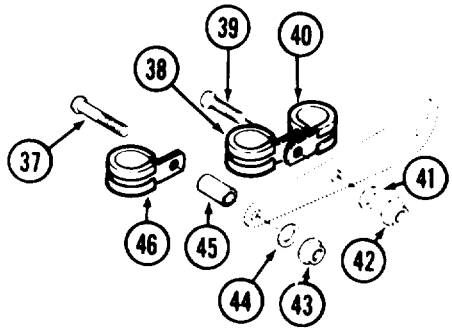


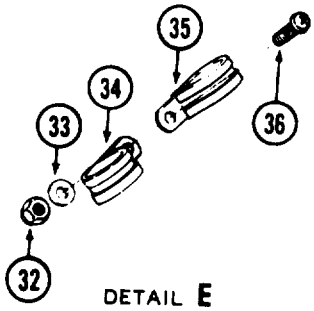
Figure 4-47. Pressure Transmitting and Fuel Inlet Hose Installation (Sheet 1 of 3)



DETAIL D



DETAIL F



DETAIL E

NOTE

TORQUE NUTS ON CLAMP SCREWS 12 TO 15 INCH-POUNDS.

Figure 4-47. Pressure Transmitting and Fuel Inlet Hose Installation (Sheet 2 of 3)

1. Hose
2. Hose
3. Hose
4. Restrictor
5. Preformed pecking
6. Preformed pecking
7. Restrictor
8. Restrictor
9. Nut
10. Gasket
11. Coupling
12. Fuel inlet hose
13. Preformed packing
14. Plug
15. Nut
16. Washer
17. Support
18. Washer
19. Bolt
20. Screw
21. Clamp
22. Clamp
23. Screw
24. Clamp
25. Clamp
26. Washer
27. Nut
28. Nut
29. Washer
30. Clamp
31. Screw
32. Nut
33. Washer
34. Clamp
35. Clamp
36. Screw
37. Screw
38. Clamp
39. Screw
40. Clamp
41. Washer
42. Nut
43. Nut
44. Washer
45 Spacer
46. Clamp

Figure 4-47. Pressure Transmitting and Fuel Inlet Hose Installation (Sheet 3 of 3)

(8) Position clamp (46) on hose (1). Secure to outboard hole in support on engine mount bolt with screw (37), spacer (45), washer (44), and nut (43).

(9) Position clamp (30) on hose (2) and secure to clamp (8, figure 4-45) with screw (31, figure 4-47), washer (29) and nut (28).

f. Install fuel inlet hose (12) on fitting at bottom of fuel control. Install coupling (11) on other end of hose.

g. Position clamp (25) on fuel inlet hose (12) and clamp (24) on hose (3) and secure with screw (23), washer (26), and nut (27). (See Detail C, figure 4-47),

h. Remove shipping plugs from bottom of fuel control inlet and bottom of accessory gear case. Install plug (14) with packing (13) in each port. Torque plugs 160 TO 190 inch pounds. Lockwire (C155) plugs. (See Detail A, figure 4-47.)

4-149. Hoses and Attaching Parts — Installation on Engine Right Side. a. Connect torquemeter vent hose (3, figure 4-48) to union on aft side of torquemeter transmitter (29, figure 4-44).

b. Remove shipping plug from port on forward right side of accessory gearbox. Place packing (1, figure 4-48) on union (2) and install in port. Connect torquemeter vent hose (3) to union (2).

c. Remove lower aft bolt (11) and washer (10) from cover on inlet housing. Install support (9) under head of bolt (11) and reinstall bolt and washer. Torque bolt (11) 160 TO 190 inch-pounds. Lockwire (C155) bolt to lower forward bolt in cover.

d. Position clamp (13) on torquemeter vent hose (3) and secure to support (9) with screw (12), washer (7) and nut (8).

e. Position clamp (14) on starter-generator air duct and clamp (6) on torquemeter vent hose (3). Secure with bolt (15), spacer (16), washer (4) and nut (5).

f. Connect torquemeter pressure hose (17) to elbow on forward side of torquemeter transmitter (29, figure 4-44).

Remove shipping plug from torque pressure per! Place packing (19, figure 4-48) on restrictor(18)

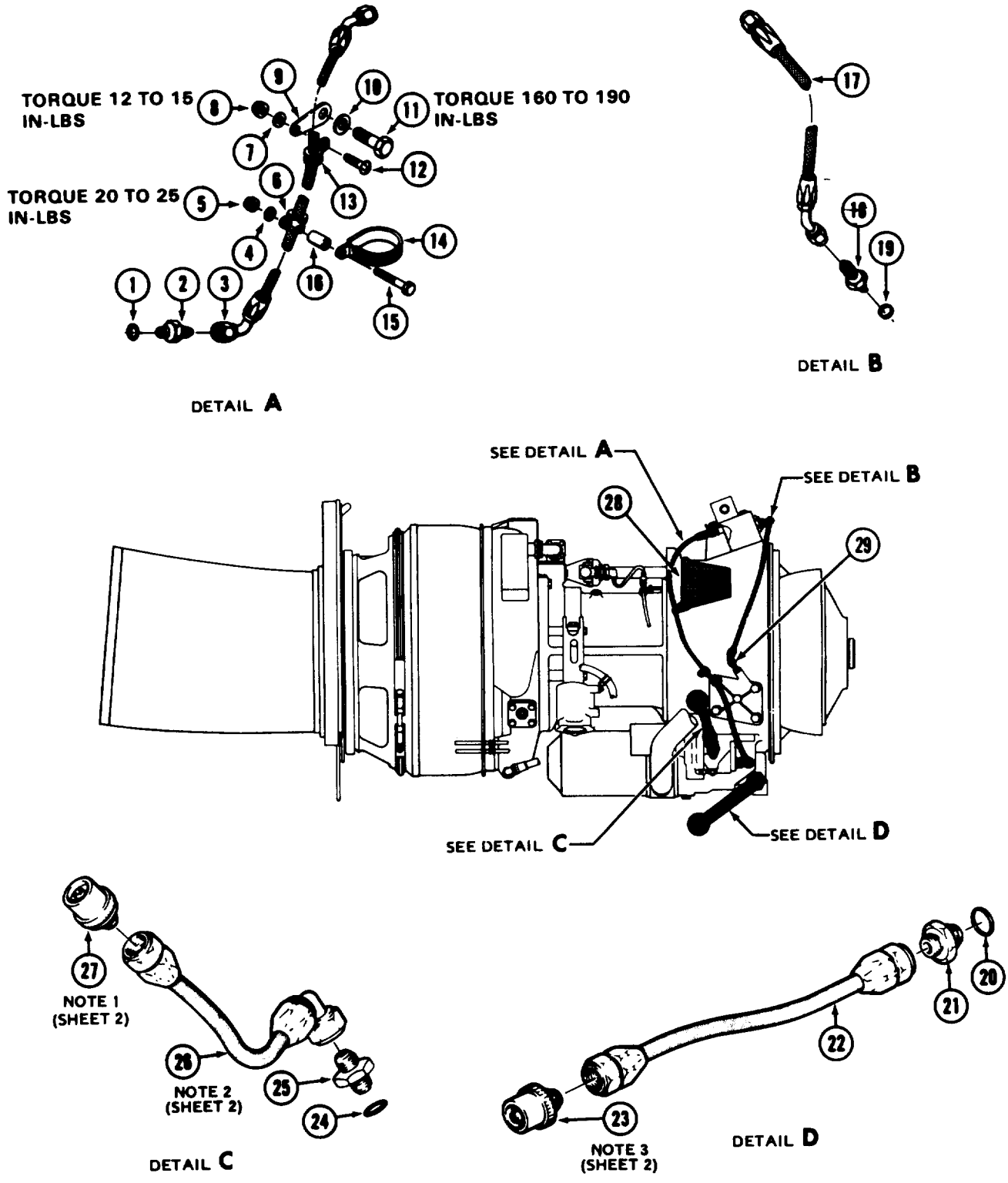


Figure 4-48. Engine Hose Installation - Right Side (Sheet 1 of 2)

NOTES:

1. On engines with crashworthy provisions, coupling must be 205-063-602-1.
2. On engines with crashworthy provisions, hose will be P/N 70-009L000G116.
3. On engines with crashworthy provisions, coupling will be 205-063-602-3.

1. Packing
2. Union
3. Torquemeter vent hose
4. Washer
5. Nut
6. Clamp
7. Washer
8. Nut
9. Support
10. Washer
11. Bolt
12. Screw
13. Clamp
14. Clamp
15. Bolt
16. Spacer
17. Torquemeter pressure hose
18. Restrictor
19. Packing
20. Packing
21. Fitting
22. Oil inlet hose
23. Coupling half
24. Packing
25. Union
26. Engine breather hose
27. Coupling half
28. Cover
29. Torque pressure port

Figure 4-48. Engine Hose Installation- Right Side(Sheet 2 of 2)

and install restrictor in torque pressure port (29). Connect torquemeter pressure hose (17) to restrictor (18).

h. Remove shipping plug from port on right side of oil pump. Place packing (20) on fitting (21) and install in port.

i. Connect oil inlet hose (22) to fitting (21) and install coupling half (23) on opposite end of hose.

j. Remove shipping plug from port forward of tachometer generator drive. Place packing (24) on union (25) and install in port.

k. Connect engine breather hose (26) to union (25) and install coupling half (27) on opposite end of hose.

4-150. Starter-Generator Installation.

NOTE

Retaind shipping covers, plugs, and hardware for installation on unserviceable engine during preservation for return to overhaul.

Retain six nuts, six washers, and gasket for use when installing starter.

a. Remove nuts (16, figure 4-49) and washers (15) and remove shipping cover from starter-generator mounting pad.

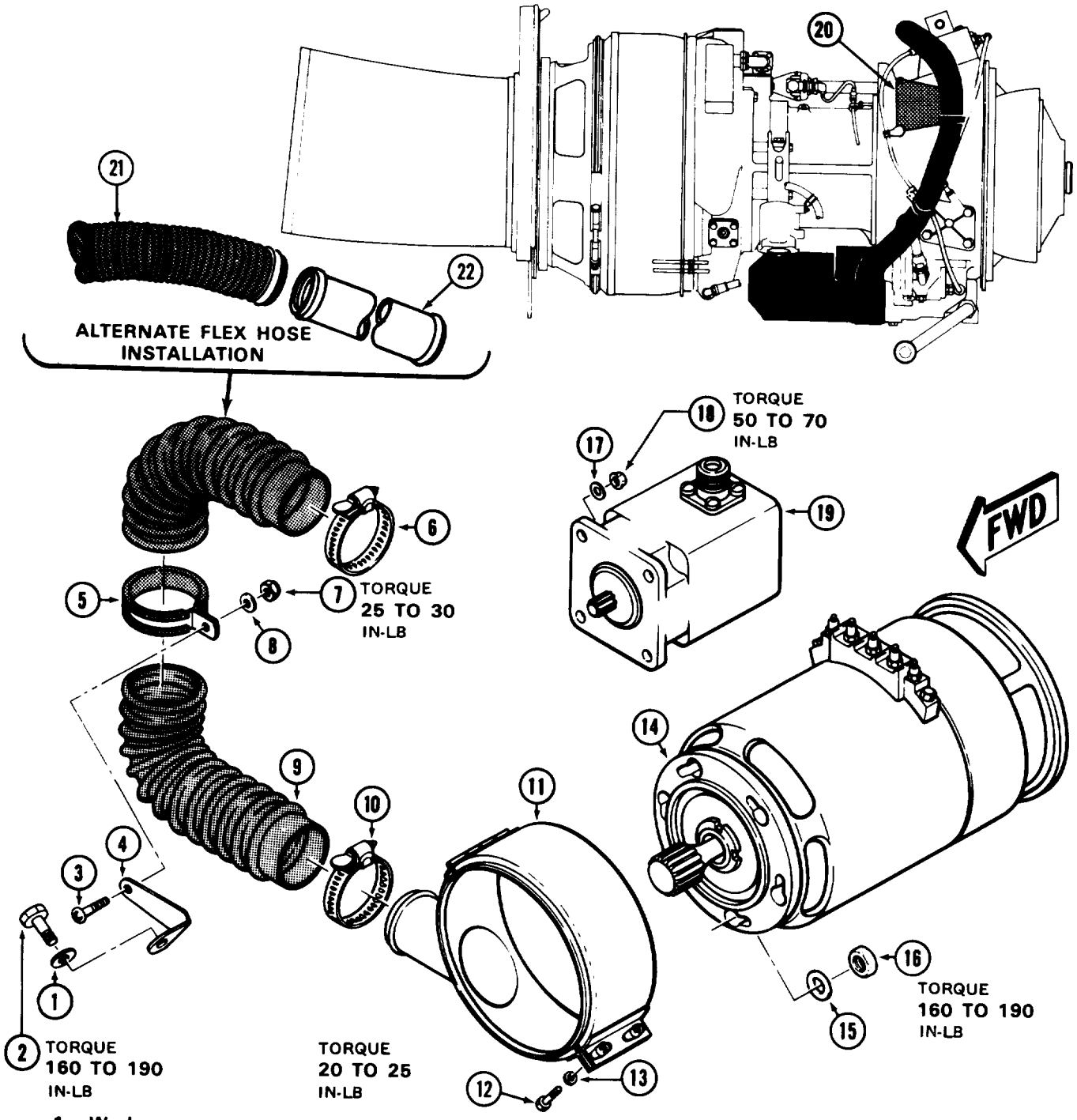
b. Inspect gasket on mounting pad for serviceability, replace gasket if necessary.

NOTE

Due to not being accessible, upper left nut and washer may be omitted.

c. To aid in starter-generator installation, washers (15) may be cemented to nuts (16) using adhesive (C25) or equivalent. Install nuts (16) and washers (5) on starter-generator mounting studs.

d. Coat starter-generator shaft and pack female splines in gearbox 2/3 full lubricant (C161). Position inlet shroud (11) on starter-generator (14) with flange of shroud toward starter-generator mounting flange. Install bolts (12) with washers (13) under head; do not tighten at this time.



1. Washer
2. Bolt
3. Screw
4. Bracket
5. Clamp
6. Clamp
7. Nut
8. Washer
9. Flex hose (one piece)
10. Clamp
11. Inlet shroud
12. Bolt
13. Washer
14. Starter-generator
15. Washer
16. Nut
17. Washer
18. Nut
19. Tachometer generator, gas producer
20. Cover
21. Flex hose
22. Sleeve

Figure 4-49. Starter Generator and Gas Producer Tachometer Generator Installation

e. Position the starter-generator brush inspection cover clamp screw to approximately the 3 o'clock position.

f. Deleted.

g. Position starter-generator (14) on drive splines and mounting studs with electrical terminals pointing to seven o'clock position.

NOTE

Shaft splines may be aligned by rotating the N1 tachometer generator drive with a 114 extension.

h. Slide starter-generator onto mounting studs, over nuts and washers until flush with mounting pad. Rotate starter-generator counterclockwise to lock in small end of holes on mounting flange. Torque nuts (16)
160 TO 190 inch-pounds.

NOTE

Mark serial number of starter-generator on end of case. This permits ease of checking number after engine is installed in helicopter. Use a contrasting color paint.

i. Position inlet shroud over starter-generator air inlet ports with hose connection on right side of starter and tighten bolts (12).

NOTE

The hose connection of shroud must be horizontal.

j. Secure flex hose (9) to inlet shroud (11) with clamp (10). Flex hose and sleeve (21 and 22) may be used as alternates.

k. Remove lower forward bolt (2) with washer (1) from cover (20) on inlet housing. Place bracket (4) under head of bolt, install washer and install bolt, finger tight only at this time.

l. Route flex hose (9) upward, position and secure to bracket (4), attach clamp (5), screw (3), washer (8) and nut (7). Torque nut (7) **25 TO 30** inch-pounds.

m. Torque bolt (2) **160** TO **190** inch-pounds. Lockwire (C155) bolt to lower aft bolt in cover.

n. Place clamp (6) around upper end of flex hose to be used when installing engine in aircraft.

4-151. Gas Producer N1 Tachometer Generator Installation.

a. Remove nuts (18, figure 4-49) and washers (17) and remove shipping cover from tachometer generator mounting pad, located on aft right side of accessory gear box.

b. Inspect gasket on mounting pad for serviceability, replace gasket if necessary.

c. Lubricate tachometer shaft with lubricant (C161).

d. Position tachometer generator (19) on mounting pad with electrical receptacle pointing to top of engine.

e. Install washers (17) and nuts (18). Install electrical connector and lockwire (C154).

4-152. Power Turbine N2 Tachometer Generator Installation.

a. Remove nuts (57, figure 4-44) and washers (58) and remove shipping cover from tachometer generator mounting pad.

b. Install new gasket on mounting pad.

c. Lubricate tachometer shaft with lubricant (C161).

d. Position tachometer generator (56) on mounting pad with electrical receptacle pointing to top of engine.

e. Install washers (58) and nuts (57). Install electrical connector and lockwire (C154).

4-153. Power Plant Electrical Cable Installation.

NOTE

Refer to Appendix F, para F3 for wiring or connector identification.

a. Install nipples (5, figure 4-50) over ends of wires of starter-generator cable (7).

(1) One nipple on wires K5C4 and K5A4.

(2) One nipple on wire P37A1.

(3) One nipple on wires K4B4 and K4D4.

b. Remove nuts and washers from terminals C, B and E of starter-generator;

NOTE

If terminals of starter-generator are too short, thin washers may be used.

c. Position wires K5C4 and K5A4 on terminal E, wire P37A1 on terminal B and wires K4B4 and K4D4 on terminal C. Reinstall washers and nuts. Place nipples (5) over terminals and secure with twine (C295).

d. Position power plant cable (1) on power plant and connect electrical connector (4) to engine electrical receptacle and lockwire (C154).

e. Connect and lockwire (C154) electrical connector (3, figure 4-50) to torque pressure transmitter. Connect and lockwire (C154) electrical connector (2) to fuel pump pressure differential switch. Connect and lockwire (C154) electrical connector (2, figure 4-51) to oil pressure switch.

f. Connect electrical cable for oil pressure transmitter to transmitter support with clamp (21, figure 4-50), screw (22), bracket (20), washer (19) and nut (18) as shown in Detail B.

g. Secure bracket (11) and bracket (16) together with screw (17), washer (13) and nut (12). Mount bracket (16) on tachometer-generator drive upper forward bolt.

h. Secure electrical cable to bracket (11) with clamp (10), screw (9), washer (15) and nut (14) as shown in Detail A.

NOTE

Step i cannot be accomplished at this time. Due to the lack of space, between the engine inlet housing and the maintenance stand. This item must be installed during engine installation.

i. Remove nut from screw through outboard hole of support. Position clamp (8) on electrical cable and secure with removed nut.

j. Secure wiring to support on aft upper mounting bolt for tachometer-generator drive by removing screw, nut and washer holding clamp for air pressure-sensing hose to support. Position clamp (60) on wiring and reinstall screw, washer and nut as shown on Detail I.

k. Secure wires for linear actuator to engine air pressure-sensing hose by positioning clamp (59) on hose and clamp (57) on wires. Secure with screw (58), washer (56) and nut (55) as shown on Detail H.

l. Remove cover from linear actuator and connect wiring (figure 4-50) as follows:

(1) Connect wire Q47B18 to terminal C.

(2) Connect wire Q46C18 to terminal R.

(3) Connect wire Q45C18 to terminal E.

(4) Reinstall cover on linear actuator.

m. Secure electrical cable to clamp on governor bleed hose (7, figure 4-45) using clamp (63, figure 4-50), screw (64), washer (62) and nut (61) as shown on Detail J.

n. Remove lower forward mounting bolt from starting fuel solenoid. Secure brackets (39) and (40) together with screw (38), washer (44) and nut (43) as shown on Detail F. Mount bracket (39) on starting fuel solenoid mounting bolt, lockwire (C154) bolt. Secure electrical cable to bracket (40) using clamp (41), screw (42), washer (45) and nut (46).

o. Route electrical cable downward to support on engine mount. Secure bracket (48) to support with screw (51), washer (52) and nut (53) as shown on Detail G. Attach cable to bracket (48) with clamp (47), screw (54), washer (49) and nut (50).

p. Secure bracket (35) to existing clamp screw on engine main fuel hose as shown in Detail E. Position clamp (36) on electrical cable and secure with screw (37), washer (34) and nut (33).

q. Secure bracket (27) to existing clamp screw on engine main fuel hose as shown in Detail D. Position clamps (26) and (30) on electrical cable and

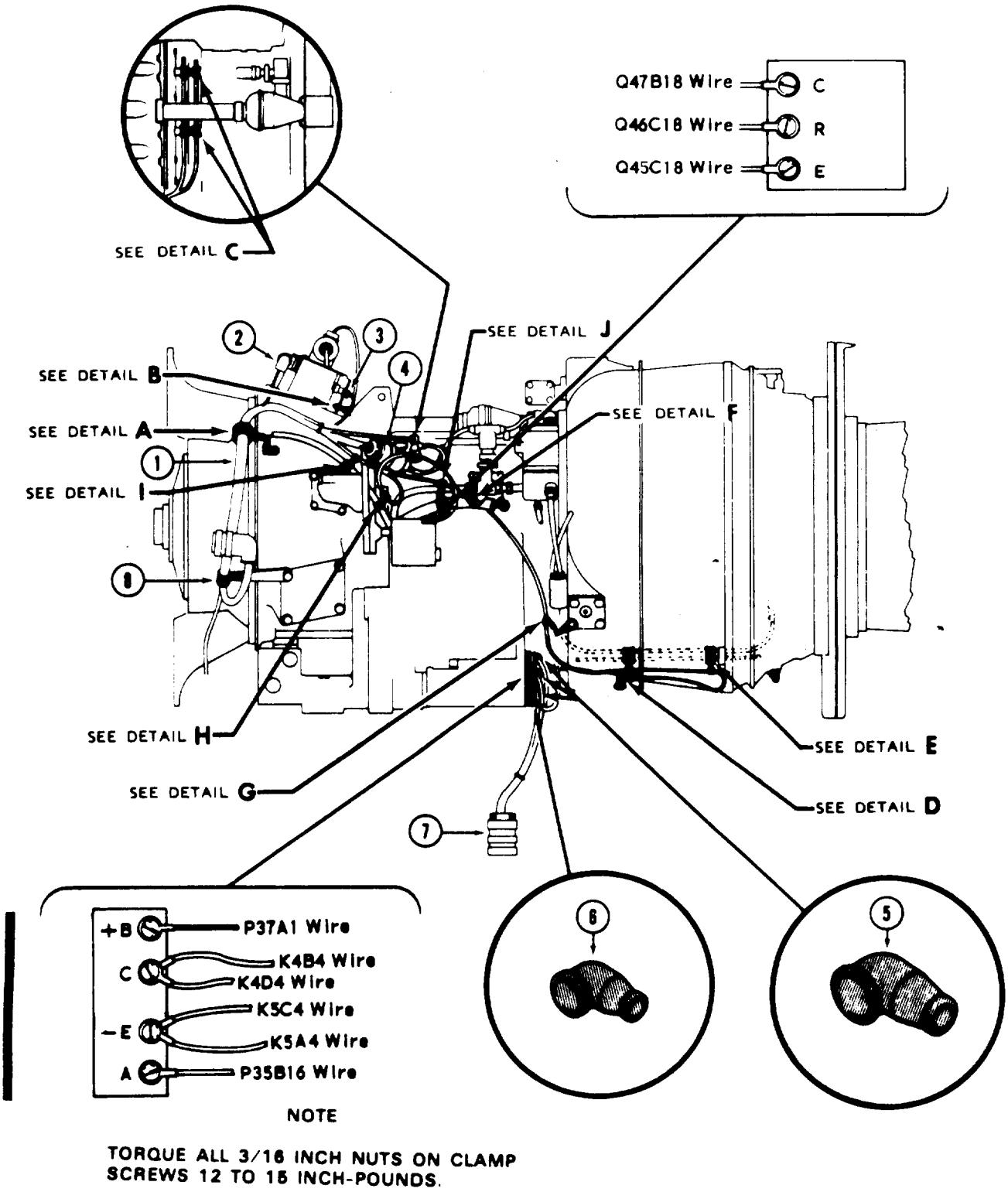
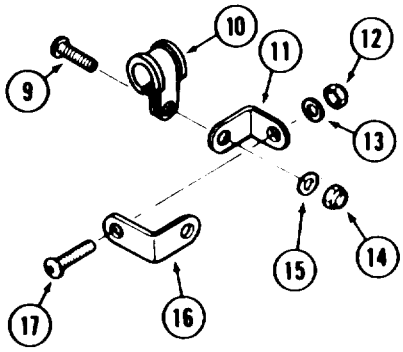
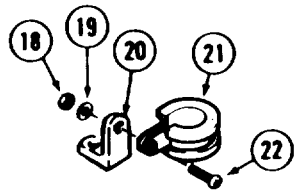


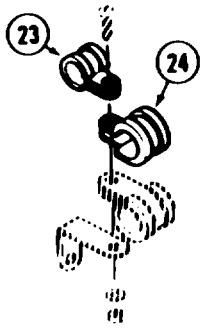
Figure 4-50. Electrical Cable Installation - Left Side (Sheet 1 of 3)



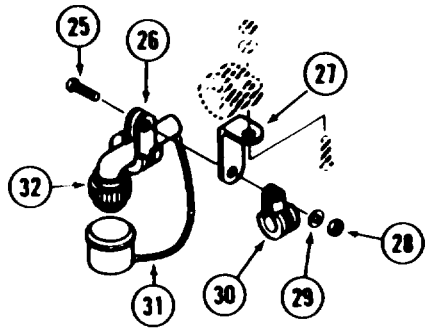
DETAIL A



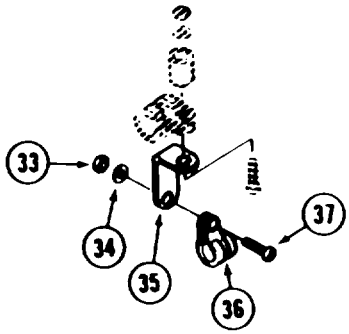
DETAIL B



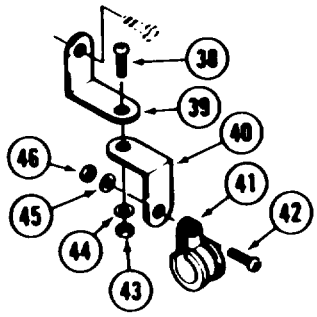
DETAIL C



DETAIL D

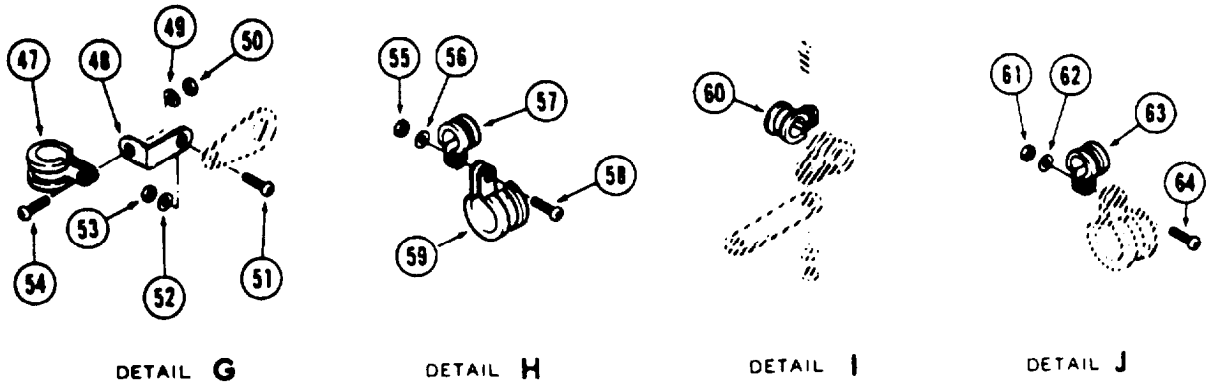


DETAIL E



DETAIL F

Figure 4-50. Electrical Cable Installation - Left Side (Sheet 2 of 3)



1. Power plant cable
2. Electrical connector
3. Electrical connector
4. Electrical connector
5. Nipple
6. Nipple
7. Starter-generator cable
8. Clamp
9. Screw
10. Clamp
11. Bracket
12. Nut
13. Washer
14. Nut
15. Washer
16. Bracket
17. Screw
18. Nut
19. Washer
20. Bracket
21. Clamp
22. Screw
23. Clamp
24. Clamp
25. Screw
26. Clamp
27. Bracket
28. Nut
29. Washer
30. Clamp
31. Cover
32. Electrical connector
33. Nut
34. Washer
35. Bracket
36. Clamp
37. Screw
38. Screw
39. Bracket
40. Bracket
41. Clamp
42. Screw
43. Nut
44. Washer
45. Washer
46. Nut
47. Clamp
48. Bracket
49. Washer
50. Nut
51. Screw
52. Washer
53. Nut
54. Screw
55. Nut
56. Washer
57. Clamp
58. Screw
59. Clamp
60. Clamp
61. Nut
62. Washer
63. Clamp
64. Screw

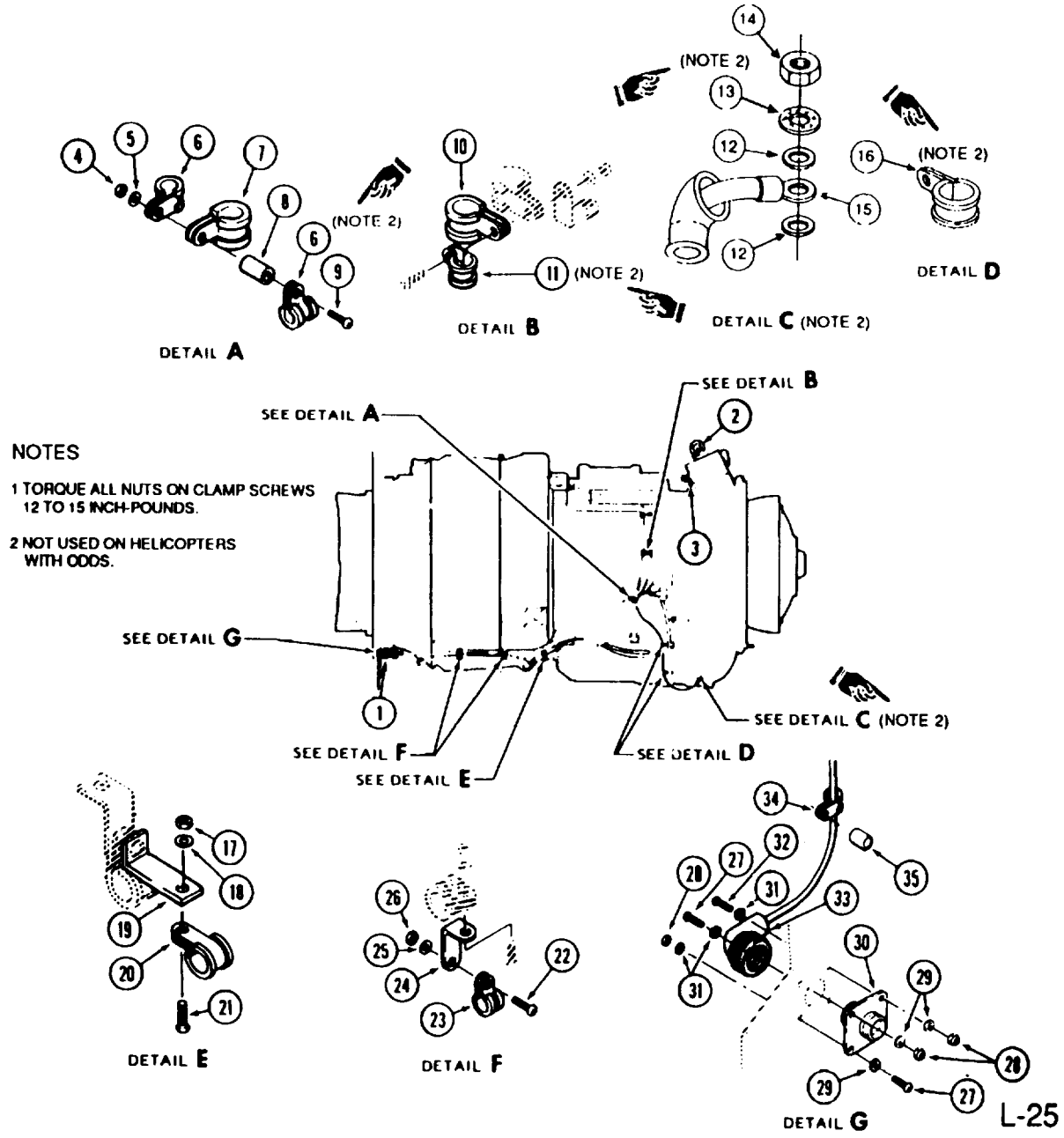
Figure 4-50. Electrical Cable Installation - Left Side (Sheet 3 of 3)

secure with screw (25), washer (29) and nut (28). Install cover (31) on electrical receptacle and secure chain of cover.

r. Position nipple (6) on wire P35B16. Install wire P35B16 on terminal A of starter-generator. Place nipple (6) over terminal and secure with twine (C295).

s. Route thermocouple cable and chip detector cable between top of engine and anti-icing air tube, secure to existing bracket for tachometer generator lead with clamps (23) and (24) in two places as shown on Detail C.

t. Route thermocouple cable and chip detector cable downward and attach to bracket for tachometer



1. Thermocouple cable
2. Electrical connector
3. Electrical connector
4. Nut
5. Washer
6. Clamp
7. Clamp
8. Spacer
9. Screw
10. Clamp
11. Clamp
12. Washer
13. Lockwasher
14. Nut
15. Nipple
16. Clamp
17. Nut
18. Washer
19. Bracket
20. Clamp
21. Screw
22. Screw
23. Clamp
24. Bracket
25. Washer
26. Nut
27. Screw, drilled head
28. Nut
29. Washer, thin
30. Connector
31. Washer, aluminum, thin
32. Screw, undrilled (2)
33. Engine thermocouple lead
34. Clamp
35. Spacer

Figure 4-51. Electrical Cable Installation - Right Side

generator cable with clamp (10, figure 4-51) on thermocouple cable and clamp (11) on chip detector cable as shown in Detail B.

u. Position crampon inlet guide vane actuator nose, clamp (6) on thermocouple cable and remaining clamp (6) on chip detector cable. Secure clamps with screw (9), spacer (8), washer (5) and nut (4) as shown in Detail A..

v. Secure chip detector cable (2 places) to bracket and clamp for inlet guide vane actuator drain hose with clamp (16) using existing hardware.

w. Place nipple (15) on chip detector cable and secure to chip detector with washer (12), lockwasher (13), washer (12), and nut (14). Position nipple (15) over chip detector terminal and secure with twine (C295). (See Detail C.)

CAUTION

No more than 16 inch-pounds of torque shall be applied to the chip detector center post nut when installing the chip detector wire.

x. Route thermocouple cable (1) aft and mount bracket (19) on existing bracket for oil scavenge line. Attach thermocouple cable (1) to bracket (19) with clamp (20), screw (21), washer (18) and nut (17).

y. Position bracket (24) under existing mounting screw for oil pressure line, two places. Secure thermocouple cable (1), in two places, to bracket (24) with clamp (23), screw (22), washer (25) and nut (26).

z. Connect thermocouple cable (1) to aft firewall as follows:

(1) Place connector (30) in opening in aft firewall. Install one drilled head screw (27), from forward side, with one thin washer (29) under head. install one thin aluminum washer (31) and nut(28)on screw.

(2) Install one drilled head screw (27) and two undrilled screws (32), with thin aluminum washers (31) under heads, from aft side of firewall. Install one thin washer (29) and nut (28) on each screw (27).

(3) Connect thermocouple cable (1) to forward side of connector (30). Lockwire (C154) to drilled head screw (27).

(4) Remove screw from aft firewall inner ring and secure engine thermocouple lead (33) to firewall using clamp (34), spacer (35) and screw. (See Detail G.)

(5) Connect engine thermocouple lead (33) to aft side of connector (30). Lockwire (C154) to drilled head screw (27).

aa. Connect electrical connector (3) to torque pressure transmitter and lockwire (154).

CHAPTER 5

ROTORS

SECTION I. MAIN ROTOR SYSTEM

5-1. MAIN ROTOR SYSTEM.

5-2. Description — Main Rotor System. Main rotor system (figures 5-1 and 5-1.1) includes a two-blade, semirigid-rotor, a stabilizer bar with dampers, a swashplate and support, a scissors and collective sleeve, and interconnecting linkage. The rotor is mounted through two pillow blocks which provide a flapping axis. Main rotor blades are attached to grips, which rotate on yoke spindles to change blades pitch. The trunnion engages splines at top of mast, supported by a cone set and secured by a retaining nut, which also serves as mast cap and lifting eye. In operation, collective pitch control stick movements cause angular changes of both blade grips equally and simultaneously. Directional control is accomplished by independent changes of each blade grip by means of cyclic control input. Stabilizer bar, mounted with its flapping axis crosswise to the main rotor, is connected to rotors controls to provide greater stability for all flight conditions. After incorporation of MWO 55-1520-242-50-1, hub moment springs and support assembly (figure 5-1.1) are attached to transmission mast assembly. During a potential mast bumping condition, the springs are contacted by a plate assembly located under the main rotor hub. The hub springs provide an additional margin of safety in the event of an inadvertent excursion of the helicopter beyond the approved flight envelope.

5-3. MAIN ROTOR HUB AND BLADE ASSEMBLY.

5-4. Description — Main Rotor Hub and Blade Assembly. Main rotor blades are either fiberglass composite material or all-metal bonded assemblies. Each blade is formed of four major sections: main spar, honeycomb core, trailing edge extrusion and nose block extrusion, all bonded to skin by adhesive applied under heat and pressure. Reinforcing doublers, grip plates, and drag plates are attached on blade butt end. Metal blades and composite blades have stainless steel strips covering the leading edges for resistance to abrasion. A trim tab is provided on trailing edge for tracking adjustments. A fitting on blade tip. which is used in flag-tracking procedure, also has a hole for attachment of rotor tie-down.

All blades have an adjustable drag brace connecting trailing edge of blade to hub, providing a means of aligning blades. Grip bearings and pillow black bearings on hub are lubricated by oil or grease. Oil levels can be checked through transparent covers. To ensure correct reassembly and maintain balance, a color coding system is used. Red dots identify all parts connected to the red blade; white dots identify all parts connected to the white blade.

5-5. Cleaning — Main Rotor Hub and Blade Assembly.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

a. Clean main rotor hub by wiping with a clean cloth moistened with solvent (C261). Do not use pressure cleaning equipment or attempt to clean grip seals.

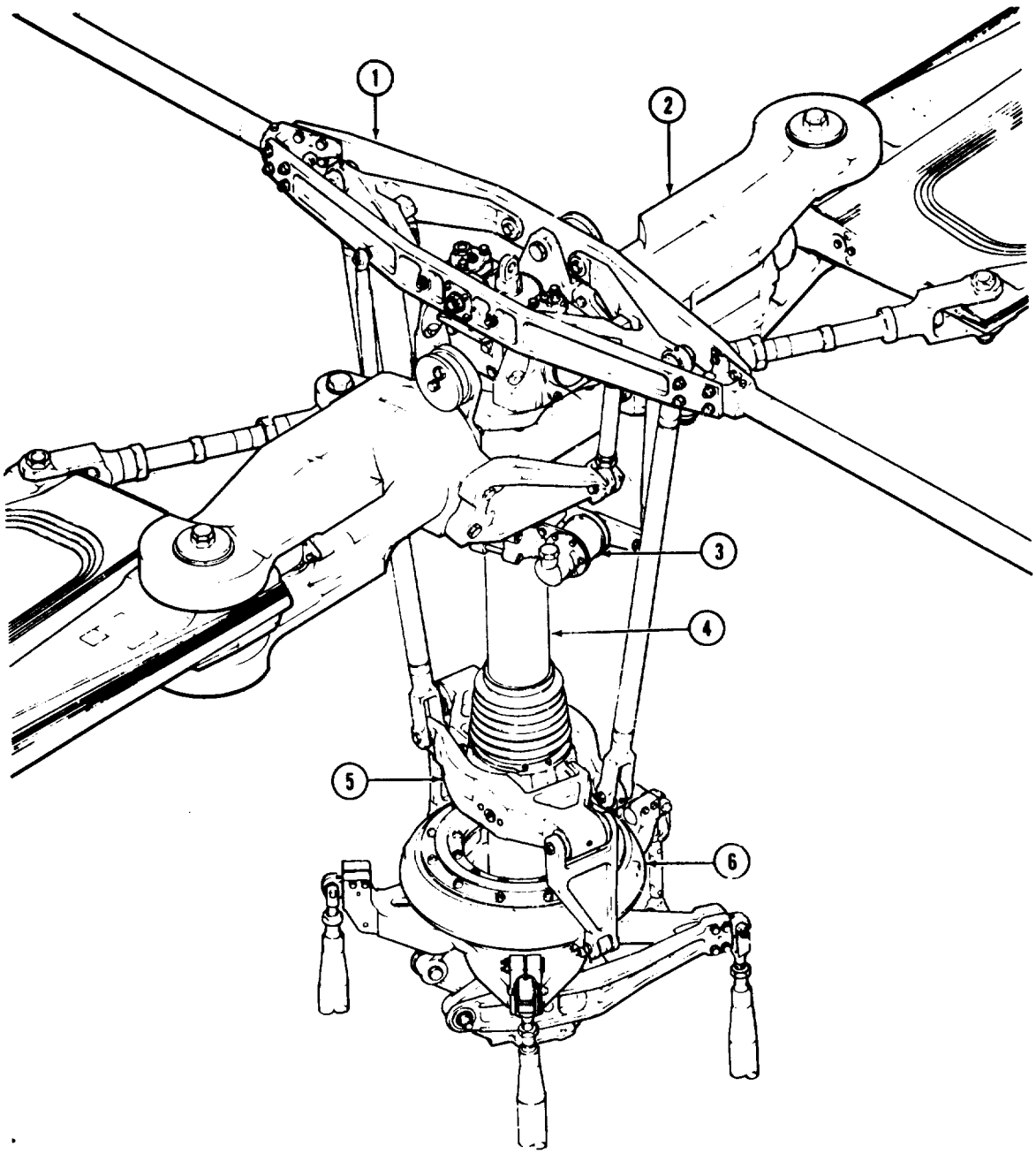
b. Wash main rotor blades with cleaning compound (C67).

5-6. Lubrication — Main Rotor Hub and Blade Assembly. Refer to paragraph 1-7 for lubrication and servicing.

5-7. Alignment — Main Rotor Hub and Blade Assembly.

Premaintenance requirements for main rotor hub and blade alignment

Condition	Requirements
Modal	All
Part No. or Serial No.	All
Spatial Tools	(134) (139) (140) (141) (149) and (T62)
Test Equipment	None
Support Equipment	Hoist, Protractor, and Supports for Blades
Minimum Personnel Required	Two
Consumable Materials	None
Special Environmental Conditions	None



1. Stabilizer bar assembly
2. Main rotor hub and blades assembly
3. Stabilizer dampers
4. Mast
5. Scissors and sleeve assembly
6. Swashplate and support assembly

Figure 5-1. Main Rotor System

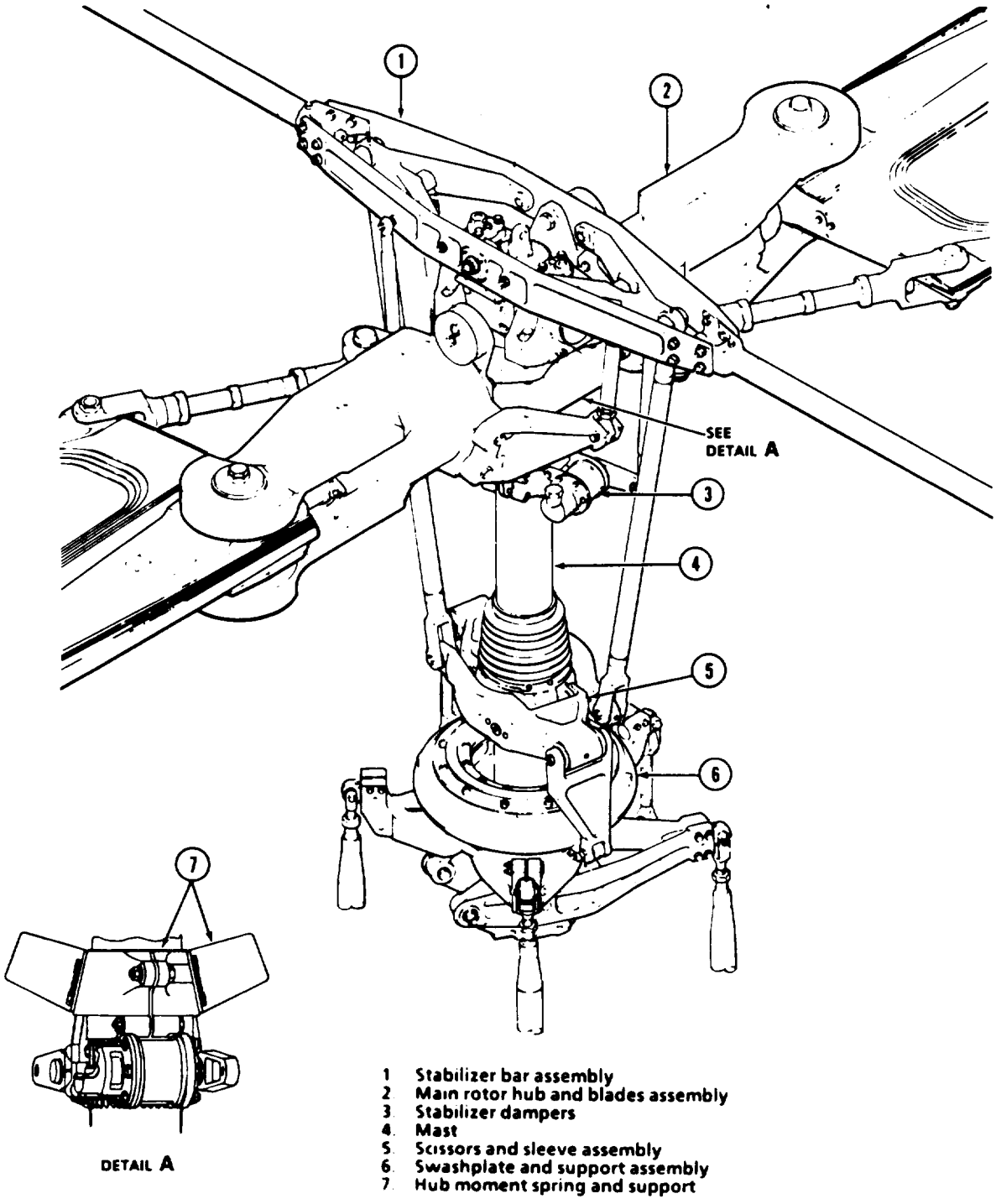


Figure 5-1.1 Main Rotor System (After Incorporation of MWO 55-1520-242-50-1)

WARNING

Do not allow main rotor blades to rotate on the pitch-change axis. If blade is inadvertently allowed to rotate on the pitch-change axis beyond 60 degrees, the main rotor grip retension strap shall be replaced.

a. Remove main rotor (paragraph 5-12). Ensure that grip positioning links (T41) are installed (figure 5-2).

b. Position flap stops (T62), one on each side of trunnion, align holes in stops with bottom holes in trunnion, and install attaching bolts.

c. MB **Place main rotor on a level buildup bench (T34), equipped with adapter plate (T49). Use suitable supports to position blades straight in plane of precone angle 2-1/2 to 3 degrees to blade grips throughout blade length.**

c.1. CB **Place main rotor on a level buildup bench (T34), equipped with adapter plate (T49). Use suitable supports located just inboard of trim tab to position blades straight in plane of precone angle 2-1/2 to 3 degrees to blade grips.**

d. Position protractor chordwise on upper surface of yoke. Zero protractor. Place protractor on machine surface of grip (chordwise) at blade retaining bolt hole. Adjust grip links (T41) to obtain a zero reading on protractor. Perform same operation on opposite grip.

d.1. CB **Measure precone angle with protractor on surface of blades spanwise, approximately 36 inches outboard of the most inboard abrasion strip splice cover (114 inches from blade bolt hole). Position protractor just aft and parallel to polyurethane abrasion strip. Adjust support height until the measured blade precone angle is between 2.5 and 3.0 degrees. Repeat this step for opposite blade.**

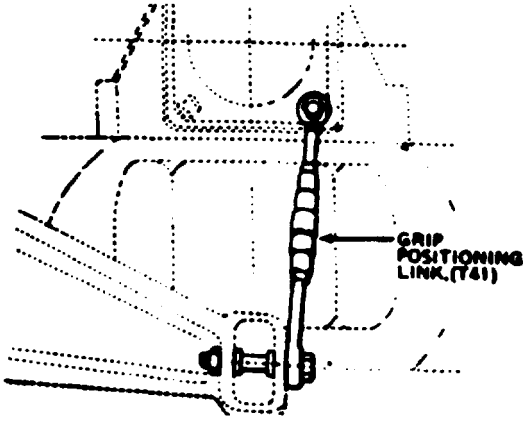


Figure 5-2. Grip Positioning Link

e. Position support assembly (T39) (4, figure 5-3) and scope assembly (T40) (5) on pillow blocks over reservoirs. Secure support to pillow blocks.

f. Check scope for zero adjustment before each use.

(1) Sight through scope at an object approximately 50 feet away.

(2) Draw a straight vertical line on object that will line up with vertical cross hair.

(3) Loosen clamp screws on support and rotate scope 180 degrees on tube axis. Tighten clamp screws.

(4) Vertical cross hair should line up on drawn line. If vertical cross hair does not align with drawn line, draw a second vertical line on object that will align with vertical cross hair.

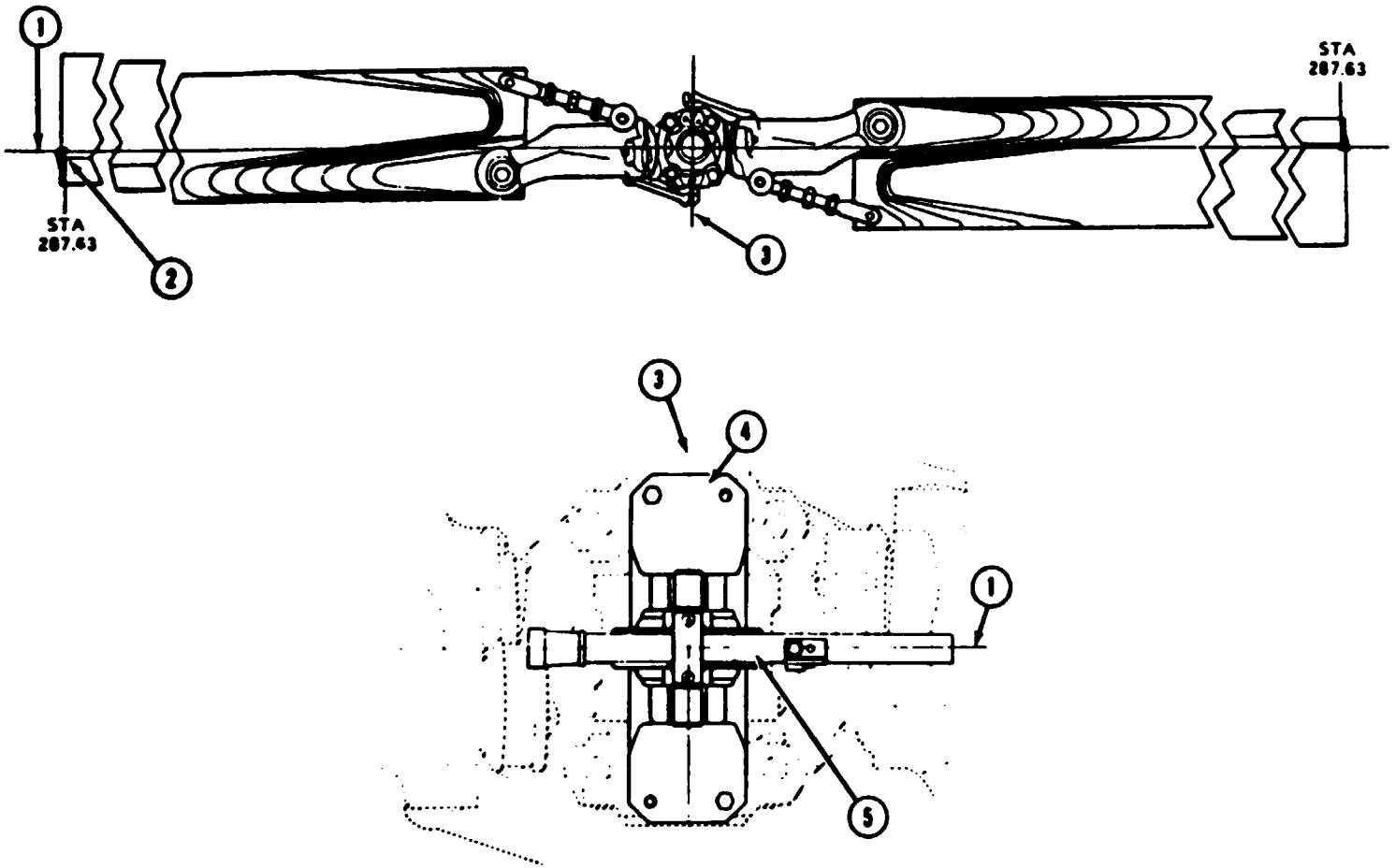
(5) Measure one-half the distance between drawn lines one and two and draw a third vertical line.

(6) Adjust screw marked "L" on side of scope to align vertical cross hair with third drawn line.

(7) Rotate scope 180 degrees on tube axis and check that cross hair aligns with third drawn line.

(8) If not, repeat above steps until satisfactory.

g. Check blade alignment by sighting on head of drive screw (2, figure 5-3), located on upper surface of blade tip just aft of stainless steel leading edge strip. Adjust drag brace as necessary to align screw head with vertical hair of scope. After tightening jamnuts, repeat check and readjust if necessary. Torque jamnuts 659 TO 800 inch-pounds.



1. ℄ pitch change axis
2. Blade alignment point (rivet head)
3. ℄ trunnion axis
4. Support assembly, (T39)
5. Scope assembly, (T40)

Figure 5-3. Main Rotor Blade Alignment

NOTE

After final drag brace adjustment, no barrel threads shall extend beyond locknut.

h. Reverse scope assembly on mount. Check and adjust opposite blade assembly.

i. When alignment is correct, remove scope and support assemblies. Paint a reference line across drag brace barrel and jamnut to indicate original alignment position for use in vibration troubleshooting. Reinstall main rotor.

j. If scope is not available to align blade, adjust length of drag brace to 19.030 inches centerline to centerline of retension bolt holes. Drag braces should be equal within 0.002 inches.

5-8. Adjustment, Collective Pitch Forces — Main Rotor Hub with Metal Blade Installed. (Figures 5-4 and 5-4.1).

a. Deleted.

a.1. Check forces at 324 rotor rpm in cruise flight with hydraulic boost off and minimum collective friction. Collective stick dynamic force is considered satisfactory under the following conditions:

(1) Up collective — Pilot should be able to pull the collective stick up until an engine torque pressure reading of 33 TO 35 psi MB or 40 psi CB is obtained. If unable to do so, a negative force exists.

(2) Down collective — Pilot should be able to push the collective stick down until an engine torque pressure reading of 10 TO 13 psi MB or 10 psi CB is obtained. If unable to do so, a positive force exists.

b. If the above conditions are not met, it is necessary to change collective force by adjusting torsion of blade retention strap in each grip. Determine exact nature of conditions; positive or negative force prevailing, as noted by pilots during flight.

NOTE

The following steps should be performed with strict attention. Loosening bolts too far will require a complete resetting of grip angle. If necessary to reset tension-torsions straps to initial setting, accomplish step c.

(1) Cut lockwire and loosen retaining bolts (6, figure 5-4) just enough to permit free turning of worm screw (4).

(2) Turning worm screw (4) clockwise, as viewed from its head, upward wrench motion, will decrease strap twist. This is the corrective action for positive collective. Rotating the worm screw counterclockwise is the corrective action for negative collective.

WARNING

Never tamper with the large retaining nut (acorn nut) In outboard end of each grip, In this procedure or any other used in AVUM.

(3) Adjustment of the worm screw (4) should not be made in increments of mare than one turn at each adjustment, and not more than four turns total.

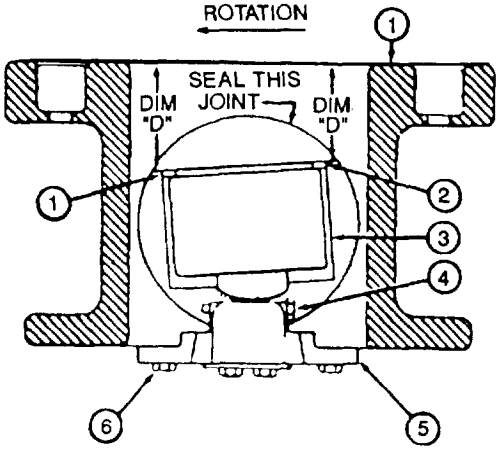
(4) After adjustment, torque static stop retaining bolts (6) 70 TO 110 inch-pounds and lockwire (C155).

(5) Repeat steps b. (1) through (4) on opposite blade.

(6) Perform operational check. Normal autorotational rpm. Refer to TM 55-1520-242-MTF.

(7) Test fly helicopter and check collective forces.

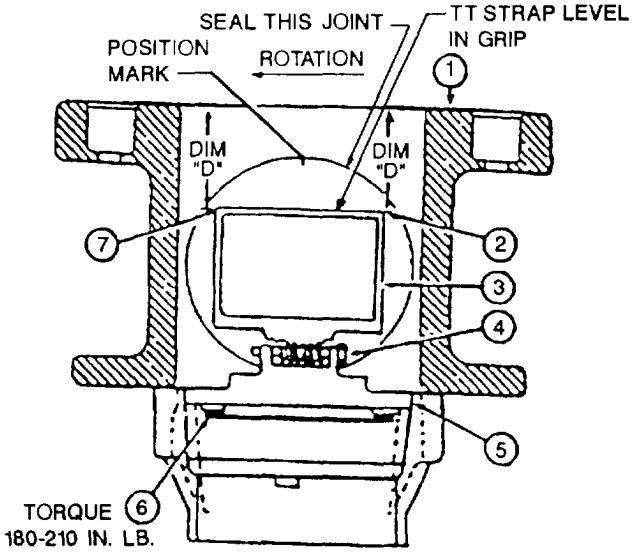
b.1. After incorporation of MWO 55-1520-242-50-1, if the above conditions are not met, it is necessary to change collective force by adjusting torsion of blade retention strap in each grip. Determine exact nature of conditions; positive or negative force prevailing, as noted by pilots during flight.



VIEW LOOKING OUTBOARD

1. MAIN ROTOR YOKE
2. TAB (TRAILING EDGE)
3. INBOARD STRAP FITTING
4. WORM SCREW
5. STATIC STOP
6. BOLT (2)
7. TAB (LEADING EDGE)

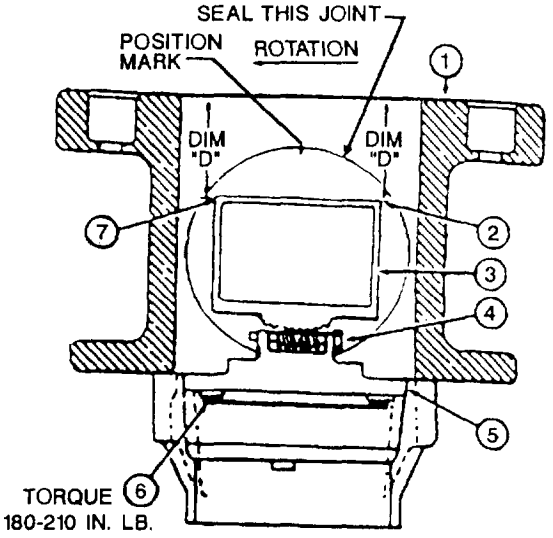
Figure 5-4. Collective Pitch Retention Strap Adjustment



VIEW LOOKING OUTBOARD

1. MAIN ROTOR YOKE
2. TAB (TRAILING EDGE)
3. INBOARD STRAP FITTING
4. WORM SCREW
5. PLATE ASSY
6. BOLT (2)
7. TAB (LEADING EDGE)

Figure 5-4.2 CB Collective Pitch Retention Strap Adjustment (After incorporation of MWO 55-1520-242-50-1 and installation of Composite Main Rotor Blades)



VIEW LOOKING OUTBOARD

1. MAIN ROTOR YOKE
2. TAB (TRAILING EDGE)
3. INBOARD STRAP FITTING
4. WORM SCREW
5. PLATE ASSY
6. BOLT (2)
7. TAB (LEADING EDGE)

Figure 5-4.1 MB Collective Pitch Retention Strap Adjustment (After incorporation of MWO 55-1520-242-50-1)

NOTE

The following steps should be performed with strict attention. Loosening bolts too far will require a complete resetting of grip angle. if necessary to reset tension-torsions straps to initial setting, accomplish step c.

(1) Remove hub moment springs from mast. Refer to paragraph 5-56.3,

WARNING

Mark plate assembly (11.1, figure 5-12) prior to removal. Adhesive shim must be returned to original position or binding of the worm gear and installation bolts is possible.

(2) Cut lockwire and loosen retaining bolts (6, figure 5-4.1) just enough to permit free turning of plate assembly worm screw (4).

(3) Turning worm screw (4) clockwise, as viewed from its head, upward wrench motion, will

decrease strap twist. This is the corrective action for positive collective. Rotating the worm screw counterclockwise is the corrective action for negative collective.

(3.1) If binding of the worm gear is suspected, proceed as follows:

(a) Remove plate assembly retaining bolts to allow access to worm screw (4).

(b) Tap center pin out of worm screw (4).

(c) Remove bolt from worm screw and plate assembly.

(d) Place an AN960-C10L washer under bolt head.

(e) Install bolt and worm screw in plate assembly.

(f) Align cotter pin holes in bolt and worm screw.

(g) Install new center pin. Center pin should not protrude more than 0.015 inch beyond worm gear.

WARNING

Never tamper with large retaining nut (acorn nut) in outboard end grip, in this procedure or any other use in AVUM.

NOTE

To ensure worm gear does not bind center pin must not protrude more than 0.015 inch beyond worm gear.

(4) Adjustments to worm screw (4) should not be made in increments of more than one turn at each adjustment, and no more than four turns total.

(5) After adjustment, torque plate assembly retaining bolt (6) 180-210 inch-pounds and lockwire (C155).

(6) Repeat steps b.1.(1) through (4) on opposite blade

(7) Install hub mount spring on mast. Refer to paragraph 5-56.5.

(8) Perform operational check. Normal autorotational rpm. Refer to TM 55-1520-242-MTF.

(9) Test fly helicopter and check collective forces.

NOTE

It is permisseble to adjust strap twist unevenly to obtain best teat flight results when metal main rotor blades are installed on hub.

c. If retaining bolts (6, figure 5-4 and 5-4.1) have been loosened too far, allowing worm gear assemblies to become disengaged, the following procedure must be accomplished to position the straps to their initial setting.

NOTE

When necessary to reset straps to their initial setting, a locally fabricated gage (T56.8) may be used (fabricate In accordance with figure 5-4.2). When gage reference line Is parallel to yoke top, straps are adjusted to their initial setting.

(1) With worm gear assembly disengaged from fitting (3), position fitting so that leading edge tab (7) dimensions “D” is 0.200 inch greater than trailing edge tab (2) dimension “D” (figures 5-4 and 5-4.1) when metal main rotor blades are installed on hub.

(2) Maintain the dimensions outlined in step (1), engage worm gear assembly, tighten, torque and lockwire bolts (6) (C155).

(3) Test fly helicopter and check collective forces. If adjustment is required perform steps b.(1) through (6).

d. After functional test flight and final pitch adjustment, seal joint of inboard fitting (3) and yoke (1) with sealant (C244) (figures 5-4 and 5-4.1).

5-8.1. CB Adjustment of Collective Pitch Forces — Main Rotor Hub with Composite Main Rotor Blade Installed.

a. Initial Adjustment. When installing composite blades the initial setting of the blade retention strap in each grip must be properly set. It is recommended that this be accomplished prior to installation of the blades. To set the retention straps for composite blades to their initial setting:

WARNING

Mark orientation of plate assembly (11.1, Figure 5-12) prior to removal. Adhesive shim must be returned to original position or binding of the worm gear and installation bolts is possible.

NOTE

Loosening bolts too far will require a complete resetting of strap angle.

(1) Cut lockwire and loosen retaining bolts (6, figure 5-4.1) just enough to permit free turning of plate assembly worm screw (4).

(2) Turning worm screw clockwise, as viewed from its head, upward wrench motion, will decrease strap twist. This is the corrective action for positive collective. Rotating the worm screw counterclockwise is the corrective action for negative collective.

NOTE

Do not use strap gage (T56.8) with composite blades.

(3) Adjust worm gear so that the retention strap is level in the grip. This will result in leading edge dimension "D" being equal to trailing edge dimension "D" as shown in Figure 5-4.2.

(4) Once retention strap is level tighten, torque and lockwire retaining bolts (6) (180 TO 210 inch-pounds).

(5) Repeat process on other blade

5-9. Operational Check - Main Rotor Hub and Blade Assembly. After main rotor hub and/or blades replacement or removal and reinstallation, perform the following checks.

a. Track main rotor blades (paragraph 5-130 MB or 5-130.1 CB).

b. Perform a functional test flight (TM 55-1520-242-MTF).

c. When corrective action is required proceed as follows:

(1) If excessive vibrations are encountered perform tracking operations and vibration correction procedures in accordance with paragraphs 5-134 MB or 134.1 CB.

(2) If collective forces are unsatisfactory refer to paragraph 5-8 MB or 5-8.1 CB.

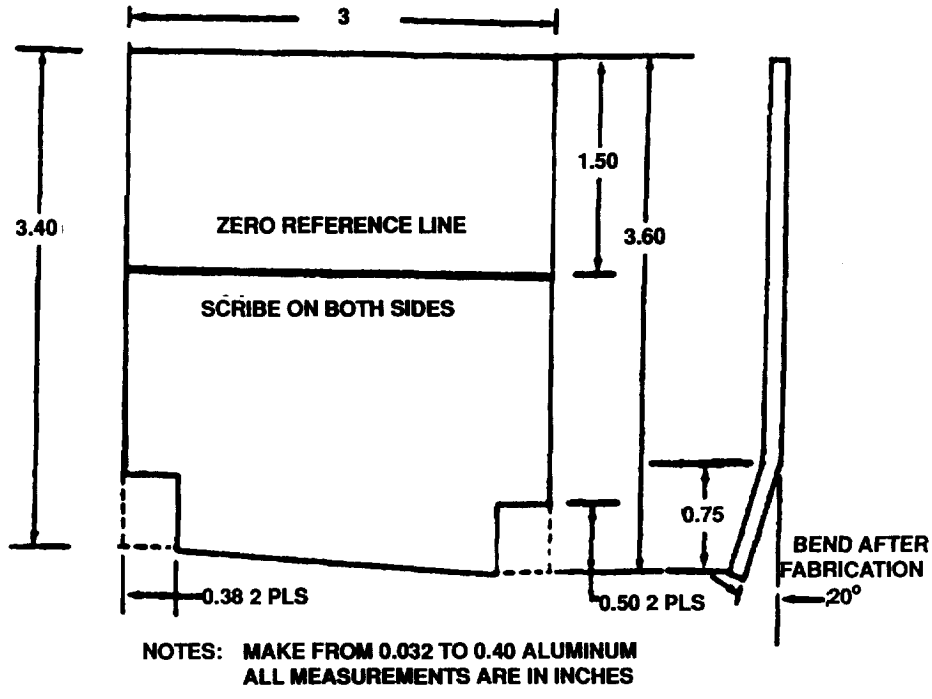


Figure 5-4.2 Strap Gage, T56.8

(3) If autorotation RPM is not within limits refer to paragraph 5-10.

5-10. Autorotation RPM Adjusting — Main Rotor Hub and Blade Assembly.

a. Check rotor rpm in autorotation (TM 55-1520-242-MTF). Make straight ahead autorotative descent at constant 60 knots indicated airspeed. (Turns and changes of airspeed affect rotor rpm.) Throttle should be at engine idle and collective full down. Do not let rpm exceed limits if rotor is out of adjustment. When in steady autorotative descent, note rotor rpm.

b. If rotor overspends, shorten both pitch change links equally. One flat rotation of pitch link barrel changes rotor speed approximately 2 to 4 rpm and may vary from aircraft to aircraft.

c. If rotor underspeeds, lengthen both pitch change links equally.

d. Tighten jamnuts on pitch change links (figure 5-5 for proper torque). Lockwire (Cl 55) upper jamnut to both barrel and clevis. Lockwire (C155) lower jamnut to barrel.

NOTE

After final pitch link adjustment the exposed thread length of upper and lower bearings shall be equal within 2-1/2 threads for pitch links without thread engagement inspection holes. For pitch links with thread engagement inspection holes, exposed thread lengths shall be equal within 5 threads, provided adequate thread engagement is indicated at inspection hole.

e. Recheck rpm in flight and repeat adjustment as necessary.

5-11. Troubleshooting — Main Rotor Hub and Blade Assembly. A chart of possible main rotor troubles, causes, and corrective action is shown on table 5-1. Refer also to Section VIII for additional information, specific testing, and mechanical procedures for adjusting the main rotor.

NOTE

Before using this table, be sure to have performed all normal operational checks.

Table 5-1. Troubleshooting Main Rotor System

CONDITION	TEST OR INSPECTION	CORRECTIVE ACTION
1. Lateral vibration.		
	STEP 1. Rotor unbalanced spanwise.	
		Balance dynamically with weight in blade bolt (paragraph 5-123).

Table 5-1. Troubleshooting Main Rotor System (Cent)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

STEP 2. Rotor unbalanced chordwise.

Balance dynamically by adjusting drag brace (sweeping blade) (paragraph 5-123).

STEP 3. Stabilizer bar unbalanced.

Balance stabilizer bar (paragraph 5-46).

2. Vertical 1/rev vibration.

STEP 1. Rotor out of track.

Track blades (paragraph 6-122).

STEP 2. Worn bearings in collective lever assembly and link.

“Replace worn bearings (paragraph 5-68).

STEP 3. Worn pitch change link rod end bearing.

l Replace if wear is excessive (paragraph 5-39).

STEP 4. Excessive wear in collective scissors assembly.

“Repair or replace scissors and sleeve assembly (paragraph .5-74).

STEP 5. Internal wear or damage in main rotor hub assembly.

Repair or replace hub (paragraph 5-14 thru 5-24).

3. Collective pitch control forces not normal in cruise (Boost off).

STEP 1. Incorrect torsion strap adjustment.

Adjust strap torsion (paragraph 5-8)

*Wear at one bearing or combined wear at these locations significantly contributes to vibrations.

Table 5-1. Troubleshooting Main Rotor System (Cont)

CONDITION	TEST OR INSPECTION	CORRECTIVE ACTION
	STEP 2. Servo cylinder irreversible valve malfunction.	Replace valve (paragraph 7-100).
4. Slow control response.		
	STEP 1. Internal leakage in servo cylinder.	Replace cylinder or seals as necessary (paragraph 7-81).
5. Pylon rock.		
	STEP 1. Defective fifth mount.	Replace mount (paragraph 6-148).
	STEP 2. Defective pylon dampers	Repair or replace pylon dampers (paragraph 6-149).
	STEP 3. Mount bolts bottomed or stripped.	Replace bolts (paragraph 6-40).
6. Engine and rotor rpm increases + 100 (+ 1.5% N2) l nd stabilizes with the application of power.		
	STEP 1. Main rotor pitch change links out of adjustment (nominal setting incorrect).	Adjust both pitch change links to obtain nominal setting (paragraph 5-13).
7. 2/rev vibration, approximately ten per second.		
	STEP 1. Pylon mounts deteriorated.	Replace mounts (paragraph (6-148).
8. Rotor rpm high or low in autorotation.		
	STEP 1. Low pitch blade angle incorrect.	Adjust both pitch change links equally (paragraph 5-10).

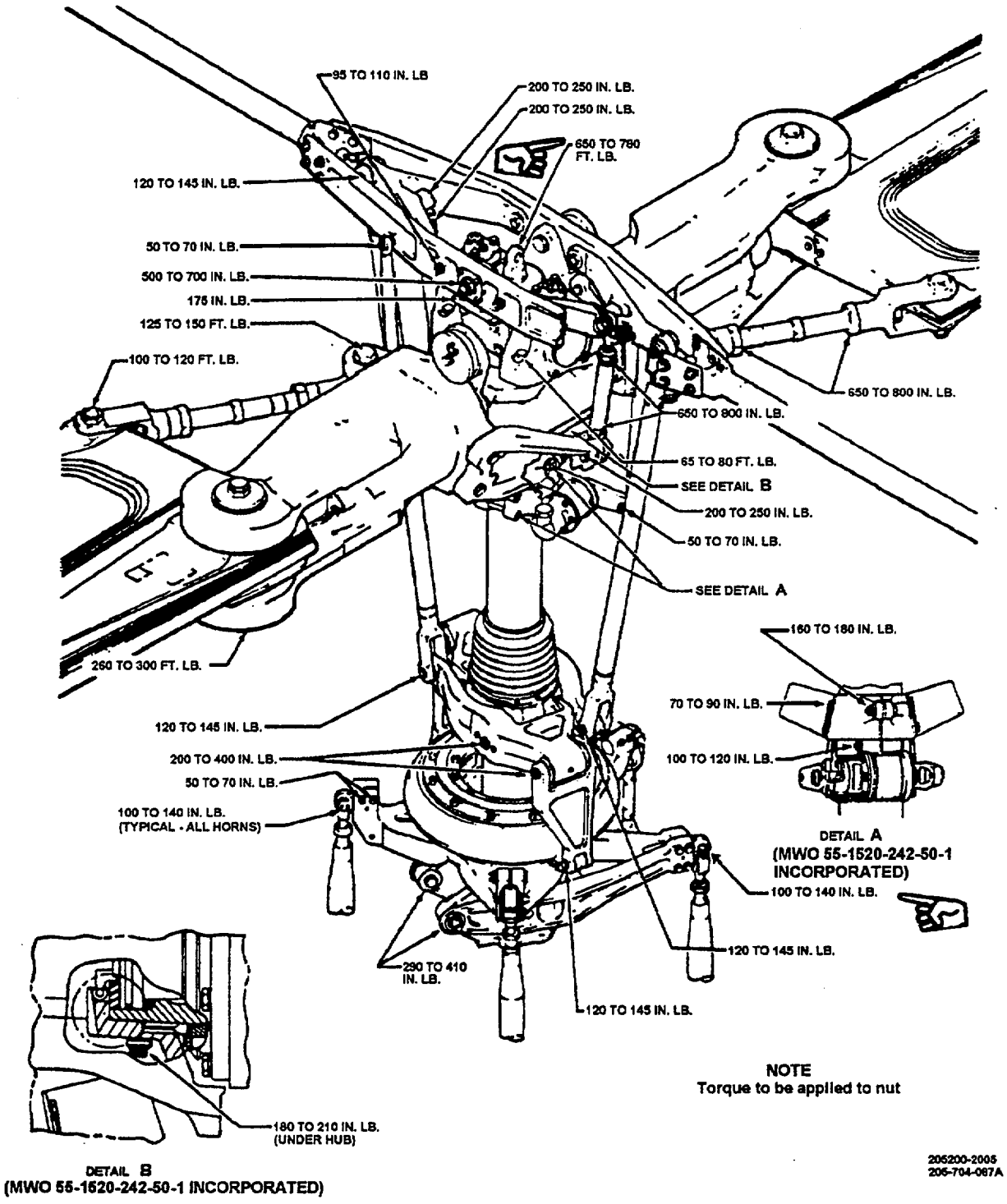


Figure 5-5. Rotor System Torque Values

5-12. Removal – Main Rotor Hub and Blade Assembly. Item numbers below refer to figure 5-6 unless otherwise Indicated.

Premaintenance requirements for removal of main rotor hub and blade l aaembly

Condition	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T11) (T12) (T13) (T22) (T34) (T41) (T49) (T53)
Test Equipment	None
Support Equipment	Tie-down, blade support assembly
Minimum Personnel Required	Three
Consumable Materials	None
Special Environmental Conditions	None

a, Remove stabilizer bar with pitch change links and tubes (paragraph 5-40).

b. Remove lockwire, bolt (4, figure 5-6), and lock (5) at side of mast nut (3)

c. Install socket (T12) (8, figure 5-7) on the mast nut, Install adapter (T13) (9), making sure it sits level on top of the trunnion Install power wrench (T11) (3) onto the adapter, making sure the through pins on the wrench reaction arm engage the two holes m the adapter Install the 3/4-inch drive bar (4) into the square drive of the power wrench and turn the knurled ratchet indexer (2) counterclockwise until the drive bar drops into the socket Install input crank handle (1) and turn counterclockwise

NOTE

Normally torque will build up in the power wrench until breakaway torque is reached. The indicator will reverse is the torque is released.

d. Remove power wrench and finish removal of the mast nut (3, figure 5-6) with a 1-1/4-inch socket. Remove washer (2).

WARNING

Do not allow main rotor blades to rotate on pitch-change axis. if blade is inadvertently allowed to rotate on the pitch change axis beyond 60°, the main rotor grip retention strap shall be replaced.

CAUTION

Grip positioning links must be installed to prevent damage to main rotor strap assemblies (figure 5-2).

e. Install a grip positioning link (T41) between each rotor pitch horn and adjacent bolt of pillow block as shown in figure 5-2.

CAUTION

Install two slings so that both grip assemblies are lifted at the same time to prevent dropping the rotor hub assembly.

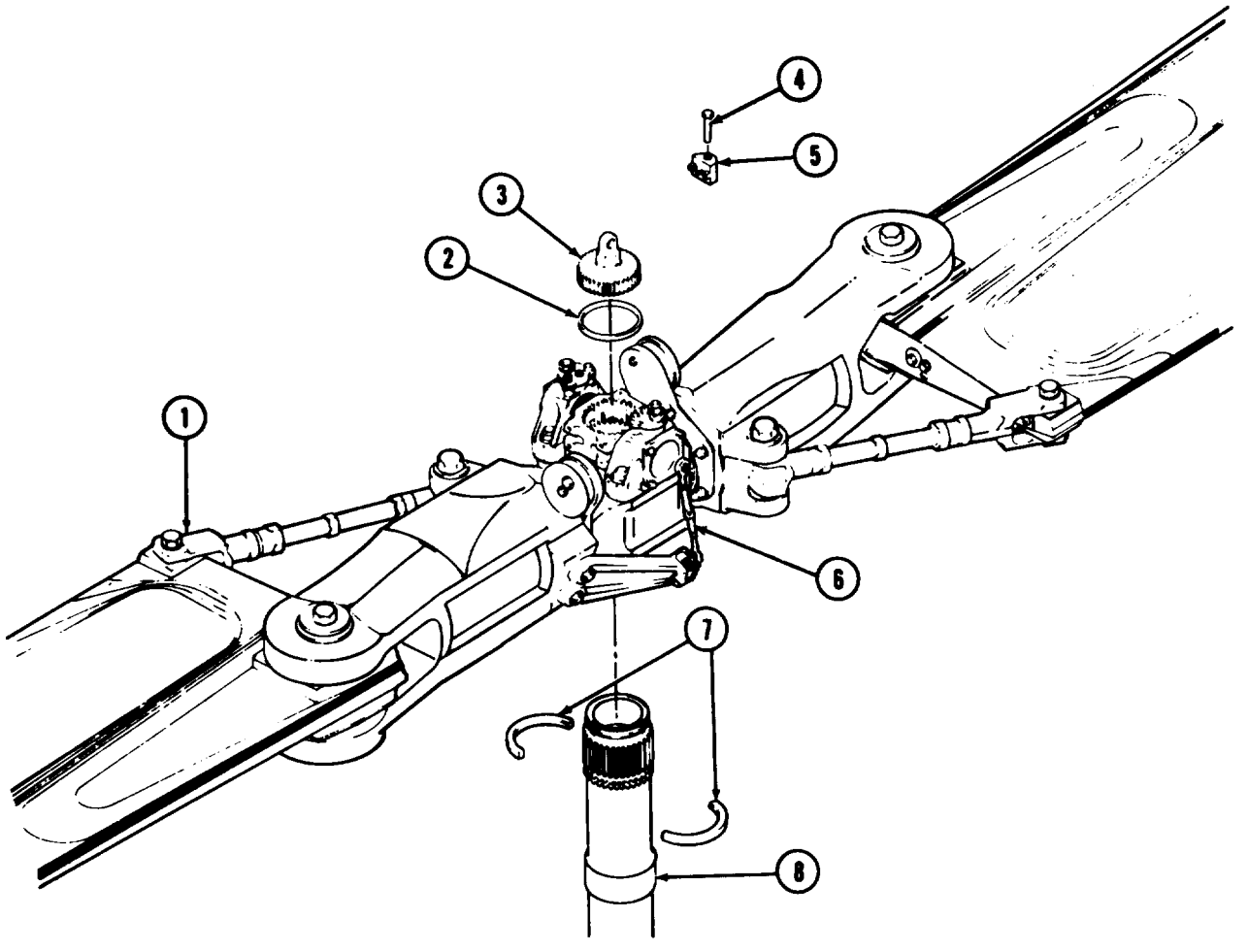
f. Install maintenance hoist (T53), or position other suitable hoist above mast, attach to hub of main rotor (1, figure 5-6) with two lifting slings (T22).

g. Guide and steady rotor by means of tie-down assembly, while lifting hub clear of mast (8) Remove split cone set (7)

NOTE

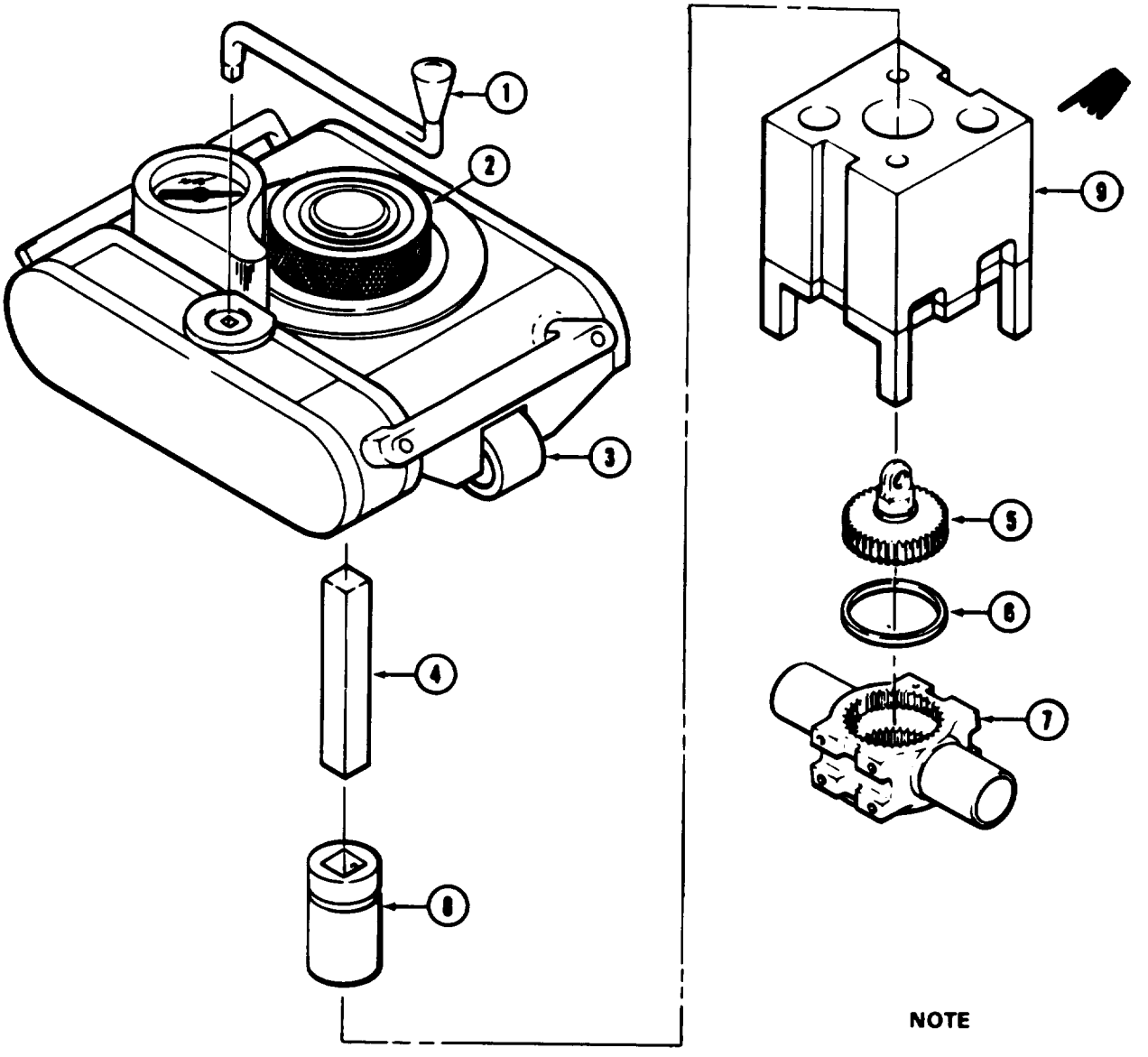
Fasten split cones together and retain as a matched set.

h. Place main rotor assembly on build-up bench (T34) equipped with adapter plate (T49). Place supports under blades.



1. Main rotor hub and blade
2. Washer
3. Mast nut
4. Bolt
5. Lock
6. Grip positioning link (T41)
7. Cone set
8. Mast

Figure 5-6. Main Rotor Hub and Blade Installation



1. Input crank handle
2. Knurled ratchet indexer
3. Power wrench (T11)
4. Drive bar
5. Retaining nut
6. Washer
7. Trunnion
8. Socket (T12)
9. Reaction torque adapter (T13)

NOTE

Torque nut to 650 foot-pounds. Wait 3 minutes. Monitor torque loss.

Retorque nut to 650 foot-pounds and monitor torque indicator for 1 minute.

Retorque if torque loss occurs in the 1 minute interval.

Back off holding pressure between wrench and torque adapter to zero.

Remove wrench and adapter and check for alignment of lock with nut splines.

Figure 5-7. Main Rotor Mast Nut Torquing

5-13. Installation — Main Rotor Hub and Blade Assembly. Item numbers below refer to figure 5-6 unless otherwise indicated.

Premaintenance requirements for installation of main rotor hub and blade assembly

Condition	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T11) (T12) (T13) (T22) (T41) (T53)
Test Equipment	None
Support Equipment	Tie-down assembly, protractor
Minimum Personnel Required	Three
Consumable Materials	(C86) Corrosion preventive compound (C155) Lockwire
Special Environmental Conditions	None

a. Ensure that grip positioning links (T41) are installed on main rotor hub (figure 5-2).

al. Inspect worm screw of plate assembly (11.1, figure 5-12). The worm screw should not turn when a torque of 10 to 15 inch-pounds is applied. Remove and w-install plate assembly if worm gear turns.

b. Install maintenance hoist (T53) on helicopter, or provide other suitable hoist.

CAUTION

Install two slings so that both grip assemblies are lifted at the same time to prevent dropping the rotor hub assembly.

c. Attach two hoisting sligns (T22) and lift main rotor hub and blade assembly (1, figure 5-6) to a position above mast (8). Use rotor tie-down tool to guide and steady rotor during handling.

NOTE

Use a light coat of corrosion preventive compound (C86) on mast splines. Make sure compound is not forced on or under the split cones when installing hub assembly. Do not coat mast threads or split cone groove with compound.

d. Coat splines of mast (8) and rotor hub trunnion with corrosion preventive compound (C86).

NOTE

Dropping the split cones does not constitute automatic replacement unless the damage limits listed on figure 5-8 are exceeded.

e. Inspect split cones for any nicks, scratches, indentions, or deformaties of any type. Replace cones if limits shown on figure 5-8 are exceeded.

NOTE

Install split cones as matched set only. Do not use grease under split cones.

NOTE

Split cones are installed and torqued with equal end gap spacing. If the split cones touch at anytime thereafter, there is no need to respace them.

f. Place cone set (7, figure 5-6) in groove of mast upper splines with bevel side up and end gaps evenly spaced.

CAUTION

Rotor must be aligned directly over mast to avoid damaging mast threads

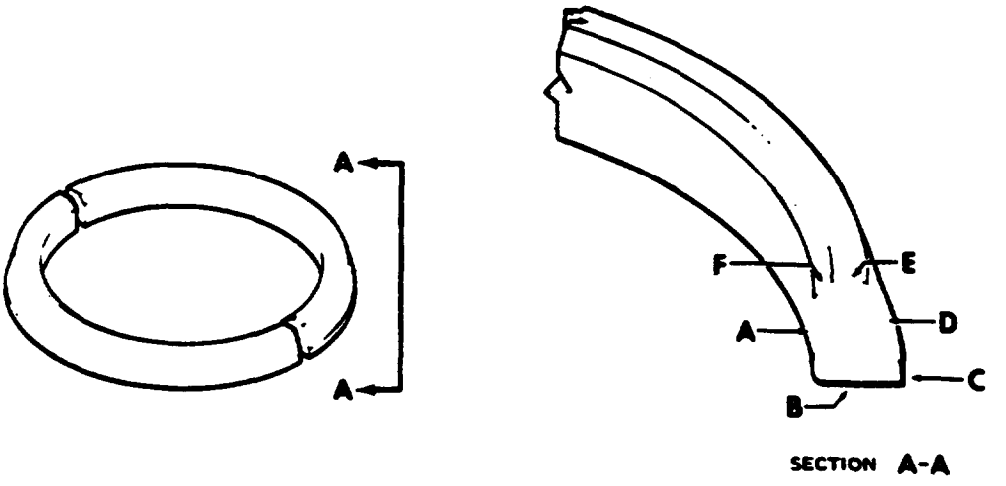
g. Position rotor directly over mast. Align master splines and lower rotor onto mast, seated on split cone *set.*

NOTE

Before installing retaining nut, be sure cap plug is installed in mast.

h. Install washer (2) and mast nut (3) on mast. Tighten, but do not torque, the nut with a 1-1/4 inch socket. Make sure split cones are evenly gapped.

Make sure that adapter (T13, 9, figure 5-7) is completely nested down on trunnion (7) to prevent drive bar (4) from disengaging from socket (8) and also to prevent incorrect torque indication.



1. Damage to surfaces C, E, and F may be considered negligible and not requiring repair if the depth of damage does not exceed **0.010** inch and if the minimum radii observed in the damage area not not less than **0.025** inch.
2. Surfaces A and D must not have any protrusions above the surrounding surface. Dents and scratches not in excess of **0.010** inch in depth may be polished out with crocus cloth (C68).
3. Damage to surface B not exceed **0.005** inch. If damage exceeds one-eighth surface area, replace cones.
4. All edges may be chamfered **0.030** inch.
5. Corrosion (Rust) repair requires twice the depth of damage to effectively clean up. The depth of corrosion damage before clean up shall not exceed one half the allowable mechanical damage before clean up.
6. Treat repaired split cones with corrosion preventive (C136).

Figure 5-8. Split Cone Damage Limits

i. Install socket (T12) (8. figure 5-7) on the retaining nut. Install adapter (T13) (9) making sure it sits level on top of the trunnion. Install power wrench (711) (3) onto the adapter making sure the through pins on the wench reaction arm engage the two holes in the adapter. Install the 3/4 inch drive bar (4) into the square drive of the power wrench and turn the knurled ratchet indexer (2) clockwise until the drive bar drops into the socket.

j. Install input crank handle (1) into wrench and turn clockwise until 660 foot-pounds of torque is read on the torque indicator.

NOTE

Monitor the torque indicator reading for l full 3 minutes. It will be normal if a decline in torque is noted on the torque Indicator. This condition is caused by the cone sets seating themselves. Do not back off on torque if a loss of torque is noted.

k. Retorque retaining nut to 650 foot-pounds and monitor the torque indicator for any loss in torque for one full minute. Repeat again as necessary. After obtaining 650 foot-pounds with no loss, turn the input crank handle counterclockwise until the torque indicator returns to zero (green). This removes the holding force on the wrench.

1. Remove input handle (1), power wrench (3), (T11), drive bar (4), adapter (9) (T13), and socket (8) (T12). check split cone eat for even gap. If lock (5, figure 5-6) and retaining nut splines do not line up. reinstall the power wrench and increase the torque on the nut until alignment is obtained.

NOTE

The protractor on the face of the power wrench may be used as a guide for estimating the additional degree of turn for alignment. Do not exceed 780 foot-pounds torque aligning the lock.

m. Install lock (5), engage with nut splines and secure to trunnion with bolt (4). Torque bolt 50 to 75 inch-pounds. Lockwire (C155) bolt head to trunnion.

n. Install stabilizer bar (figure 5-27, sheet 1) and connect (8) to pitch horns (10), control tube (21) to scissor levers (25), and tubes (18) to damper levers (13) (paragraph 5-47). Remove grip positioning links when connecting pitch links to pitch twin. Install washer and nut . Torque nut 100 to 140 inch-pounds.

NOTE

If same hub and blade assembly and pitch links are being Installed, and adjustment of pitch links Is known to be satisfactoty, omit step o. and proceed to step p.

o. Set main rotor minimum pitch as follows:

(1) Adjust each pitch link to 10.5 inches between bearing centers, with rod ends aligned and with exposed threads equal at both ends within 0.030 inch (figure 5-9).

(2) Place cyclic stick in centered position and collective control stick full down.

(3) Take reading by placing protractor chordwise on each blade grip. Add two readings together. Total of two readings should be 15 TO 17 degrees.

(4) Adjust both links equally and in same direction until above reading is obtained.

NOTE

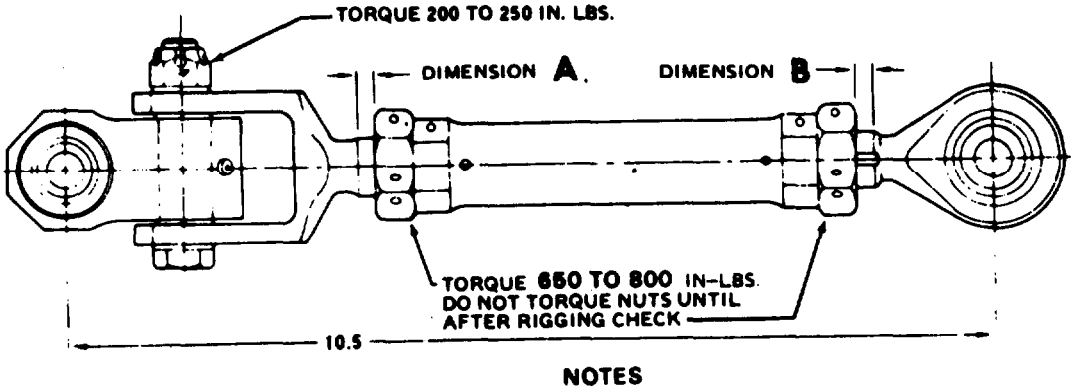
Pitch change links may require further adjustment during operational check. If rotor overspends In autorotation, shorten links equally. If rotor underspends, lengthen links equally. Normal autorotation rpm will be set at light gross weight. (TM 55-1520-242-MTF).

(5) Torque jamnuts on pitch change links, 850 to 800 inch-pounds. Lockwire (C155) upper jamnut to both barrel and clevis. Lockwire (C155) lower jamnut to barrel. Check hole in barrel to ensure minimum thread engagement.

p. Remove maintenance hoist from helicopter.

p1. Main rotor greased hub and blade installation-see lubrication requirements in paragraph 1-7.

q. Perform operational check (paragraph 5-9).



NOTES

DIMENSION A DIMENSION B shall be equal within 0.030 inch.

Set pitch links to 10.5 inches initially. Shorten pitch link of low blade to adjust blade track at low RPM.

Figure 5-9. Pitch Change Link Assembly

SECTION II. MAIN ROTOR HUB

5-14. MAIN ROTOR HUB.

5-15. Description — Main Rotor Hub. The main rotor hub assembly consists of a yoke with a machined spindle on each end. Grips are mounted on each spindle for pitch change. The yoke is underslung on a trunnion mounted through two pillow blocks forming a flapping axis. The splined trunnion mounts to top of mast. After incorporation of MWO 55-1520-242-50-1 a plate assembly is attached under the yoke. At rotor flapping angles of greater then 4 degrees the elastomeric springs mounted on the mast will be contacted by the plate assembly. Hub spring contact only is not an indication that the aircraft is operating beyond the approved flight envelope.

5-16. Inspection — Main Rotor Hub (Installed).

a. Check that oil seepage from main rotor grips does not exceed normal amount. Replacement of grip seals is required if either of the following conditions occurs:

(1) During a 2 hour flight, grip reservoir is empty.

(2) After a 24 hour period when helicopter is not operated, grip reservoir is empty.

NOTE

Do not attempt to clean main rotor grip seals.

b. Inspect pillow block and grip reservoirs as follows:

(1) Inspect for seepage; seepage standards are the same as for the main rotor grips (step a, above).

(2) Inspect for contamination; discolored oil indicates contamination. If contamination is noted, flush and refill the reservoirs at the next inspection or service. If flushing fails to remove the contamination, replace the hub assembly.

c. Inspect all parts for security.

d. Visually inspect exposed parts for corrosion or damage. Refer to paragraph 5-20 for detailed inspection of parts.

5-17. Removal — Main Rotor Hub. a. Remove main rotor hub and blade assembly (para. 5-12).

b. Remove blades from hub (para. 5-30).

5-18. Disassembly — Main Rotor Hub.

WARNING

Mark plate assembly (11.1, Figure 5-12) prior to removal. Adhesive shim must be returned to original position or binding of the worm gear and installation bolts is possible.

Table 5-2. Inspection Requirements Main Rotor Hub

FIGURE 5-24 INDEX NO.	DEFECTS	METHOD	PARAGRAPH REFERENCE	
		INSPECTION	INSPECTION	REPAIR
Grip (3)	Wear, pitting, corrosion, score marks, worn bushings, leaking grip and grip reservoir seals	Visual and measurement	5-20	5-21
Drag Brace Bolts (7) and (18)	Wear, pitting, corrosion scoremarks	Visual and measurement	5-20	5-21
Blade Retaining Bolt (4)	Wear, pitting, corrosion, score marks, loss of lubricant	Visual and measurement	5-20	5-21
Pillow Bled (1)	Wear, pitting, corrosion, score marks, leaking reservoir seals	Visual	5-20	5-21
Drag Brace (8)	Corrosion, damage, wear	Visual	5-20	5-21

Premaintenance requirements for disassembly of main rotor hub

Condition	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T34) (T41) (T42) (T49) and (T72)
Test Equipment	None
Support Equipment	Standard Bearing Puller
Minimum Personnel Required	Two
Consumable Materials	(C86) (C43) (C235) (C177) (C231.1) (C29) (C36) (C162) (C261) (C68) (C4) (C91) (C242) or equivalent
Special Environmental Conditions	None

a. Remove grip reservoirs as follows:

NOTE

Removal of both rotor grip reservoirs are Identical.

(1) The following applies to oil lubricated hub

(a) Remove boil (1, figure 5-10) lockwashers (2), steel washer (3) aluminum washer (4) and packing (5).

(b) Remove reservoir cover (6), packings (8) and sight glass (9).

(2) For hubs that are grease lubricated (after incorporation of MWO 55-1615-258-50-1), remove lockwire, bolt (14, figure 5-10), washer (13), plate cover (12) and gasket (15).

b. Remove pillow block reservoirs as follows:

NOTE

Removal of both pillow block reservoirs are Identical.

(1) The following applies to oil lubricated hubs:

(a) Remove bolts (1, figure 5-11) lockwashers (2), steel washers (3), and aluminum washers (4).

(b) Remove reservoir cover (5) and packing (6) from reservoir.

(c) Remove reservoir (7) and packings (8) from pillow block (9).

(2) For grease lubricated hubs (after incorporation of MWO 55-1650-258-50-1) remove lockwire, bolts (19, figure 5-11), washers (18), plate (17), and gasket (20).

CAUTION

When replacing main rotor pillow block bolts, replace one bolt at a time.

CAUTION

The pillow blocks may be removed to comply with the sudden stoppage Inspection In chapter one provided that the blocks and yoke are marked for reassembly In the same position, and the blocks and trunnion are removed and installed as an assembly. Do not disassemble these components.

(1) Remove nut (13), washers (12), and bolt (10).

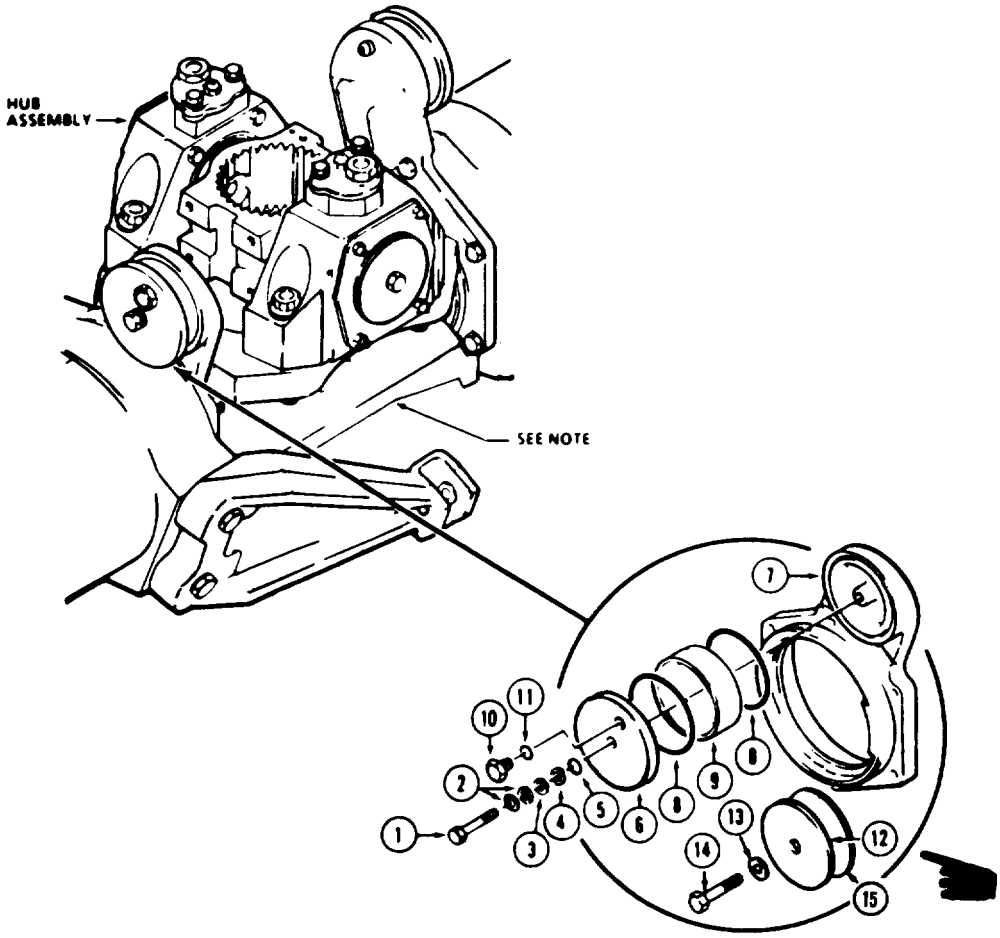
(1.1) Prior to incorporation of MWO 55-1520-242-50-1, proceed to next step. After incorporation of MWO 55-1520-242-50-1, coat mating surfaces of pillow block (9), new bolt (10), and bushing with corrosion preventive compound (C91), coat entire shank of bolt (10) with corrosion preventive compound (C91).

NOTE

Do not use excessive amounts of sealant that could impair future replacement of bolts.

(2) Prior to incorporation of MWO 55-1520-242-50-1, install new bolt (10) with two washers (12) and nut (13). Torque nut 77 to 79 foot-pounds. If full depth thread does not show through nut, remove one washer and retorque nut,

(2.1). After incorporation of MWO 55-1520-242-50-1, install new bolt (10) with washer (12) and nut (13). Thoroughly clean all surfaces with solvent (C261). Coat bolt shank with corrosion preventive compound (C91). When replacing bolts that had evidence of the nut bottoming out use two washers under the nut and assure that one full depth thread shows through nut. Torque bolts 65 to 80 ft. lbs., this will prevent the nut from bottoming out. After bolts are installed apply a small bead of sealing compound (C242 or equivalent) around the base of bolt head, washer(s) (12) and the interface between the bushing (11) sleeve and the yoke (P/N 204-011-102-1). Sealing compound is required to prevent moisture from entering bolt cavity,



1. BOLT
2. WASHER (SPLIT LOCK)
3. WASHER (THIN STEEL)
4. WASHER (ALUMINUM)
5. PACKING
6. RESERVOIR COVER
7. PLATE ASSEMBLY
8. PACKING
9. SIGHT GLASS
10. FILLER PLUG
11. PACKING
*12. PLATE COVER
*13. WASHER
*14. BOLT
*15. GASKET

NOTE

PLATE ASSEMBLY INSTALLED AFTER INCORPORATION OF MWO 55-1615-258-50-1.

* FOR USE ON P/N 204-012-101-139 and 141 ONLY.

Figure 5-10. Main Rotor Hub Grip Reservoirs

NOTE

Do not use excessive amounts of sealant that could impair future replacement of bolts.

d. Remove nut (29, figure 5-12), washers (28), and bolt (1) to detach drag brace (2) from grip (4).

e. Deleted.

f. Deleted.

g. (AVIM) Remove grip for seal replacement.

NOTE

If main rotor hub assembly balance has not been disturbed and only seal replacement Is required, hub assembly does not require rebalancing, nor is hub and blade assembly alignment required if drag brace length has not been altered.

(1) Place hub assembly on buildup bench (T34) equipped with an adapter plate (T49). Remove blades from hub (paragraph 5-30).

(2) Cut lockwire and remove bolt (31, figure 5-12), and washer (30), clamp (27), and retention nut lock (26). Screw off retention nut (32) and remove index key (3).

(2.1) Cut lockwire and remove bolts (24) and washers (23) attaching pitch horn (25) to grip (4) and remove horn.

(3) Remove retaining pin (6) from retention strap fitting (17) at outboard end of retention strap (15). Remove strap fitting (17) and preformed packings (16).

CAUTION

If shield assembly P/N 204-012-116-3, is installed, grip is free to slip from yoke.

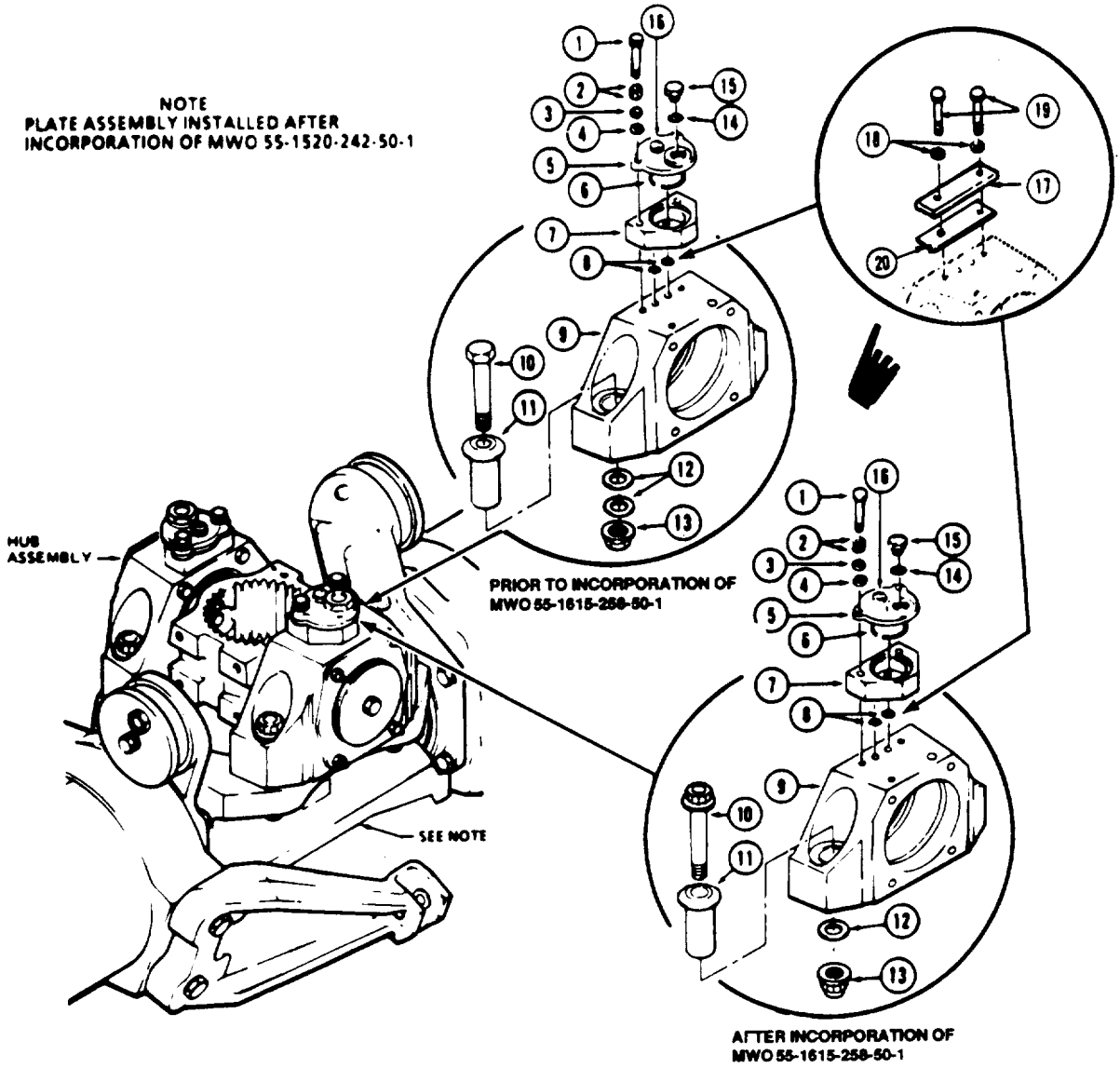
(4) Remove grip assembly (4) by pulling outboard while rotating 90 degrees.

(5) Cut lockwire and remove six bolts (18) and washer (19) attaching grip plate (20) to grip assembly (4).

(6) Remove grip plate (20), grip seal (5), grip plate shim (22) and packing (21). Identify shims for reinstallation in the same location from which removed.

WARNING

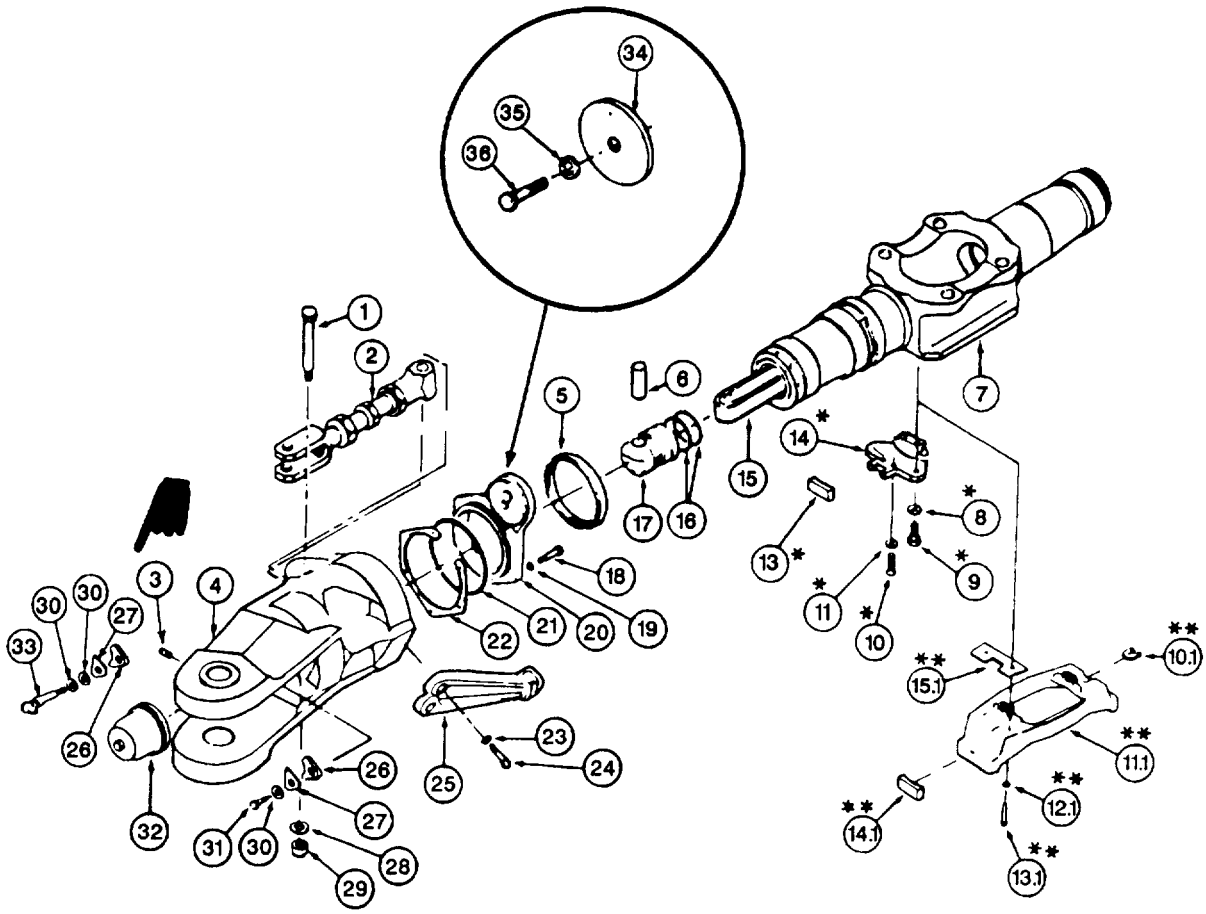
Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.



1. BOLT
2. WASHER (SPLIT LOCK)
3. WASHER (THIN STEEL)
4. WASHER (ALUMINUM)
5. RESERVOIR COVER
6. PACKING
7. RESERVOIR
8. PACKINGS
9. PILLOW BLOCK
10. BOLT
11. BUSHING
12. WASHER
13. NUT
14. PACKING
15. FILLER PLUG
16. PLUG
*17. PLATE
*18. WASHER
*19. BOLT
*20. GASKET

*FOR USE ON P/N 204-012-101-139 & 141 ONLY

Figure 5-11. Main Rotor Hub Pillow Blocks



1. Drag brace bolt
2. Drag brace assembly
3. Index key
4. Grip assembly
5. Grip seal
6. Retaining pin
7. Yoke
8. Washer*
9. Bolt*
10. Screw*
10.1. Key * *
11. Washer*
11.1. Plate assembly* *
12. Deleted
12.1 Washer* *
13. Stop*
13.1. Bolt* *
14. Static stop*
14.1. Stop (rubber)* *
15. Retention strap
15.1. Shim* *
16. Preformed packing
17. Retention strap fitting
18. Bolt
19. Washer
20. Grip plate
21. Preformed packing
22. Grip plate shim
23. Washer
24. Bolt
25. Pitch horn
26. Retainer nut lock
27. Clamp
28. Washer
29. Nut
30. Washer
31. Bolt
32. Strap retainer nut
33. Grease fitting* * *
34. Cover plate* * *
35. Washer* * *
36. Bolt* * *

* Prior to incorporation of MWO 55-1520-242-50-1
* * After incorporation of MWO 55-1520-242-50-1
* * * After incorporation of MWO 55-1615-258-50-1

Figure 5-12 Main Rotor Hub Grip Seal Replacement

(7) Clean all cement and grease from grip plate (20) using methyl-ethyl-ketone (C177) and plastic scraper.

(8) If lubricating oil or grease has entered the retention strap cavity due to faulty outboard strap fitting packings, replace packings. Additionally inspect the strap assembly in accordance with paragraph 5-20.

(9) Check shield assembly (12, figure 5-13) for evidence of damage to dust shield or wear to seal contact area. A maximum of **0.020** inch wear is authorized in seal contact area. If shield assembly is damaged or packing (13) requires replacement proceed as follows:

NOTE

The grip bearings and inner races (8 and 10, figure 5-13) are matched sets therefore all parts must be reinstalled in their original position.

(a) Remove, hub assembly from buildup bench.

(a.1.) Prior to incorporation of MWO 55-1520-242-50-1, remove lockwire and two bolts (9), two washers (8), two screws (10), and two washers (11), securing static stop (14), aligning bracket (12), and stop (13) to yoke assembly (7).

NOTE

Mark plate assembly (11.1) orientation, "Red" end and "White" end prior to removal. Similarly mark shims (15.1) with location as "Red" and "White".

(a.2.) After incorporation of MWO 55-1520-242-50-1, remove lockwire and four bolts (13.1, figure 5-12) and four washers (12.1) securing plate assembly (11.1) and shims (15.1) to yoke (7). Remove plate assembly (11.1) from yoke (7). Remove key (10.1) and stop (14.1).

(b) Tap outboard end of strap assembly (11, figure 5-13) with a nonmetallic hammer to move inboard strap fitting (16) inboard until pin (18) can be removed.

(c) Remove inboard strap fitting (16) with back up ring (15) and packing (17) from yoke (14).

(d) Remove backup ring (15) and packing (17) from inboard strap fitting (16).

(e) Remove strap assembly (11) outboard from spindle of yoke (14).

(f) Remove seal sleeve (3) with packing (1), channel seal (2), and packing (7) from spindle of yoke (14).

(g) Clean sealant from spindle and sleeve with MEK (C177) and plastic scraper.

(h) Remove packing (7) from outside of seal sleeve (3) and channel seal (2) with packing (7) from inside of seal sleeve (3).

(i) Remove lockwire and two screws (4) securing lock plate (5) to nut (6).

(j) Remove nut (6) from spindle of yoke (14) using tool (T72).

NOTE

If PIN 204-012-116-3 shield assembly (12) is installed, bearing puller (T42) cannot be used. This shield assembly should be removed by tapping around its circumference with a nonmetallic hammer.

(k) Position bearing puller (T42) with bearing puller attachments as shown in figure 5-14, and remove inner race (8, figure 5-13), inner sleeve (9), inner race (10) and shield assembly (12) with packing (13) from yoke (14). Identify inner races (8 and 10) for proper location.

(l) Remove packing (13) from inside of shield assembly (12).

(10) Shield Assembly (12, figure 5-13). Visually inspect the shield assembly for the following. Any of the following defects are cause for rejection:

(a) Pits, nicks and scratches

(b) Scoring or grooving of seal area.

(c) Dust shield for security.

(d) Cracks.

(e) Any other visible defects.

(f) Any defect which affects the sealing capability of the shield assembly.

5-19. Cleaning - Main Rotor Hub.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

a. Clean all parts with solvent (C261).

b. Clean sealant from retaining pins and strap fittings using methyl-ethyl-ketone (C177) and plastic scraper.

5-20. Inspection - Main Rotor Hub. (Disassembled)

a. Inspect grip reservoir and pillow block reservoir sight gages for scratches, cracks, and for transparency. Inspect plate assembly for grease leakage, warpage and proper seating.

b. (AVIM) Inspect grips, pillow blocks, pitch horns, drag braces, and blade retaining bolts for wear, pitting, corrosion, and scoring in accordance with figures 5-15 to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

b.1. Inspect grip plate for evidence of damage. Maximum allowable damage is 0.150 at lower boss and 0.035 at the upper oil passage area. If crack is suspected on plate assembly, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

c. Inspect blade retaining bolts for loss of dry film lubricant or after repair, touch up bare metal exposed using dry film lubricant (C162).

d. (AVIM) Inspect strap retaining pins with 10-power magnifying glass for corrosion and bonding separation. Any evidence of corrosion is cause for rejection and replacement.

(1) Serviceable pins shall be modified by installing one aluminum alloy washer (P/N AN960PD816L) to each end of the inboard and outboard pins.

NOTE

If washers (AN960PD816L) are not available, they may be fabricated from 2024-T3 aluminum alloy 0.016 inch thick with an OD of 0.875 inch.

(2) Accomplish bonding by applying a light coat of adhesive (C25) (after thorough degreasing of pin) to the ends of each pin and to the washers. Permit 30 minutes cure time. Apply an even coat of properly mixed metalset A-4 adhesive (C32) and secure washers to retention pins. Cure for 24 hours.

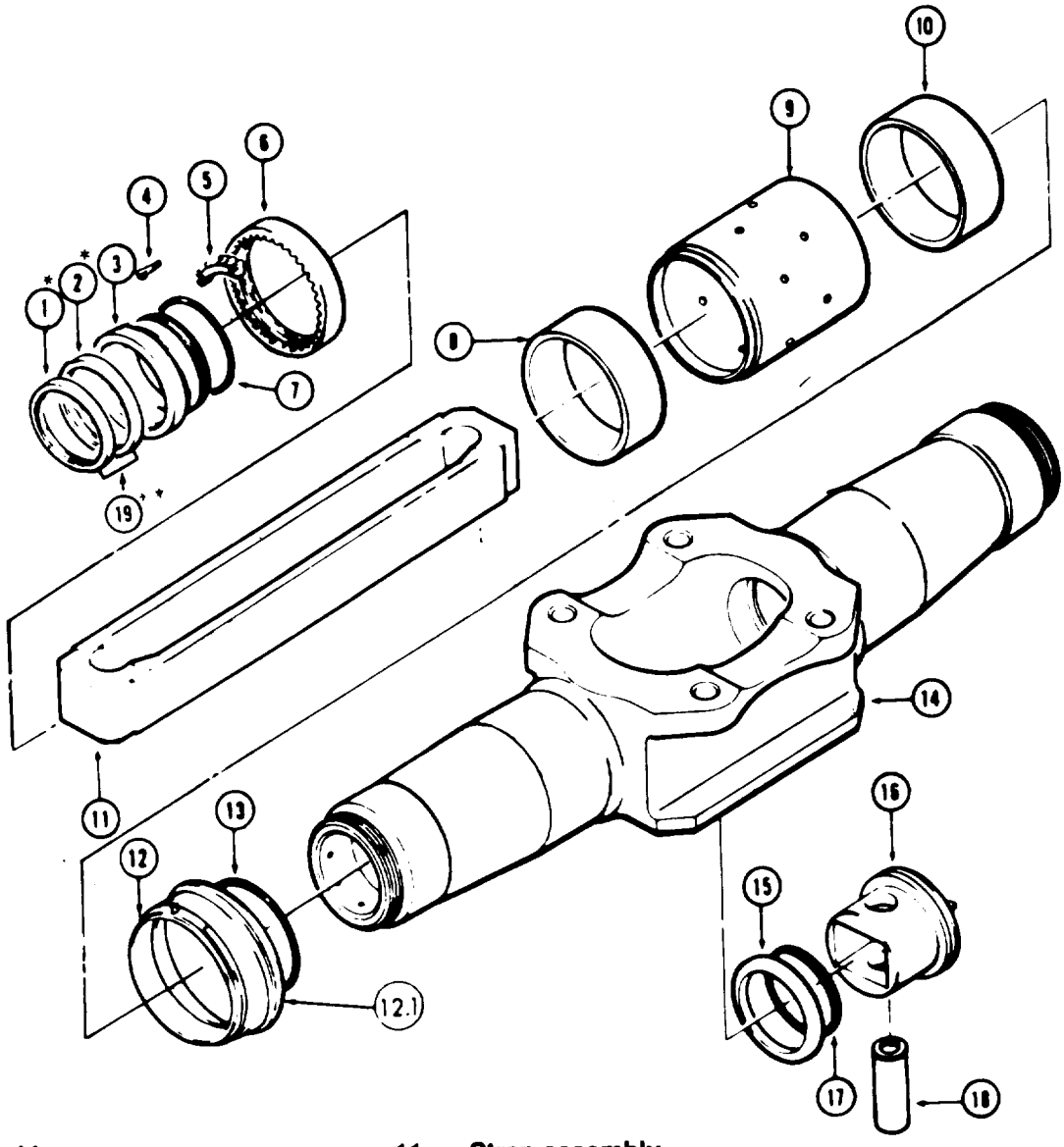
e. (AVIM) Inspect parts for wear using the limits shown on figure 5-20. If crack is suspected on plate assembly, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

f. Prior to incorporation of MWO 55-1520-242-50-1, inspect static stops for cracks or deformation. If crack is suspected on plate assembly, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

f.1. After incorporation of MWO 55-1520-242-50-1, inspect plate assembly (figure 5-19.3) for cracks and other defects. Inspect adhesive (C29) shim on worm screw brace for cracks and security. Loose or missing adhesive requires complete removal and reapplication of adhesive during assembly. If crack is suspected on plate assembly, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

f.2. After incorporation of MWO 55-1520-242-50-1, inspect key (10.1 figure 5-12) for cracks and corrosion. Replace at overhaul or if cracks are present.

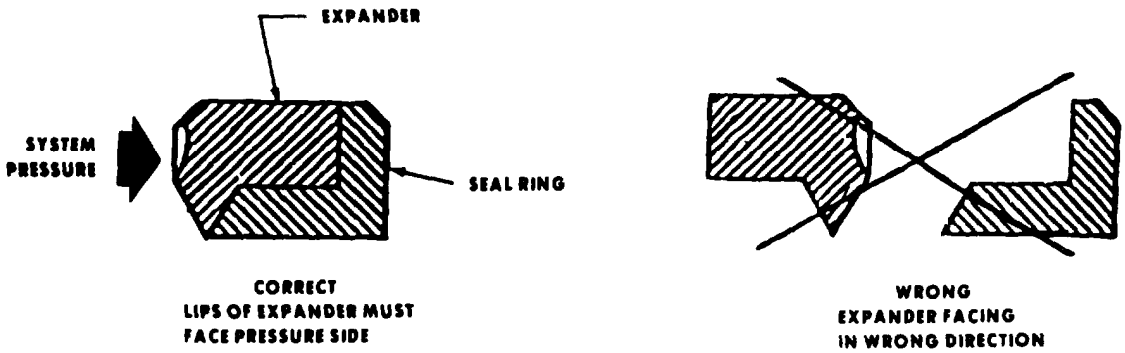
g. (AVIM) Inspect grip retention nut for wear and cracks. If crack in grip retention nut is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series .



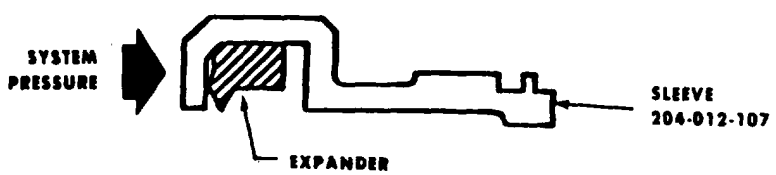
*1. Packing
*2. Channel seal
3. Seal sleeve
4. Screw
5. Lock plate
6. Nut
7. Packing
8. Bearing inner race
9. Sleeve
10. Bearing outer race
11. Strap assembly
12. Shield assembly
12.1. Dust Shield
13. Packing
14. Yoke
15. Backup ring
16. Strap fitting
17. Packing
18. Retaining pin
**19. Hat seal

* Prior to incorporation of MWO 55-1615-258-50-1
** After incorporation of MWO 55-1615-258-50-1

Figure 5-13. Main Rotor Hub Shield Replacement



TO INSTALL HATSEAL II IN GLAND PROCEED AS FOLLOWS:



STEP I INSTALL THE EXPANDER IN GROOVE AND POSITION TOWARD PRESSURE SIDE OF GROOVE

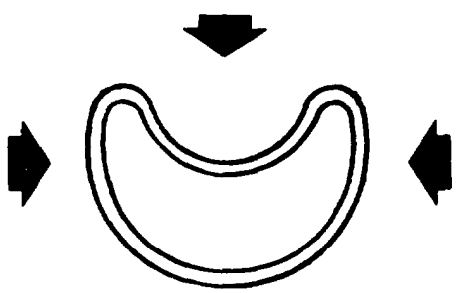
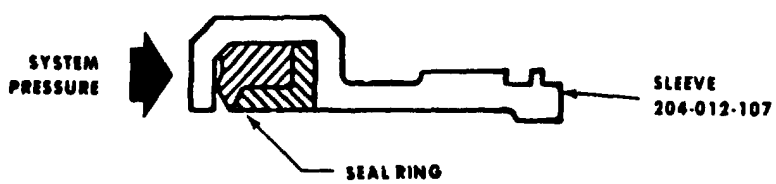


FIG. 1



STEPII AFTER FITTING EXPANDER IN GROOVE, FOLD SEAL RING AS SHOWN IN FIG. 1 AND INSTALL IN GROOVE ON LOW PRESSURE SIDE OF EXPANDER.

FIGURE 5-13.1. SEAL INSTALLATION

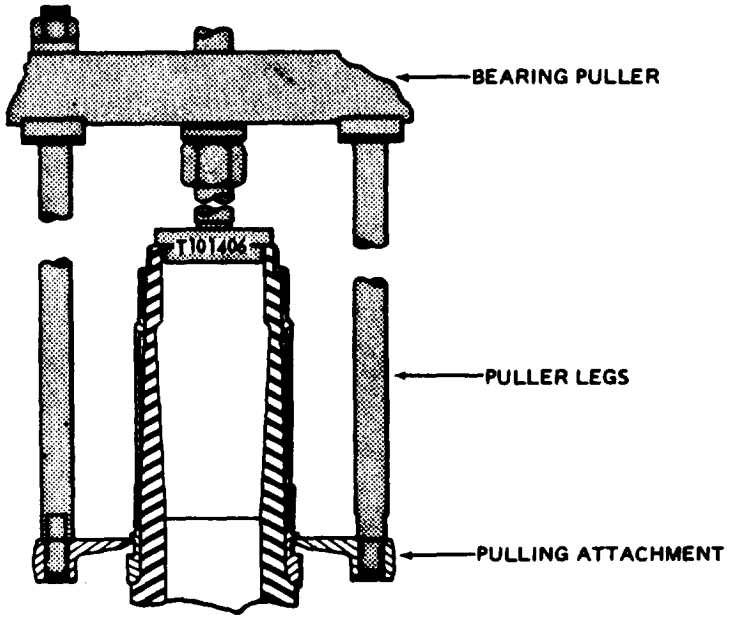


Figure 5-14. Removal of Shield and Bearing Races From Yoke Spindle

h. Dimensions of damaged areas on drag brace bolts, after polishing and cleanup, shall not exceed one-quarter of the bolt circumference. Bolts shall be replaced if the outside diameter (in inches) is less than the values specified below.

(1) Inboard drag brace 0.8730 inch.

(2) Outboard drag brace 0.8721 inch.

i. Replace hub if the inside diameters (in inches) exceed the values specified below.

(1) Blade retaining bushing 2.504 inches.

(2) Drag brace bushing 0.877 inch.

j, Inspect strap assembly as follows:

(1) Visually inspect for broken wires protruding through the urethane cover at the corners. The summation of broken wires including those found in previous inspections, shall not exceed a maximum of 50 loose ends at each corner or a total of 400 over the entire strap.

(2) Inspect strap for bulging of the cross section. Bulges within 4 inches of the ends are normal; however, bulges outside these areas may not exceed 0.06 inch above the normal straight contour.

(3) Cracks in the urethane coating are acceptable provided the wires are not visible,

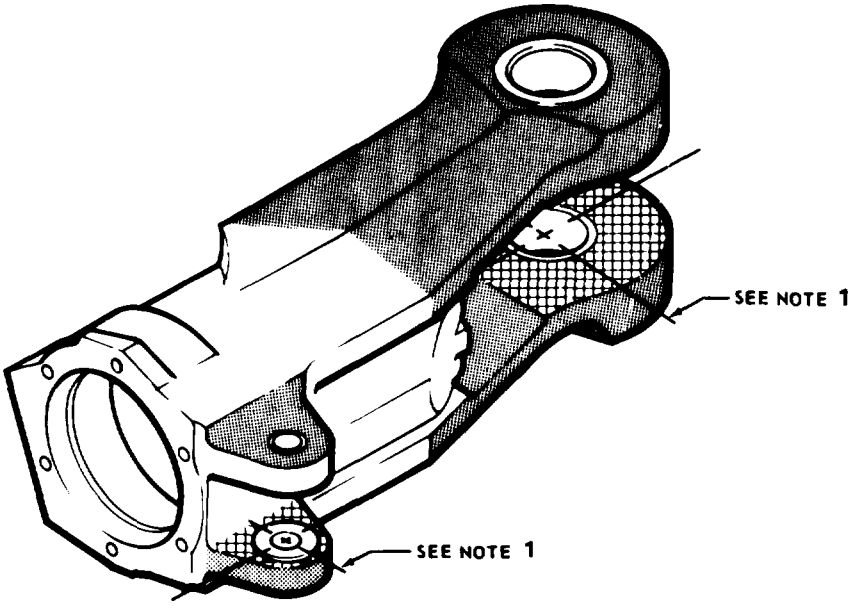
(4) Delamination of the urethane coating from the bushings in the area of the urethane wedges is acceptable. However, displacement of the bushings from their normal position is cause for rejection. Delamination in any other area is cause for rejection.

NOTE

Exposure of wire due solely to delamination of the urethane coating from the bushings “is not cause for rejection.

(5) A permanent twist is acceptable.

(6) Strap stiffness may vary from strap to strap when flexed in an unloaded condition. This is not a



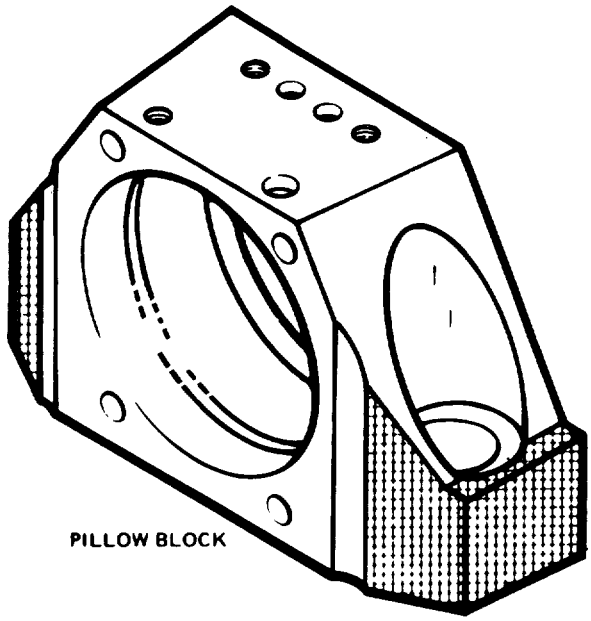
DAMAGE AREA REPAIR SYMBOLS

TYPE OF DAMAGE	AREA	AREA	AREA
	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED		
NICKS, SCRATCHES, SHARP DENTS	0.020 IN. BEFORE AND AFTER REPAIR	0.060 IN. BEFORE AND AFTER REPAIR	0.060 IN. BEFORE AND AFTER REPAIR
CORROSION	0.010 IN. BEFORE REPAIR 0.020 IN. AFTER REPAIR	0.030 IN. BEFORE REPAIR 0.060 IN. AFTER REPAIR	0.030 IN. BEFORE REPAIR 0.060 IN. AFTER REPAIR
MAXIMUM AREA PER FULL DEPTH REPAIR	SEE NOTE NO. 1	NOT CRITICAL	NOT CRITICAL
NUMBER OF REPAIR AREAS	—	NOT CRITICAL	NOT CRITICAL
EDGE CHAMFER	0.060 IN.	0.10 IN.	0.150 IN.

NOTES:

1. The area of repair on surfaces mating with the blade or drag brace should not exceed one-half of any quadrant.
2. No cracks allowed.
3. Inner surfaces of bushings (blade and drag brace) may have damage up to 0.002 inch depth over one-quarter of the circumference.

Figure 5-15, Main Rotor Hub Grip Damage Limits



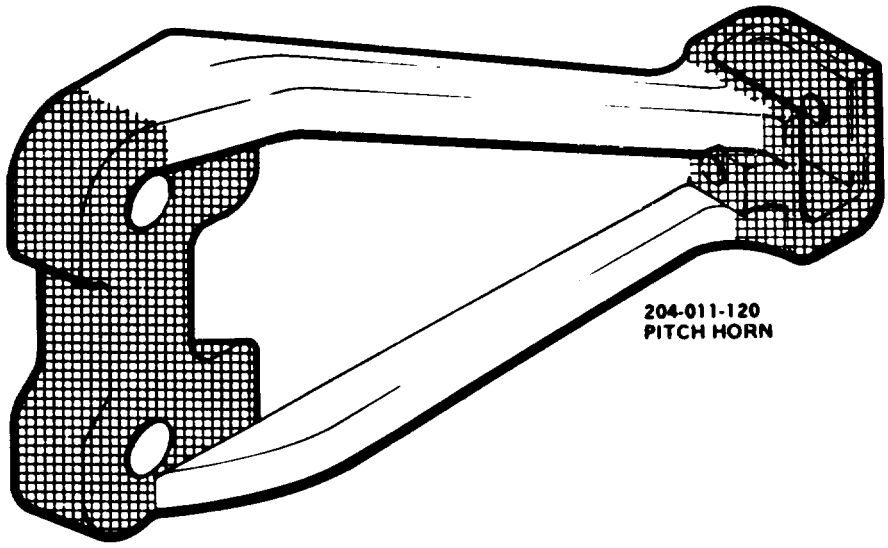
DAMAGE AREA REPAIR SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
NICKS, SCRATCHES SHARP DENTS	0.020 IN. BEFORE AND AFTER REPAIR	0.040 IN. BEFORE AND AFTER REPAIR
CORROSION	0.010 IN. BEFORE REPAIR 0.020 IN. AFTER REPAIR	0.020 IN. BEFORE REPAIR 0.040 IN. AFTER REPAIR
AREA OF FULL DEPTH REPAIR	0.10 SQ. IN.	0.25 SQ. IN.
NUMBER OF REPAIR AREAS	ONE PER SEGMENT	NOT CRITICAL
BOLT HOLE DAMAGE	0.001 INCH FOR ONE-FOURTH CIRCUMFERENCE	

NOTES:

1. All edges may be radiused or chamfered 0.060 inch to remove nicks and dents.
2. Repair areas should not overlap.
3. No cracks allowed.

Figure 5-16. Main Rotor Hub Pillow Block Damage Limits



DAMAGE AREA REPAIR SYMBOLS

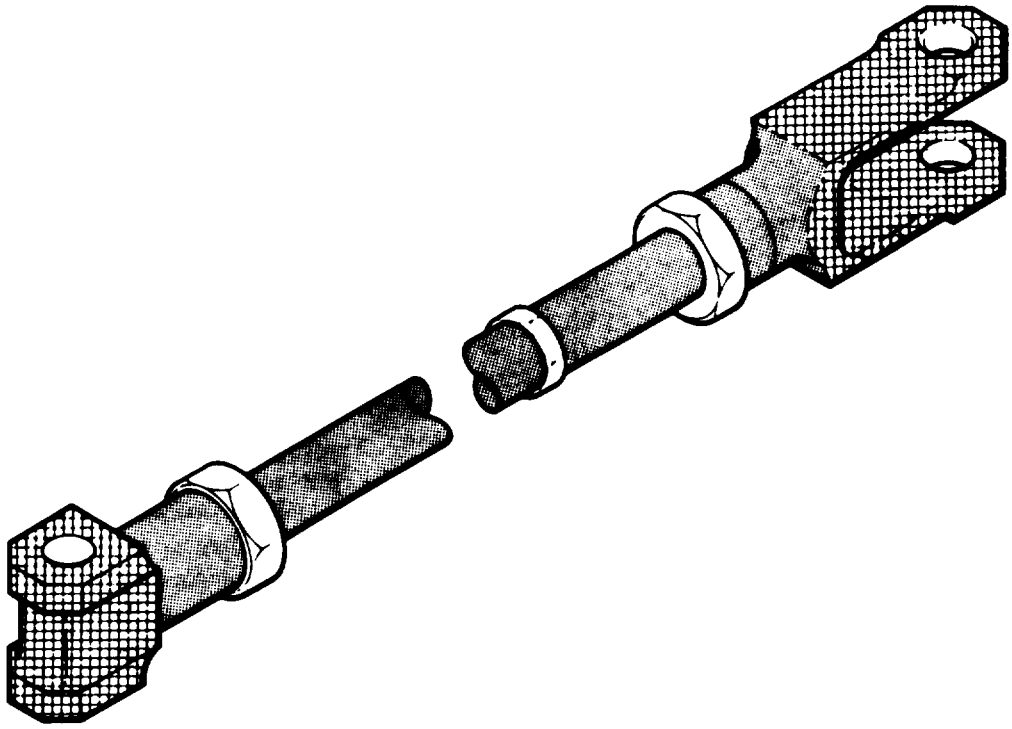
TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
NICKS, SCRATCHES SHARP DENTS	0.010 IN. BEFORE AND AFTER REPAIR	0.030 IN. BEFORE AND AFTER REPAIR
CORROSION	0.005 IN. BEFORE REPAIR 0.010 IN. AFTER REPAIR	0.015 IN. BEFORE REPAIR 0.030 IN. AFTER REPAIR
AREA OF FULL DEPTH REPAIR	0.10 SQ. IN.	0.50 SQ. IN.
NUMBER OF REPAIR AREAS	2 PER SEGMENT	NOT CRITICAL
EDGE CHAMFER	0.030 INCH	0.060 INCH

BOLT HOLE DAMAGE: 0.3743 MINIMUM, 0.3748 MAXIMUM

NOTE:

1. No cracks allowed.

Figure 5-17. Pitch Horn Damage Limits



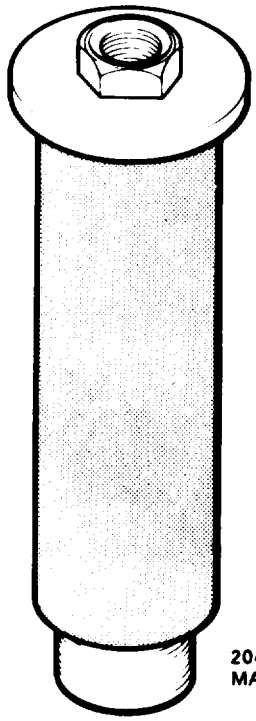
TYPE OF DAMAGE	DAMAGE AREA REPAIR SYMBOLS		
	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED		
SCRATCHES, DENTS AND CORROSION	0.010 INCH	0.020 INCH	0.030 INCH
MAXIMUM AREA PER FULL DEPTH REPAIR	0.25 SQUARE INCH	0.25 SQUARE INCH	NOT CRITICAL
NUMBER OF REPAIRS	ONE PER TANG	TWO PER SEGMENT	NOT CRITICAL
EDGE CHAMFER	0.030 INCH	0.030 INCH	0.060 INCH

THREAD DAMAGE
- DEPTH: ONE THIRD OF THREAD
- LENGTH: ONE QUARTER INCH
- NUMBER: TWO PER SEGMENT

BOLT HOLE DAMAGE: 0.8744 MINIMUM, 0.8748 MAXIMUM

NOTE:
1. No cracks allowed.

Figure 5-18. Drag Brace Damage Limits



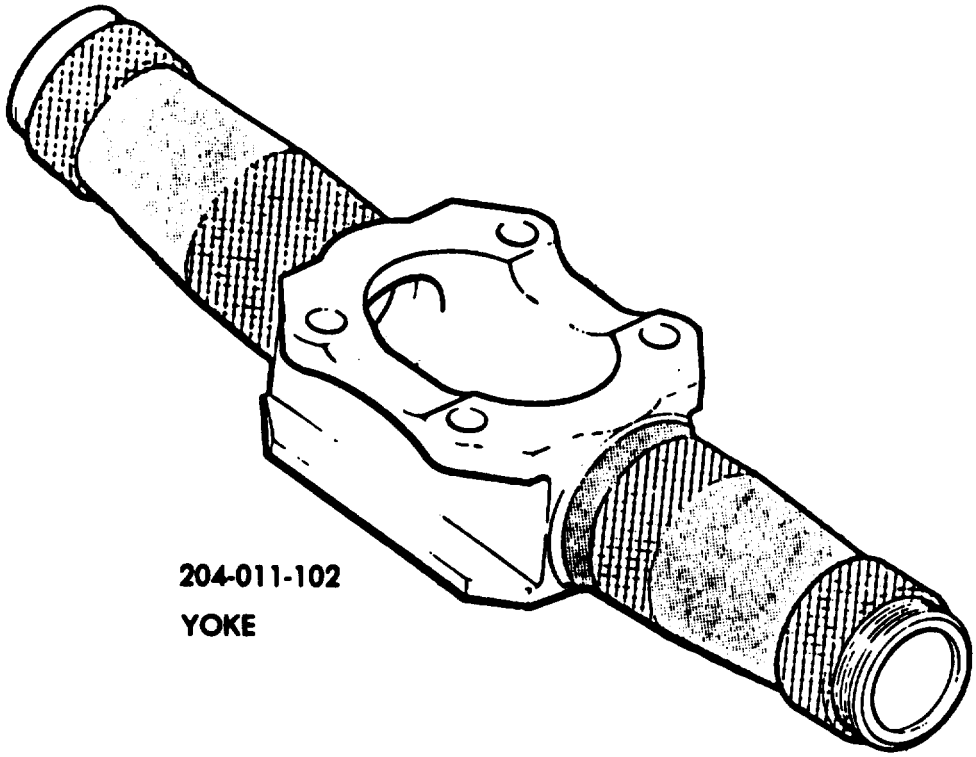
204-011-151
MAIN ROTOR BLADE BOLT

DAMAGE AREA REPAIR SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
NICKS, SCRATCHES, AND CORROSION	0.005 IN.	0.010 IN.
MAXIMUM AREA OF FULL DEPTH REPAIR	0.25 SQ. IN.	NOT CRITICAL
NUMBER OF FULL DEPTH REPAIRS	2	NOT CRITICAL
EDGE CHAMFER	N/A	0.030 IN.
THREAD DAMAGE:	DEPTH: ONE-THIRD LENGTH: ONE-HALF INCH NUMBER: ONE	

NOTE:
1. No cracks allowed.

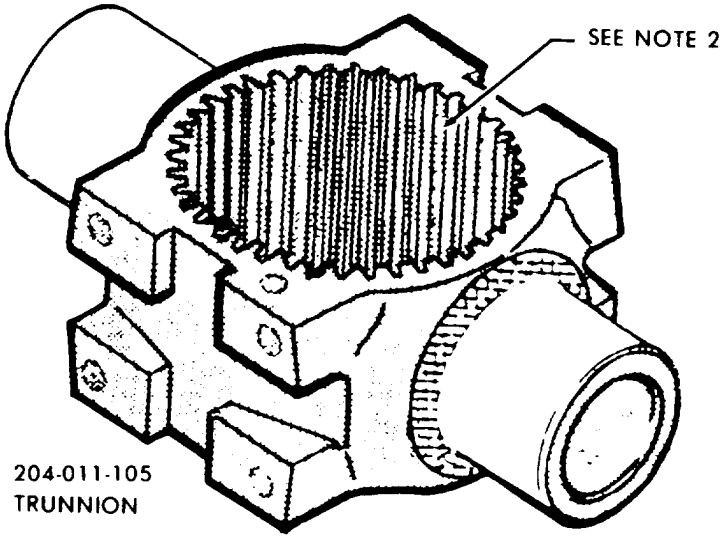
Figure 5-19. Main Rotor Blade Bolt Damage Limits



204-011-102
YOKE

TYPE OF DAMAGE	DAMAGE AREA REPAIR SYMBOLS		
SCRATCHES, DENTS AND CORROSION	0.002	0.010	0.020
MAXIMUM AREA PER FULL DEPTH REPAIR	0.50 SQ. IN.	0.50 SQ. IN.	NOT CRITICAL
NUMBERS OF REPAIRS	-TWO PER SEGMENT		NOT CRITICAL
EDGE CHAMFER	0.030	0.030	0.040
THREAD DAMAGE	DEPTH: ONE THRID OF THREAD LENGTH: ONE HALF INCH NUMBER: TWO PER SEGMENT		
CRACKS	NONE ALLOWED		

Figure 5-19.1. Yoke Damage Limits



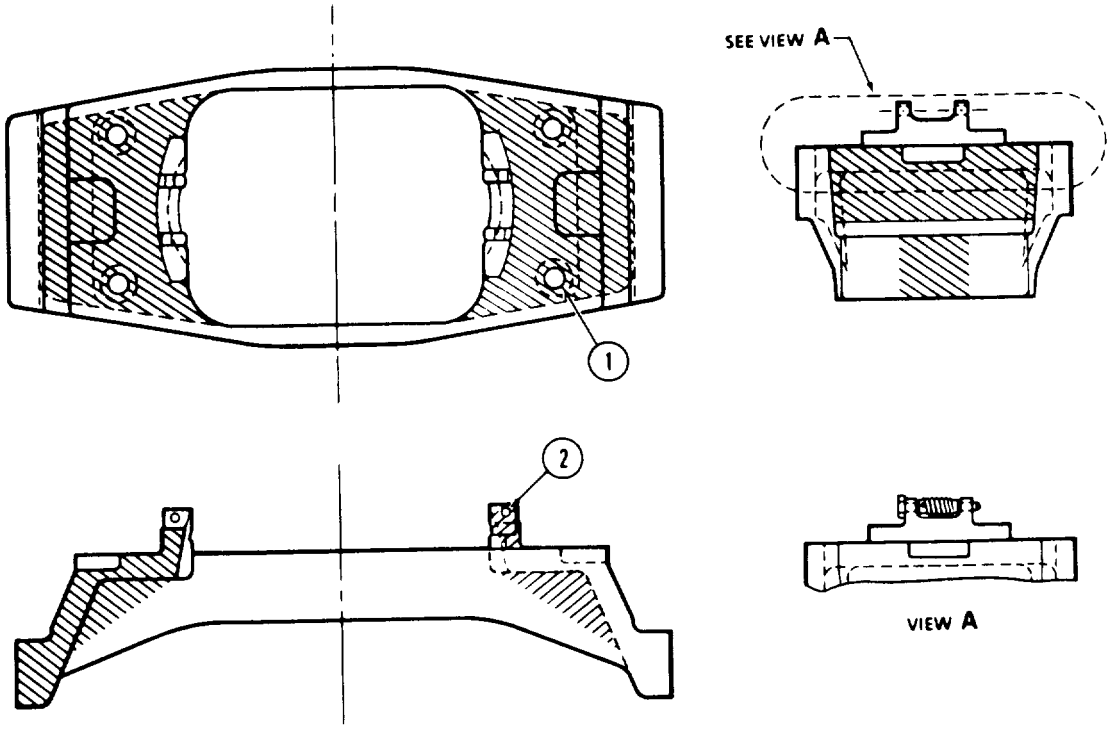
DAMAGE AREA REPAIR SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREA ALLOWED		
MECHANICAL AND CORROSION	0.010. IN BEFORE AND AFTER REPAIR	0.030 IN BEFORE AND AFTER REPAIR	SEE NOTE NO 3
AREA OF FULL DEPTH REPAIR	0.05 SQ INCH	0.25 SQ INCH	
NUMBER OF REPAIR AREAS	ONE PER SIDE	TWO	

Notes:

1. EDGES MAY BE RADIUSED OR CHAMFERED 0.040 INCH TO REMOVE NICKS AND DENTS
2. NICKS AND DENTS ON THE SPLINES MAY BE CLEANED UP TO ONE THIRD OF THE SPLINE DEPTH FOR HALF THE LENGTH OFF THE SPLINE
3. MINOR SCORES AND SCRATCHES NOT EXCEEDING A DEPTH OF 0.002 INCH MAY BE POLISHED OUT NOT TO EXCEED ONE–FOUTH SPINDLE CIRCUMFERENCE
4. REPAIR AREAS SHOULD NOT OVERLAP

Figure 5-19.2 Inspection Limits-Trunnion.

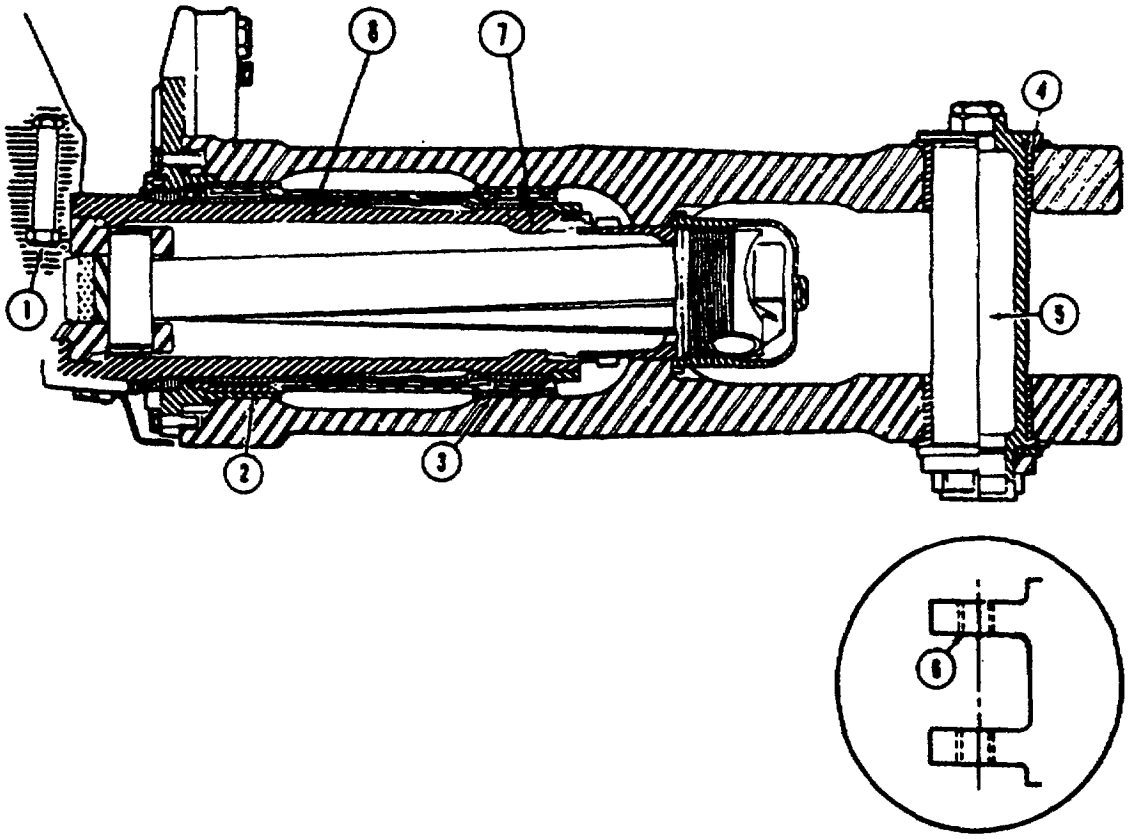


204-011-207-101 PLATE ASSY

TYPE OF DAMAGE NICKS, SCRATCHES, SHARP DENTS	DAMAGE AREA REPAIR SYMBOLS	
	MAXIMUM DEPTH AND REPAIR AREAS ALLOWED	
MAXIMUM DAMAGE DEPTH (MECHANICAL)	0.020 IN.	0.035 IN.
MAXIMUM AREA OF FULL-DEPTH REPAIR	0.50 SQ. IN.	0.75 SQ. IN.
MAXIMUM EDGE CHAMFER	0.050 SQ. IN.	0.100 SQ. IN.
MAXIMUM NUMBER OF REPAIRS	TWO PER AREA	NOT CRITICAL
MAXIMUM ACCEPTABLE HOLE DIAMETER	(1) 0.430 IN.	
	(2) 0.196 IN.	
CORROSION DAMAGE	0.010 IN.	0.020 IN.
MINIMUM COUNTERBORE THICKNESS	(1) 0.375 IN.	

204011-2055A
204-011-207A

Figure 5-19.3. Plate Assembly – Damage Limits (After Incorporation of MWO 55-1520-242-50-1)



ITEM	NOMENCLATURE		MIN.	MAX.	REPLACE
			(MANUFACTURING TOLERANCES)		
1	Nut (Torque)		77	79 FT-LBS	
2	Liner	ID	5.624	5.625	5.631
3	Liner	ID	5.374	5.375	5.381
4	Bushing	ID	2.500	2.501	2.504
5	Bolt (Blade Retaining)	OD	2.4992	2.4999	2.4982
6	Bushing (Drag Brace)	ID	0.8745	0.8750	0.877
7	Spindle (yoke)	OD	4.4990	4.5003	4.495
8	Spindle (yoke)	OD	4.7490	4.7503	4.745

Figure 5-20. Main Rotor Grip - Limits Chart

valid inspection to determine strap condition and therefore is no cause for rejection.

(7) Oil or grease contamination resulting in swelling/severe deterioration of the urethane coating is cause for rejection. If oil has come in contact with the strap but no swelling/deterioration is evident the strap shall be cleaned with solvent (C261) and continued in service.

(8) Inspect bushings for cracks using a ten (10) power glass. No cracks are permitted. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

(9) Inspect bushings for fretting corrosion. A maximum of **0.005** inch in depth for 25 percent of total area is allowed on bushing flange surfaces. A maximum of **0.002** inch in depth is allowed for 25 percent of the total bushing bore surfaces.

k. Inspect strap fittings in accordance with figure 5-21. If crack is suspected in the strap fittings, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

l. Inspect grip plate (7), fig. 5-10, for evidence of damage. Maximum allowable damage is 0.150 inch at lower boss and 0.035 inch at the upper passage area.

m. (AVIM) Inspect pitch horn bushings and replace if loose or out of round. Replace bushings in the control end of the horn if the inside diameter exceeds 0.3750 inch.

n. Inspect yoke in accordance with figure 5-19.1. If crack is suspected in the yoke, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

o. Inspect trunnion in accordance with figure 5-19.1. If crack is suspected in the trunnion, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

5-21. Repair or Replacement - Main Rotor Hub.

a. Replace blade retaining bolts if pitted. fretted. or corroded or if limits of figure 5-19 are exceeded. Replace dry film lubricant with lubricant (C162) as required.

b. Replace drag brace bolts if area of cleanup of damage exceeds one-quarter of the bolt circumference.

c. Replace inboard drag brace bolt if outside diameter is less than 0.8730 inch.

d. Replace drag brace bolt if outside diameter is less than 0.8721 inch.

e. Replace hub if blade retaining bushing inside diameter exceeds 2.504 inches.

f. Replace hub if drag brace bushings inside diameter exceeds 0.877 inch.

g. (AVIM) Inspect yoke spindles as specified in figures 5-19.1 and 5-20. Longitudinal scratches on the main rotor yoke spindle not exceeding 0.002 inch in depth need not be completely removed. Surface burrs, however, should be removed using crocus cloth (C68). Any measurable circumferential damage requires depot repair.

NOTE

Yoke spindles are not authorized repair items at AVIM level. If damaged or worn beyond limits, re-assemble hub and forward to depot maintenance.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

NOTE

Should the dry film lube or cadmium plating require removal for any reason, it may be accomplished using abrasive pads (C16) saturated with methyl-ethyl-ketone (C177). Re-application of cadmium plating or dry film lubricant shall be accomplished at the authorized maintenance level in accordance with existing directives.

h. (AVIM) Inspect grip for limits specified in figure 5-15. Grips that fail to meet inspection requirements after polishing and cleanup of damaged areas shall be forwarded to depot maintenance.

i. (AVIM) Polish out areas of corrosion or damage with abrasive cloth (C1) blending edges of damage into the surrounding surface to a smooth contour.

j. Corrosion damage existing on aluminum alloy parts (Grip Assembly, Pitch Horn, Pillow Block and Grip Plate) must be polished to twice the depth of the existing corrosion pitting. Total area depth of rework is not to exceed the maximum allowable criteria as stated for the part involved.

k. (AVIM) Replace grip retention nut if worn or cracked.

l. (AVIM) Replace strap retaining pin if any evidence of corrosion exists. Ensure that a washer is bonded to each end of pin (refer to paragraph 5-20.d.).

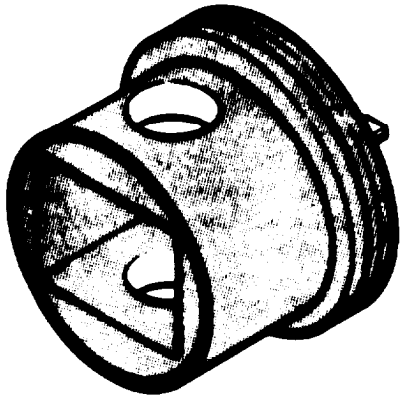
m. Replace drag brace if corroded or damaged beyond limits of figure 5-18.

n. Replace grip reservoir and pillow block reservoir sight gages if cracked or discolored to the point of not being able to see the liquid level thru the gage.

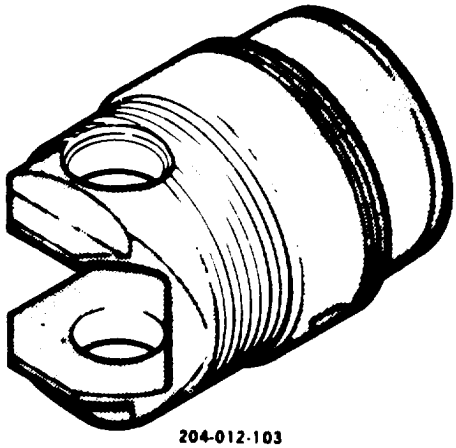
o. (AVIM) Prior to incorporation of MWO 55-1520-242-50-1, replace static stop if cracked or deformed.

o.1 .(AVIM) After incorporation of MWO 55-1520-242-50-1, replace plate assembly if damaged beyond limits in figure 5-19.3,

Figure 5-21.1 Deleted

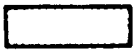


204-012-102
FITTING



204-012-103
FITTING

Damage Area Repair Symbol



Type of Damage	Maximum Depths and Repair Areas Allowed
Mechanical and Corrosion Damage	0.005 In. Before and After Repair
Maximum Area Per Full Depth Repair	0.50 Sq. In.
Number of Repairs	One Inside One Outside
Edge Chamfer	0.020 In. Max. to Remove Nicks and Scratches
Bore Repair	0.0005 In. for One-Quarter Circumference
Thread Damage	
Depth:	One-quarter of Thread
Length:	One-half Inch
Number:	One
Spline Damage	
Depth:	One-third of Spline
Length:	One-half of Spline
Number:	Two

NOTE:

1. No cracks allowed.

2. Fitting P/N 204-012-103 may have grooves extending from the four corners of the rectangular hole, on the inside diameter to the inboard end of the fitting. These grooves are permissible of P/N 204-012-103-1, 3, 5.

Figure 5-21. Strap Fittings — Damage Limits

p. (AVIM) Replace grip seals (5, figure 5-12), shield assembly (12, figure 5-13), and patting during assembly.

q. (AVIM) Replace straps if damaged beyond allowable limits,

r. (AVIM) Replace strap fittings if damaged beyond allowable limits.

a. If damage is found on parts which are not authorized to be replaced at AVIM, such as, grips or bearing race, reassemble hub and forward to depot maintenance.

t. (AVIM) Replace unserviceable pitch horn bushings (paragraph 5-20 m) as follows:

(1) Press bushings out of horn base.

(2) At the control end, press out the single bushing, use a drift to tap out one of the dual bushings, then press out the remaining bushing.

(3) Thoroughly dean the pitch horn with advent (C261), chill the bushings, and press them into the horn.

(4) Bushings installed in the control end of the horn must be line bored 0.3743 to 0.3748 inch after installation. Bushings installed in the horn base do not require boring.

u. If main rotor hub has been modified for grease lubrication, install plate (12) (Figure 5-10) washer (13) and bolt (14). Lockwire with (C155).

5-22. Assembly — Main Rotor Hub.

Premaintenance requirements for assembly of main rotor hub

Condition	Requirements
Model	All
Part No. or Serial No,	All
Special Tools	(T34) (T49) (T72)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	(G1) (C111) (C158) (C25) (C29) (C128) (C237) (C86) (C28) (C136) (C281) (C312) (C155) (C27)
Special Environmental Conditions	None

a. Install grip reservoirs as follows:

CAUTION

Ensure that proper packings are installed in hub P/N 204-012-101-31 during assembly. Refer to TM 55-1520-210-23P.

NOTE

Installation procedure for both rotor grip, oil reservoirs is identical.

(1) The following applies to oil lubricated hubs:

(a) Install packing (8, figure 5-10), sight glass (9), and reservoir cover (6), with filler plug (10)) at top.

(b) Secure cover (6) with packing (5), aluminum washer (4), steel washer (3), lockwashers (2), and bolt (1). Torque bolt (1) 18 to 20 inch-pounds Apply slippage marks to grip reservoir retention bolt,

(2) The following applies to grease lubricated hubs (after incorporation of MWO 55-1615-258-50-1):

(a) Install gasket (15) (figure 5-10), plate cover (12), washer (13), and bolt (14).

(b) Lockwire (C155) to secure bolt.

b. Install pillow block reservoirs as follows:

NOTE

Installation procedure for both pillow block reservoirs Is Identical.

(1) The following applies to oil lubricated hubs:

(a) Install packings (8, figure 5-11) and reservoir (7) on pillow block,

(b) Install packing (6) and reservoir cover (5) on reservoir.

(c) Secure with aluminum washer (4), steel washer (3), lockwashers (2) and bolt (1). Torque bolt (1) 18 to 20 inch-pounds.

(d) Remove filler plug (15) and packing (14) from reservoir cover (5) and service reservoir (paragraph 1-7). Replace packing (14). Reinstall filler plug (15) and apply slippage marks.

(2) The following applies to grease lubricated hubs (after incorporation of MWO 55-1615-258-50-1):

(a) Install gasket (20) (figure 5-11), plate (17), washers (18), and bolts (19).

(b) Lockwire (C-155) to secure bolts.

c. (AVIM) Install shield assembly and inner race on yoke as follows:

(1) Prior to incorporation of MWO 55-1520-242-50-1, temporarily install static stop (14, figure 5-12) with tow bolts (9) in yoke assembly (7).

CAUTION

Four bolts (13.1) shall be finger tight to prevent damage to plate assembly (11.1).

(1.1) After incorporation of MWO 55-1520-242-50-1, temporarily install plate assembly (11.1) with four bolts (13.1) and washers (12.1) on yoke assembly (7).

WARNING

Mark plate assembly (11.1, Figure 5-12) prior to removal. Adhesive shim must be returned to original position or binding of the worm gear and installation bolts is possible.

NOTE

Static stop is used to align shield assembly.

(1.2) Rebonding of the dust shield to the radius ring shall be accomplished as follows:

(a) Vapor degrease dust shield and radius ring.

(b) Clean radius ring surface by lightly abrading with abrasive (C1). Wipe clean with cloth moistened with dry cleaning solvent (C261). Wipe with clean dry cloth.

(c) Abrade shield with a wire brush. Wipe clean with cloth moistened with dry cleaning solvent (C261). Wipe with clean dry cloth.

(d) Apply adhesive (C29) to mating surfaces of both shield and ring.

(e) Apply a light pressure and cure for 24 hours at room temperature.

(f) Seal I.D. of shield, bridge gap between shield and machined breakout with adhesive (C29).

(2) Position yoke on buildup bench (T34), and adapter plate (T49), with flat surface of adapter down. Secure yoke in plate.

(3) Apply lubricant (C129) to seal portion of shield assembly (12, figure 5-13) and to packing (13).

(4) Prior to incorporation of MWO 55-1520-242-50-1, install packing (13) in inside groove of shield assembly (12). Place in position on spindle of yoke (14). Align slot in shield assembly with tang of static stop.

(4.1) After incorporation of MWO 55-1520-242-50-1, install packing (13) in inside groove of shield assembly (12). Place in position on spindle of yoke. Align slot in shield assembly with key (10.1, figure 5-12) installed in yoke.

(5) Ensure that inner races are reinstalled in original position. Apply lubricant (C129) to spindle area where inner races (8 and 10) will be positioned.

(6) Place inner race (10) on yoke spindle with chamfered or radius end inboard. Tap lightly using a nonmetallic drift to seat against radius ring.

(7) Position sleeve (9) on yoke spindle and install inner race (8) with chamfered or radius end inboard. Tap lightly using a nonmetallic drift to seat against inboard bearing race.

(8) Deleted.

(9) Install nut (6) and torque **85 TO 170** footpounds using tool (T72). Tap nut with a nonmetallic mallet to seat inner races and shield assembly. Retorque nut **85 TO 170** foot-pounds.

(10) Back off nut (6) to obtain a gap of **0.005 TO 0.015** inch between nut (6) and inner race (8).

NOTE

Lock plate (5) can be installed on spindle of yoke with either face next to spindle which will allow alignment of holes in lock with holes in end of spindle.

(11) Install lock plate (5) and secure with two screws (4). Lockwire (C155) screws.

(12) Apply lubricant (C129) to packing (1) and to channel seal (2) or replacement hat seal (19).

NOTE

Wipe area around packing (7) and mating surface to ensure there is no lubricant. (Wet sealant will act as lubricant for packing (7).)

(13) Install packing (7) on outside of seal sleeve (3). Install packing (1) in channel seal (2) and then into seal sleeve (3). Install hat seal (19).

(13.1) Apply a thin layer of sealant (C242) to yoke spindle on mating surface with seal sleeve as shown in figure 5-21.1.

(14) Install assembled seal sleeve (3) in place on spindle and in nut (6) with extreme care not to damage preformed packing (7) or hat seal (19).

NOTE

Tap lightly with nonmetallic hammer to seat seal sleeve in place.

WARNING

Seal sleeve should be properly seated against yoke spindle. Failure to do so may cause subsequent seal damage and lubricant leakage. Allow sealant to cure prior to further assembly.

(15) Prior to incorporation of MWO 55-1520-242-50-1, remove from buildup bench (T34); invert and remove static stop (14, figure 5-12) temporarily installed.

(15.1) After incorporation of MWO 55-1520-242-50-1, remove from buildup bench (T34). Invert and remove plate assembly (11.1) temporarily installed.

d. (AVIM) Install strap assembly (11, figure 5-13) and inboard fitting as follows:

(1) Apply lubricant (C129) to packing (17).

(2) Insert strap assembly (11) through yoke spindle from outboard end. Place backup ring (15) over strap in center of yoke with flat surface inboard.

(3) Place packing (17) on strap fitting (16) and install fitting on end of strap assembly (11) with tabs on fitting down. Insert retaining pin (18) and slide backup ring (15) on fitting (16) tight against shoulder of fitting.

(3.1) Coat cavity of spindle and mating surface of backup ring and fitting with grease (C129).

(4) Press fitting and strap assembly into yoke spindle cavity.

WARNING

Mark plate assembly (11.1, Figure 5-12) prior to removal. Adhesive shim must be returned to original position or binding of the worm gear and installation bolts is possible.

NOTE

Tabs on inboard strap fitting must be down on installation with a differential dimension of 0.20 inches between leading edge and trailing edge. Measure from top of yoke as shown in figure 5-4.

Check that worm teeth of static stop are engaged and stop is in slot of radius ring.

e. Prior to incorporation of MWO 55-1520-242-50-1, install stop (13, figure 5-12), static stop (14) and secure in place with two washers (8) and two bolts (9), torque bolts **70 TO 110** inch-pounds. Recheck position of inboard strap fitting if in proper position then lockwire (C155) bolts (9).

NOTE

Plate assemblies which required removal and re-application of adhesive (C29) should be installed using the installation procedures for new plate assemblies.

f. After incorporation of MWO 55-1520-242-50-1, install plate assembly (11.1, figure 5-12) to yoke (7) as follows:

NOTE

Check that worm screws of plate assembly fully engage the racks on the inboard strap fittings and stops are in slots of radius rings.

(1) Coat mating surfaces of yoke (7) and key (10.1), and shank of bolts (13.1) with corrosion preventative compound (C87).

WARNING

Assure shims (15.1) are returned to original position. Mixing shims, end-for-end, could result in improper clamp-up of worm screw.

(2) Install two keys (10.1), two shims (15.1), two stops (14.1) and plate assembly (11.1). Secure in place with four bolts (13.1) and washers (12.1).

(3) Apply 10 inch-pounds of torque to bolts (13.1). Recheck position of inboard strap fittings. Adjust fitting position if necessary.

(4) Torque bolts (13.1) to **180 TO 210** inch-pounds and lockwire (C154).

NOTE

Retorque of the static stop plate will be accomplished per special inspection requirements.

(5) DELETED.

f.1. If installing new plate assembly (11.1) and shims (15.1), install as follows:

NOTE

Stops (14.1) and keys (10.1) do not have to be Installed while determining shim thickness

(1) Hand tighten bolts (13.1) in plate assembly (11 .1) making sure worm screw bottoms out on rack Gradually tighten bolts in a criss cross ("X") pattern to 10 inch-pounds. Measure gap between yoke and plate assembly at each bolt location. Record each measurement being careful to keep the measurements for the red and white ends separate. Mark plate assy orientation and remove plate assembly.

(2) Gap measurement between yoke and plate assembly may not be equal end-to-end and side-to-side. Proper shimming of the plate assy requires shims for the red and white ends to be calculated separately. This could result in a different shim thickness between the red and white ends.

(3) Average the two measurements taken for the red end. Subtract 0.008-0.012 inch from that average. Peel shim (23A) to this thickness. This will provide the required 0.008 to 0.012 inch pinch fit on the red end. Repeat this procedure for the white end. Using a grease pencil, mark the shims "RED" and "WHITE".

(4) Position rubber stops on inboard fittings.

(5) Apply a thin film of mold release (C80.1 or C80.2) to yoke (7) adjacent to the location of the worm gear supports, so adhesive (C29) does not bond to the yoke.

(6) Coat mating surfaces of the yoke (7) and key (10.1), and shank of bolts (13.1) with corrosion preventative compound (C87).

(7) Position each key (10.1) in yoke and temporarily secure in place.

WARNING

Application of too much adhesive can result in improper shimming of plate assy.

(8) Apply a thin, even layer of adhesive (C29) (approximately 1/16 to 1/8 inch thick) just above the radius on the vertical surface along the length of the worm screw brace, as shown in figure 5-21.2.

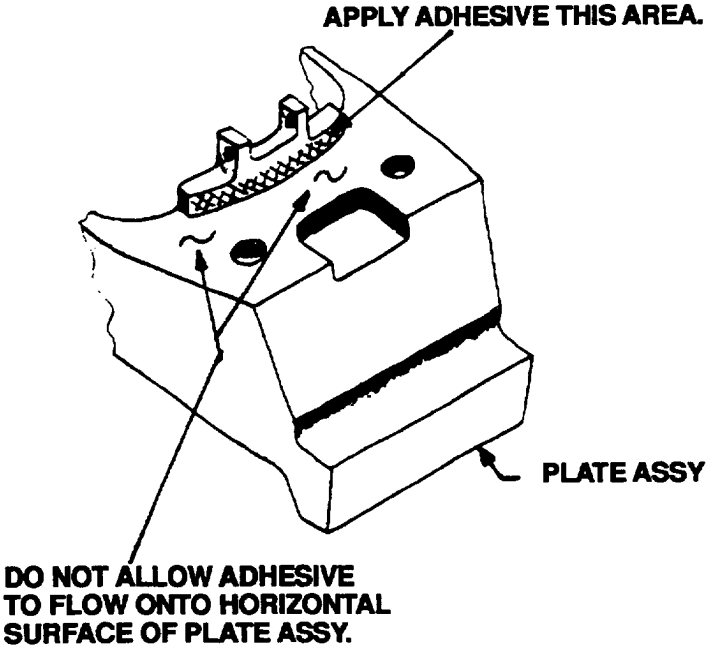


Figure 5-21.2. Plate Assembly- Application of Adhesive

(9) Position shims (15.1) on plate assembly (11.1). Typical two places.

(10) While adhesive is still wet, install plate assembly (11.1) to yoke (7) with bolts (13.1) and washers (12.1).

NOTE

Check that worm gears (57) are engaged with rack and that stop is in slot of radius

(11) Apply 10 inch-pounds of torque to bolts (13.1). Recheck position of inboard strap fittings. Adjust fitting position if necessary.

(12) Torque bolts (13.1) to 180 TO 210 inch-pounds and lockwire (C155).

(13) Allow adhesive to cure for 24 hours at room temperature.

(14) Verify that worm gear does not turn using 10-15 inch-pounds of force.

g. (AVIM) Assemble and install grip as follows:

(1) Apply sealant (C237) to mating surface of outer diameter of new seal (5) and install in grip plate (20) with lip of seal inboard in place. Apply a bead of sealant around O.D. of seal on inboard side.

NOTE

To determine shim thickness install grip plate assembly (20) on grip assembly. Tighten bolts snug and measure gap between grip and face plate. Remove plate and install packing (21) and shims (22) to give 0.003 TO 0.007 inch damp upon beadings.

(2) Install packing (21) in groove of grip plate (20).

(3) Position shim (22) and previously assembled items, on grip assembly and secure with bolts (18) and washers (19). Lockwire (C155) bolts.

(4) Lubricate seal (5) with grease (C129) and install grip assembly on yoke spindle, using caution while guiding inboard bearing over inner race to prevent damage to bearing. After bearing is mated, the grip assembly may be tapped into plate while in the vertical pitch position.

(5) Install packings (16) on retention strap fitting (17). With grip assembly invertical pitch position, install and slip retention strap fitting (17) on retention strap (15).

(6) insert retaining pin (6) through fitting (17) and strap. Align hole in fitting (17) with groove in grip, with the leading edge of the grip in direction of rotation, insert index key (3). Lightly coat interior of retention nut (32) with corrosion preventive compound (C86) and temporarily screw nut on fitting (17).

NOTE

Lock (26) and attaching bolt will be installed after completion of grip spacing.

CAUTION

Torque bolts initially to 90 inch-pounds Then torque to 120 inch-pounds and then to 180 TO 190 inch-pounds This predudes improper seating of the pitch horn and possible damage to the serrated locking ring or the insert screw in the grip.

h. Coat shank of bolt (24) with CPC (C87). Do not apply CPC to threads. Coat the mating surface of pitch horn (25) and grip (4) with primer (C312). While primer is still wet, install pitch horn (25) on grip (4) and secure with bolts (24) and washer (23). Torque bolts 160 to 190 inch-pounds and lockwire (C155).

i. Install drag braces (2) and blade bolts, making sure the same items are installed on the same side from which removed.

j. (AVIM) Adjust main rotor grip spacing (paragraph 5-23).

k. Service hub, refer to paragraph 1-7.

l. Balance main rotor hub assembly if required. (See Note at the beginning of paragraph 5-18. g.) Reference paragraph 5-24 for balancing instructions.

5-23. Grip Spacing — Main Rotor Hub. (AVIM)

Premaintenance requirements for grip spacing on main rotor hub

Condition	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T34) (T41) (T49) (T59) (T62)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Two
Consumable Materials	None
Special Environmental Conditions	None

a. Position hub on buildup bench (T34) (8, figure 5-22) equipped with adapter plate (7) (T49). Install grip positioning links (6) (T41) on each side of hub and adjust links (6) such that tip of grip spacing tool (2) (T59) is centered on blade bolt. Install flap stops (5) (T62) on each side of trunnion with side marked 204 seated on hub yoke.

b. Tighten nut (13) until hub grip is fully seated inboard and then backoff nut (13) one full turn. Tap grip outboard using a heavy plastic mallet to seat hub parts. Repeat on opposite side of hub.

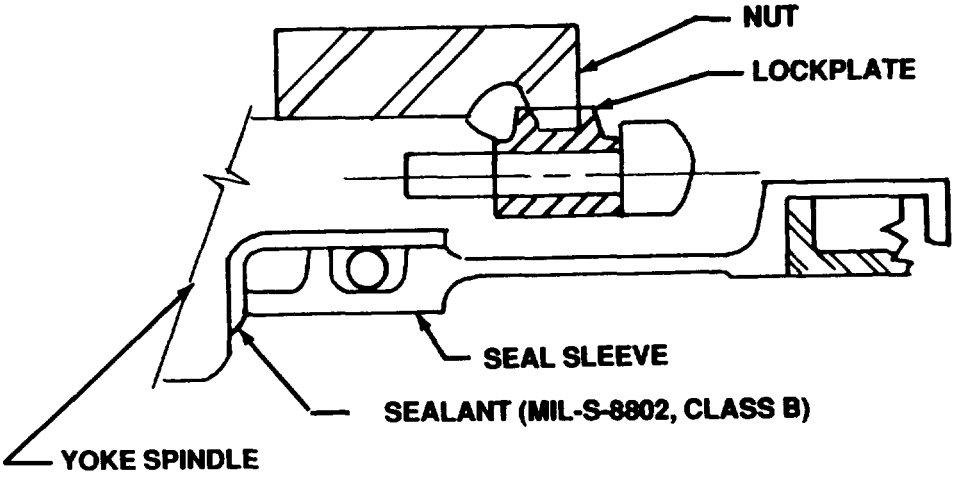
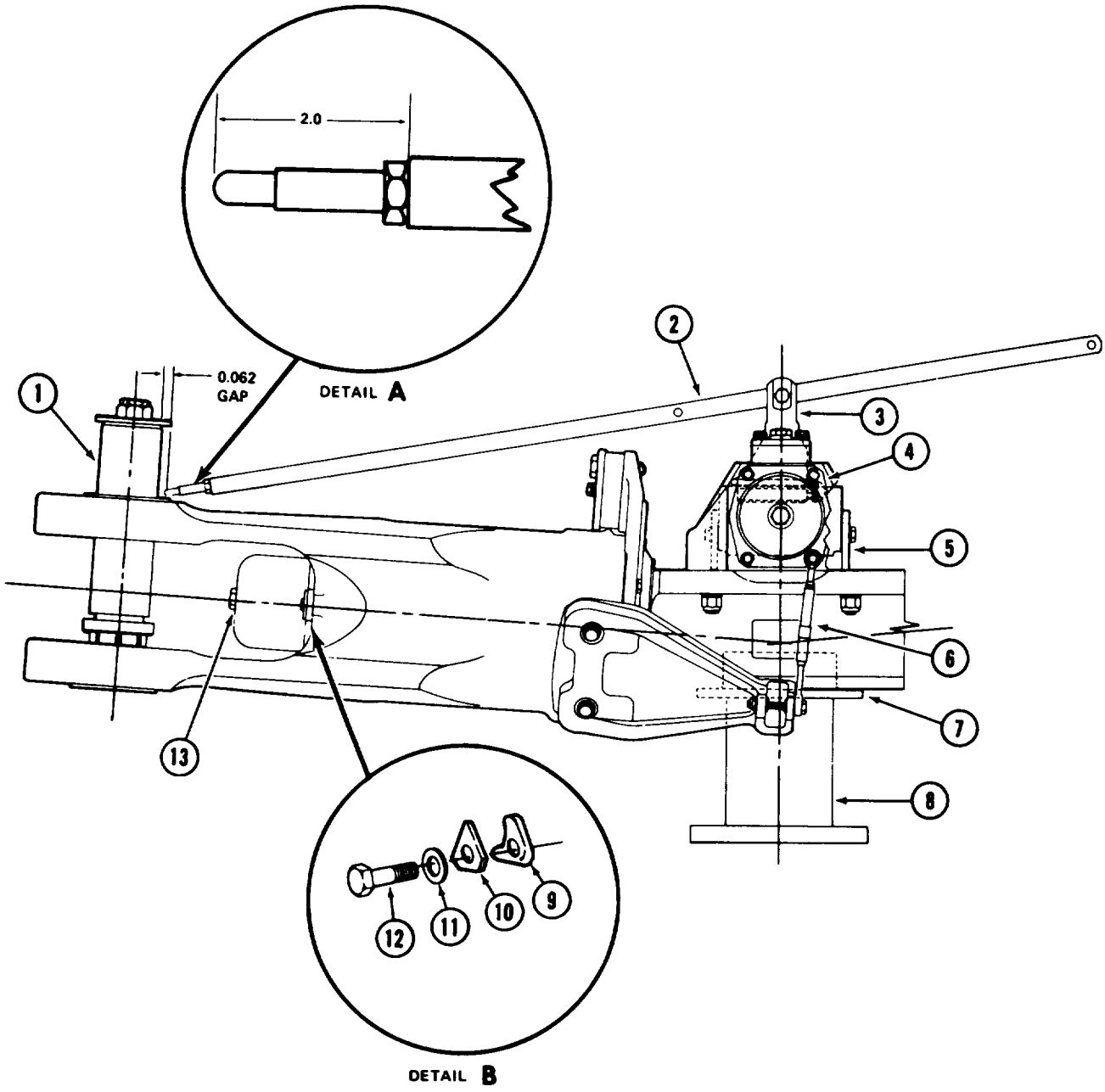


Figure 5-21.1 Installation of Seal Sleeve



1. Blade bolt
2. Grip spacing gage (T59)
3. Plug (T59)
4. Nut, knurled
6. Flap stop (T62)
6. Grip positioning link (T41)
7. Adapter plate (T49)
8. Buildup bench (T34)
9. Lock
10. Clamp
11. Washer
12. Bolt
13. Nut

Figure 5-22. Main Rotor Hub Grip Spacing

c. Insert plug (3) (T59) in trunnion bore end back off nut (4) to secure plug in trunnion. Set adjustable end of gage (2) (T59) to the 2.0 inch dimension shown in detail A, figure 5-22. Position gage on plug and secure gage to plug at hole marked 204-012-101. Locate the adjustable end of gage on grip bushing flange and position blade bolt (1) as shown in figure 5-22.

d. Check dimension between tip of gage (2) (T59) and barrel of bolt (1). Adjust nut (13) to obtain a clearance of 0.062 inches (±0.010 inches). Tap grip outboard after each adjustment and check clearance. Repeat for other grip. The gap measurement at one blade bolt must be within 0.002 inches of the gap measurement at the other blade bolt.

NOTE

If retention nut (13) is moved to facilitate installation of lock (9), recheck dimension in step d. above.

e. Rotate gage (T59) (2) and plug (T59) (3) to opposite grip and accomplish steps c. and d.

f. Install lock (9), clamp (10), washer (11) and bolt (12) to secure nut (13) on each grip. Lockwire (C155) bolts (12).

g. Remove filler plugs and fill grips and reservoirs to 1/2 level of the reservoirs with Lubricating oil. (Refer to paragraph 1-7.)

h. Balance main rotor hub assembly if required.

NOTE

If main rotor hub assembly balance has not been disturbed and only seal replacement is required, hub assembly does not require rebalancing, nor is hub and blade assembly alignment required if drag brace length has not been altered.

5-24 Balancing – Main Rotor Hub, (AVIM) a. Ensure that grips and pillow block reservoirs are filled with oil to the correct level (paragraph 1-7).

b. Balancing procedures for the main rotor hub assembly are contained in TM 55-4920-201-14.

c. Note balance conditions indicated by black indicator disk at top of arbor (figure 5-23).

d. Application of balance corrections:

(1) Balance hub spanwise by inserting lead shot (C247) into cavity of blade retention bolt to achieve balance within limits.

(2) Balance hub chordwise by attaching weights and/or small washers, as required, to pillow block liner. A maximum of 16 weights and/or washers may be attached with an AN bolt of sufficient length to secure weights without bottoming bolt in liner,

(3) Install and lockwire (C155) plugs in blade bolts.

(4) Color band parts to maintain their respective position.

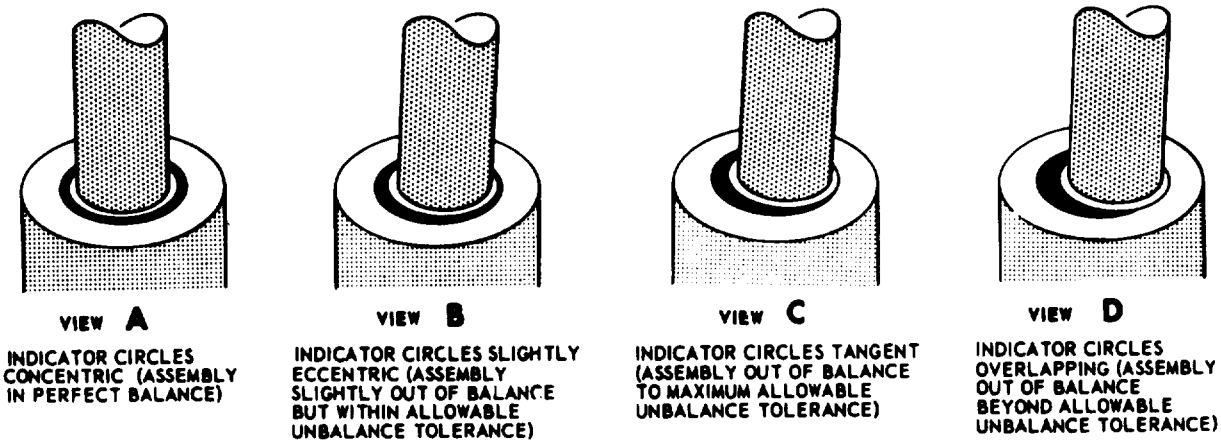


Figure 5-23. Balance Indication Interpretation

CAUTION

Grip positioning links (6, figure 5-22) must be installed to prevent damage to tension and torsional strap assemblies during handling and shipping.

5-26. Installation - Main Rotor Hub. a. Install main rotor blades in hub (paragraph 5-33).

b. Install hub and blade assembly (paragraph 5-13).

5-26. Painting - Main Rotor Hub. (AVIM)

Premaintenance requirements for painting of main rotor hub

Condition	Requirements
Modal	All
Part No. or serial No.	All
Special Tools	None
Test Equipment	None
Support Equipment	Paint Spray Gun
Minimum Personnel Required	one
consumable Materials	(C196) (C206)
Special Environmental Conditions	Dust Free

NOTE

Painting of main rotor hub is limited to touchup painting of previous painted parts.

a. Apply one coat of primer (C206) to bare metal surfaces.

b. Apply paint (C196) over primer and allow to air dry for 12 hours.

5-26.1 Painting — Main Rotor Hubs Painted Camouflage Black (AVIM)

a. Wash hub with compound, (C76), then prime with primer, (C110), to bare metal surface.

(1) Spray surface with one coat of compound (C59) to a dry film thickness of 0.0004 TO 0.0007 inch and allow to air dry for 45 minutes. Then apply 0.0006 TO 0.0009 inch dry thickness of primer (C110) and air dry for one hour.

b. Topcoat with epoxy coating, (C108).

(1) Thinning Directions: (C106) is a two-package paint which is prepared by adding one part of component Ii to one part of component I slowly while stirring. Each component must be agitated thoroughly before combining.

(2) The mixed paint shall be thinned for spraying by adding one part of thinner, (C284), to two parts of mixed paint. Stir the mixture thoroughly, strain. and allow to stand at room temperature for one hour before spraying.

(3) Precautions

(a) Surface to be painted must be absolutely dean.

(b.) Equipment must be adequately grounded.

(c) Paint will not adhere to wash primer that has blushed or that has been applied when relative humidity is below 35%.

(d) Mix only amount to be sprayed that day.

(e) Thick coatings do not adhere well.

(f) Do not mix paints from more than one vendor.

(g) Components are not interchangeable with those of other colors. (Black Component I must be used with Black Component II.)

(h) Use Class I primer with Class I topcoat

(i) Clean all painting equipment with thinner, (C284) immediately after use.

(4) Apply a mist first coat of reduced topcoat and air dry for 30 minutes. Apply a second coat to a total dry film thickness of 0.0016 ± 0.0002 inch. Allow eight days for total cure.

5-26.2 Preparation for Storage or Shipment — Main Rotor Hub.

CAUTION

Grip positioning link must be installed to prevent damage to tension-torsion strap assemblies during handling and shipping. (Refer to figure 5-22).

a. Clean and dry hub assembly in accordance with MIL-P-116.

b. Apply corrosion preventive compound (C91) to bushings and exposed unplated steel surfaces.

c. Place hub in shipping container base, and lower onto frame center block.

d. Secure frame end brackets over each end of hub, and around hub bolt attached to frame.

e. Install washer and retaining nut. Tighten nut securely.

f. Place 12 eight-unit bags and 1 four-unit bag (total 100 units) of desiccant (C105) in container.

g. Lower container top into place and secure with bolts, washers, and nuts, tightened to provide moisture proof closure.

5-26.3 Placing in Service — Main Rotor Hub.

NOTE

Replacement main rotor hub shall be checked for appropriate setting of TT straps (metal blade setting versus composite blade setting) refer to paragraph 5-8 MB or 5-8.1 CB.

a. Remove bolts and remove top half of shipping container.

b. Remove attachments and lift hub out of container.

NOTE

Blade bolts are balanced and should not be interchanged.

c. Clean and dry hub assembly in accordance with MIL-P-116.

NOTE

The main rotor hub container may be used as a build up stand for attachment of main rotor blades (Refer to paragraph 5-33.a.).

SECTION III. MAIN ROTOR BLADES

5-27. MAIN ROTOR BLADE.

NOTE

When operating aircraft in geographical areas where excessive blade erosion will occur, refer to TB 1-1615-351-23 for instructions for application of anti-erosion tape procedures.

5-28. MB **Description - Main Rotor Blade.** Each main rotor blade is an ail-metal bonded assembly attached to the blade grip with a retaining bolt and held in alignment with an adjustable drag brace. The blade has a symmetric 21 -inch constant chord airfoil. Total blade twist-is 7° 30" (nominal). An inertia weight is installed in the outboard end of the blade ins-tie the D spar and held in place by screws through the aft side of the spar. Stainless steel strips cover leading edges for resistance to abrasion. The outboard four feet is covered with a cobalt abrasive strip. A trim tab is provided on trailing edge for tracking adjustments. A fitting on blade tip, which is used in flag tracking procedure, has a hole for attachment of rotor tie-down. Each blade is precisely statically balanced against a master blade during manufacture and overhaul and does not require any balance adjustments at time of installation or during service.

5-29. MB **Inspection - Main Rotor Blade (Installed).**

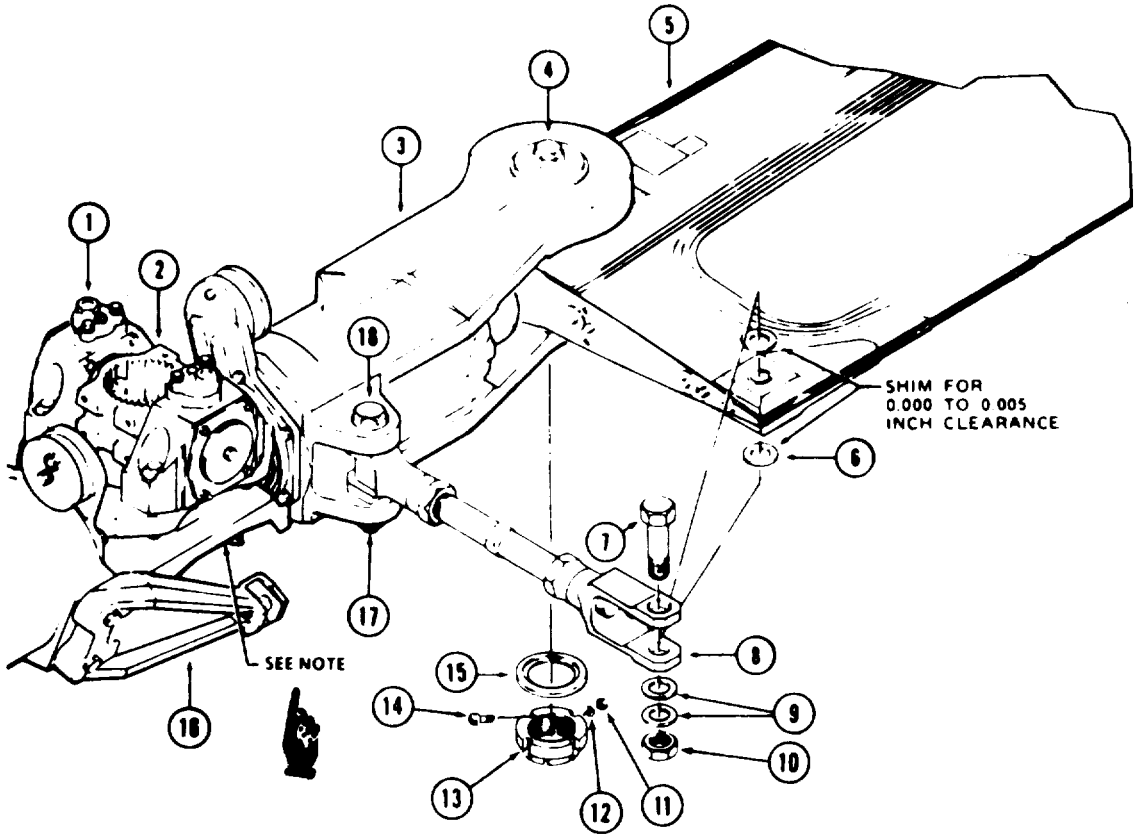
a. Inspection frequencies and areas of inspection are covered in TM 55-1520-210-PM and -PMD.

b. Inspection requirements, defects, and method of inspection are shown in table 5-3.

c. Detailed inspection procedures are given in paragraph 5-31.

Table 5-3. MB Inspection Requirements Main Rotor Blade.

FIGURE 5-25 INDEX NO.	DEFECTS	METHOD OF inspection	PARAGRAPH REFERENCE inspection	REPAIR
Trailing edge (13)	Nicks, dents, scratches, and corrosion	visual	5-31	5-32
Skin (12)	Nicks, dents, scratches, corrosion, and bond separation	Visual and tapping	5-31	5-32
Trim tab (7)	Looseness, cracked fairing compound, corrosion, and bond separation	Visual and tapping	5-31	
Tip fitting (6) and weights	Security and looseness of tip weights	visual	5-31	
Grip plate (1) and drag plate (8)	Nicks, scratches, and bonding separation	Visual and tapping	5-31	5-32
Doubler (2)	Dents, nicks, scratches, and bond separation	Visual and tapping	5-31	5-32



1. Pillow block
2. Hub trunnion
3. Grip
4. Blade retaining bolt
5. Main rotor blade
6. Shims
7. Drag brace bolt
8. Drag brace
9. Washer
10. Nut
11. Nut
12. Washer
13. Nut
14. Screw
15. Washer
16. Pitch horn
17. Nut
18. Drag brace bolt

NOTE
PLATE ASSEMBLY INSTALLED AFTER INCORPORATION OF MWO 55-1520-242-50-1.

204011-2052
204-011-207A

Figure 5-24. Main Rotor Hub and Blade Assembly

5-30. Removal — Main Rotor Blade.

Premaintenance requirements for removal of main rotor blade

Condition	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T34) (T45) (T49) (T85)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Three
Consumable Materials	None
Special Environmental Conditions	None

NOTE

Damage to root closure could occur during removal/replacement of the blade. Extreme care should therefore be exercised during removal and replacement.

a. Place main rotor hub on buildup bench (T34) equipped with plate (T85). Support each blade (5, figure 5-24) so that leading edge is straight.

b. Remove bolt (7) with shims (6), washers (9), and nut (10) to detach drag brace (8) from blade. Secure shims to brace or to blade for use in reassembly.

c. Remove screw (14) with nut (11) and washer (12) to unlock nut (13). Remove nut and washer (15) from lower end of blade retaining bolt (4).

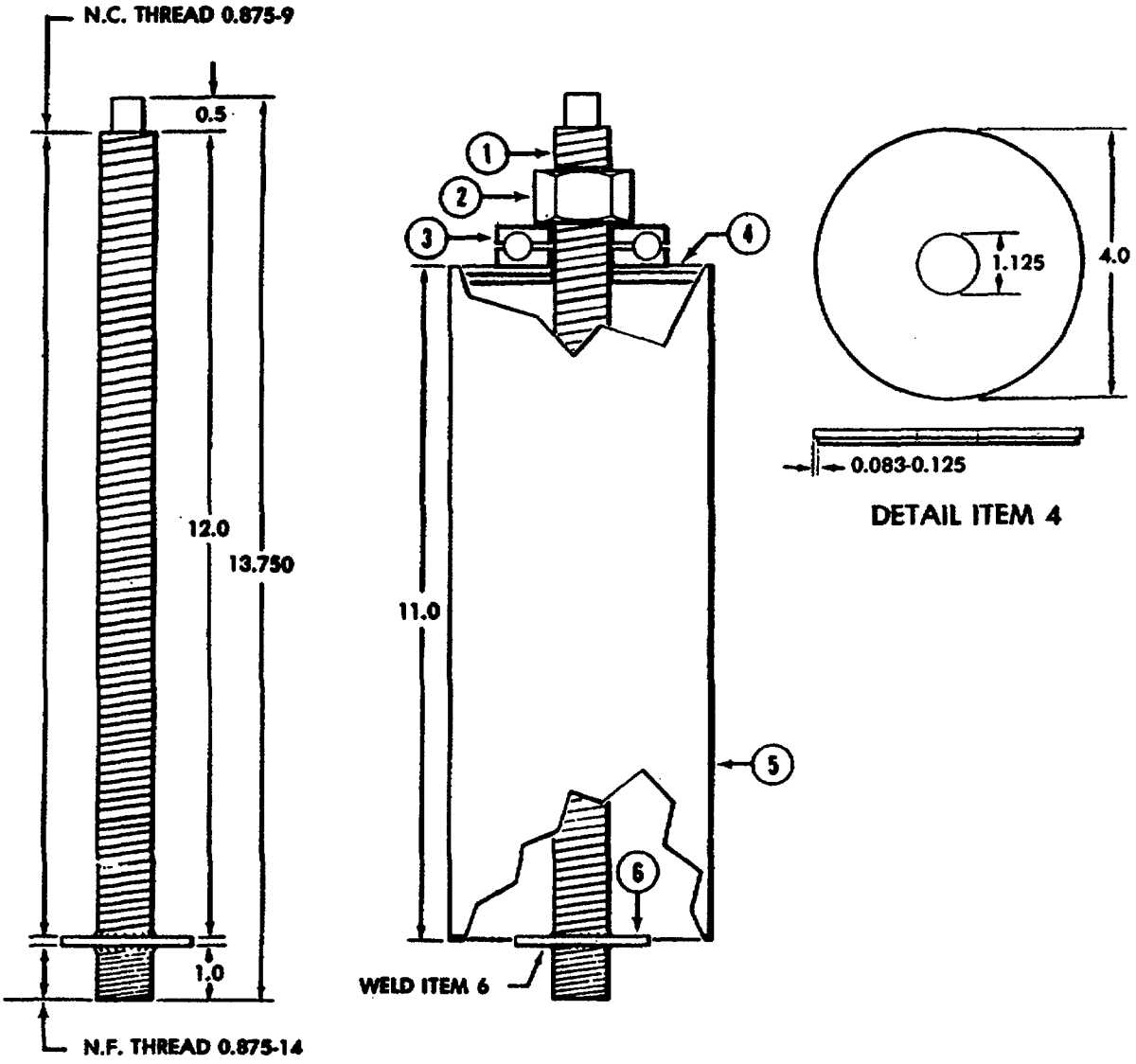
CAUTION

Reason for lifting blades is because they are pre-set to 2-3/4 degree cone, and elevation is necessary to free bolts. If difficulty Is still encountered in removing bolts use Main Rotor Blade Retention Bolt Extracting Fixture Assembly, which may be locally fabricated as shown on figure 5-24.1.

CAUTION

Some Main Rotor Grips may have a shim installed at the main rotor blade mating surface. If shim is found loose upon blade removal, clean and reinstall shim on grip using adhesive (C-29).

d. Gently raise tip of blade until blade bolt (4) can be readily removed. Remove blade from grip.



DETAIL ITEM 1

1. Puller rod assembly 4130 (or better) 1.0 O.D. - 13.750 long
2. Hex nut 0.875 NC (9) thread
3. Bearing (thrust) I.D. 0.880 to 1.000
4. Plate, steel or aluminum, 4.0 O.D., 0.375 thick
5. Tube, steel or aluminum, wall thickness 0.083 - 0.125
6. Steel flat washer, 2.0 O.D. - 0.875 I.D.

Figure 5-24.1. Main Rotor Blade Retention Bolt Extracting Fixture

NOTE

Do not change adjustment of drag brace. Ensure that blade retention bolt is identified, for reassembly in same grip from which removed. Ensure that blade is identified (only required if blade is to be reassembled to same grip of same hub and blade assembly from which removed).

e. Remove opposite blade in same manner.

5-31. MB Inspection - Main Rotor Blade.

For ease and clarity of presentation, the inspection requirements for the blades are divided into blade areas and blade categories. Classify damage according to the limits provided. Refer to TM 55-1520-210-PMD for inspection frequencies.

a. Trailing edge and skin inspection.

(1) Nicks and scratches anywhere on the surface of the skins or trailing edge strip, not in excess of **0.008** inch in depth, are acceptable if they are polished out.

(2) Nicks and notches in the extreme trailing edge of the blade. **0.120** inch deep or less, shall be polished out over a distance of at least 2 inches, each side of the nick or notch. Outboard of the trim tab, nicks and notches **0.250** inch maximum depth, may be polished out over a minimum distance of 2.0 inches each side of defect.

NOTE

If a nick or scratch in the skins in excess of 0.008 inch deep can be polished smooth without leaving the skin in the polished area so thin it can be dented with fingernail pressure, a patch may be applied over the area without cutting a hole.

(3) In the outboard four feet of the blade, any dent in the skin which does not tear the skin or affect flight characteristics, is acceptable.

(4) Dents in skin, inboard of outer four feet of blade, not in excess of **0.100** inch deep, are acceptable.

(5) If a nick or scratch exists in a sharp dent in the skin, total depth of both shall not exceed **0.100** inch.

(6) Inspect trailing edge and skin, both surfaces, for cracks, buckles, and obvious deformation. These defects are not reparable. Dent filling compound has been known to chip, crack, or appear cracked when the skin underneath is sound. Investigate these conditions thoroughly. Cracks in skin are not reparable. If void is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

(7) Check main retention bolt hole and drag plate bolt for nicks, dents, scratches, corrosion, pitting, elongation, and size. Replace main retention bushing if ID exceeds **2.505** inches. Replace drag plate bushing if ID exceeds **0.877** inch. Any nicks, dents, scratches, corrosion, or pitting of either bushing in excess of replacement dimension after polishing is cause for removal and replacement at an approved overhaul facility. Local polishing in excess of replacement dimension is acceptable only if a burr needs to be removed. Example would be a burr created by scratch from the top of the bushing ID to the bottom.

b. Inspect scarf joints at leading edge stations 83 and 240.

NOTE

Scarf joints may have taco shell shaped caps or polyurethane tape bonded over the joints, or no covers at all.

(1) If no caps or tape are installed on scarf joints, inspect for loss of filler material and corrosion. If loss of filler material or corrosion are detected, send blade to AVIM for repair (paragraph 5-32d.).

(2) If tape is bonded over scarf joints, inspect for security and abrasion. Replace tape if unsecure or abraded (paragraph 5-32d.).

(3) If scarf joint caps (taco shells) are installed over scarf joints, perform the following inspection steps: If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

(a) Inspect caps for corrosion, abrasion that extends thru the thickness of the cap, distortion, and holes. Damage of this type is cause for removal and substitution with polyurethane tape (C270). Refer to paragraph 5-32d.(1).

(b) Inspect caps for debonding (voids). If voids occur, do not attempt to inject. Remove cap and substitute with polyurethane tape (C270). Refer to paragraph 5-32d.(1).

NOTE

Removal of scarf joint caps may cause 1:1 lateral vibration.

Table 5-4. **MB** *Main Rotor Blade - Reparable Nicks, Scratches, and Corrosion Limits*

PARTS AFFECTED	MAX DEPTH OF DEFECT	SPAN STATION
Skin	*0.008	Entire Span
Abrasive Strips	0.012	Entire Span
Coverplates	**0.012	Butt End
Doublers, Grip and Drag Plates	0.012	Doubler Area
Trailing Edge Strip	0.120	Inboard of Trim Tab
Trailing Edge Strip	0.250	Outboard of Trim Tab

*Maximum depth without overlay patch. Skin corrosion to any depth is permissible provided it does not extend over an area larger than that permitted for patching. Remove corroded skin and apply patch. Refer to paragraph 5-32a.(3).

If crack, void, or liquid in honeycomb is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

**No cracks allowed.

c. Inspect trim tab for looseness, cracked fairing compound, and corrosion. Evacuate blade to depot if trim tab replacement is required.

d. Butt end inspection.

(1) Inspect exposed ends of grip plates, drag plates, doublers, skin, and spar for evidence of cracked paint or aging of sealing compound.

(2) Apply sealing compound (29) to bond lines as required.

e. Tip end inspection.

(1) Inspect tip cap for security of attachment.

(2) Inspect tip cover to ensure sealing compound seals honeycomb against entry of moisture.

f. Grip plate and drag plate inspection.

(1) Inspect grip plates and drag plates for nicks and scratches. Refer to table 5-4 for limitations. Damage within limits of table 5-4 are acceptable if they are polished out.

(2) Inspect grip plates and drag plates for cracked paint indications along bond lines. Further inspect for voids using 10 x glass when paint indications are discovered. Verify whether indications are voids or aging of sealing compound. if voids are found, inspect in accordance with step j. Apply sealing compound (C29) to bond lines as required. If crack or void is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

g. Doubler inspection.

(1) Inspect doublers for nicks and scratches. Refer to table 5-4 for limitations. Nicks and scratches within limits of table 5-4 must be polished out.

(2) Inspect doublers at edge for cracked paint indications along bond lines. Further inspect for voids using 10x glass when paint indications are discovered. Verify whether indications are voids or aging of sealing compound. If voids are found, inspect in accordance with step j. Apply sealing compound (C29) to bond lines as required. If crack or void is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

h. Foreign object damage inspection. Main rotor blades receiving damage in the form of nicks, scratches, or dents in the skin may be repaired if within repair limitations (figure 5-25 and tables 5-4 and 5-5).

CAUTION

Patch type repairs inboard of station 210 must be inspected daily for cracks.

(1) Inspect for nicks and scratches (table 5-4).

(2) Inspect for dents (table 5-5).

i. Tip balance weight inspection. (Overspeed).

(1) Remove three screws and remove tip cap from rotor blade.

(2) Visually inspect lead weights for distortion. Distortion is acceptable up to the point where the lead is flush with the outer face of the steel retainer (204-011-266-3).

(3) Loose lead tip weights alone are not cause for replacing the rotor blade (refer to Chapter 1, Main Rotor Overspeed Insp). Tighten loose stud retention nuts to the following torque: 1/4 inch studs, **40 TO 50** inch-pounds, 5/16 inch studs **80 TO 100** inch-pounds.

(4) Striking of rotor blades to check for loose balance weights is not an acceptable inspection procedure.

(5) Inspect studs for looseness and distortion. Loose or distorted studs are unacceptable.

Table 5-5. ***MB*** *Main Rotor Blade - Dent Limits*

PARTS AFFECTED	DEPTH OF DEFECT INCHES	DENT SEVERITY	SPAN STATION
Skin	*Any Depth without puncture	---	Outboard four feet
Skin	0.100	---	Inboard of a station four feet from the tip

* In the outboard four feet of the blade, any dent in the skin that does not tear the skin or affect flight characteristics is acceptable.

(6) If blade complies with above requirements, the tip cap shall be reinstalled. Apply a bead of sealing compound (C242) around tip cover mating surfaces. Use three new Nk 509-416R12 or NAS 1189-3P10 screws. These screws have a self-locking feature and are for a one time use only.

(7) Blades not conforming to above requirements should be shipped to an overhaul facility for tip weight replacement and rebalance.

I.1. Visually inspect for evidence of corrosion.

(1) Using light reflected from surface of blade, inspect for any puffing up of the paint finish. If puffing is present, local removal of finish is required to determine if corrosion is present under finish. Where doubt exists, use a 10x magnifying glass to be sure no corrosion exists.

(2) Carefully check the blade skin around the alignment pin (on the top surface) for signs of corrosion or voids. If void is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

(3) Inspect paint finish at butt joint of abrasive strip and skin for wear. The condition of the paint on the forward areas of the abrasive strip is unimportant. If paint finish is worn through to aluminum skin, or to butt joint filler material, reapplication of primer is required (para 5-34). Inspect aluminum skin for corrosion and pits prior to refinishing. If aluminum skin is pitted in areas just behind abrasive strip, sand out the pits with 240 grit abrasive paper in an area sufficiently made to prevent cupping or excess metal removal in a small localized area. Do not sand more than **0.008** inch deep (one half the thickness of skin). Use fine grit abrasive paper to finish polish the damage area. Rub spanwise to remove burnishing or sandpaper marks and all traces of pitting.

j. Inspect for voids as follows: If void is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

NOTE

A void shall be defined as an unbonded area that is supposed to be bonded. Many sub-definitions of voids are often given such as lack of adhesive, gas pocket, misfit, etc. This manual shall make no distinction among these but shall group them in the one general term Void. All dimensions are in inches.

NOTE

Voids or delaminations in bonded areas of the blade may be detected by tapping. When tapping any area, use a tapping hammer or a suitable coin which will produce a ringing sound when struck against the blade. The tapping rate should be accomplished to produce a continuous sound so that any difference in sound tone can be readily detected. This tapping rate will vary, depending on the surface material and construction of assemblies. The force used in striking the surface will be to such a degree that it will not dent or damage the surface being inspected. Any void detected shall be tapped to the extent that its size can be determined and marked on the blade.

(1) Skin to spar bonded joint area.

(a) Inspect for evidence of voids. Pay particular attention to the outer **12** inches of the blade (top and bottom).

(b) Edge voids are not acceptable at the leading edge of the skin. Voids must not extend to within **0.25** inches of the leading edge of the skin. No voids are allowed within **1.5** inches of blade tip. At locations other than above, voids not larger than **0.38** inches (chordwise) by **2.0** inches (spanwise) are acceptable providing spacing between void centers exceed **6** inches.

(c) Suspected voids in the skin to spar bonded joint area on both top and bottom blade surfaces shall be inspected by tapping. The skin to spar bonded joint area is the area located from the leading edge of the skin (located just aft of abrasive strip) to the aft portion of the main spar. This distance is approximately **0.65** inches chordwise. If tapping proceeds aft of spar, a change in pitch should occur and should not be interpreted as a void.

(1.1) Voids at butt end of blade.

(a) Voids not deeper than **3.0** inches between nose block and box beam are acceptable.

(b) Voids between trailing edge extrusion and skin not deeper than **1.0** inch nor wider than **1.0** inch are acceptable.

(c) Any other void not longer than **1.0** inch chordwise nor deeper than **0.35** inch spanwise is acceptable.

(d) No voids are acceptable within **0.5** inch of the front or rear edge of either grip plate, (viewing the section of the butt end).

(e) A void between the skin and the core within 3 inches of the tip of the blade is acceptable up to **0.50** inch wide (spanwise) and **8.0** inches long (chordwise). A void between the skin and tip cover **0.35** inch maximum wide by **6.0** inch maximum long is acceptable on each side of the blade if they are not within **0.25** inch of the blade tip. However, then sum of the maximum widths of a void on the top side and a void on the bottom side must not exceed **0.050** inch.

NOTE

Any void described in this paragraph which is apparent at the butt end is to be sealed with adhesive.

(2) Voids under skin, outboard of station **100.0**.

NOTE

Where two voids of different types (Example: void between skin and trailing edge extrusion next to a void between the skin and core) are closer than 1.0 inch apart they shall be considered as one void and the stricter limitation shall apply.

(a) Voids between the skin and the trailing edge extrusion shall not exceed one-third the width of the faying surfaces.

(b) Voids between the skin and the core shall not exceed **1.0** inch in width by any length. Voids within **1.0** inch of each other are to be considered one void. At the splice between the inboard and outboard cores (station 159) a void **0.60** inch maximum spanwise by the full chordwise width of the core is acceptable.

(c) Voids between the skin and the spar beam reinforcement doubler, not wider (chordwise) than **0.25** inches are acceptable. Voids not larger than **0.38** by **2.0** inches are acceptable providing spacing between void centers exceeds **6.0** inches. Edge voids are not acceptable.

(3) Voids in the spar assembly, outboard of station 100.

NOTE

Any void described in this paragraph which is apparent at the tip end is to be sealed with adhesive.

(a) **1.0** inch wide (maximum) void between abrasive strip and nose block at extreme leading edge is acceptable but must be sealed at the tip and at the splice between cobalt and center abrasive strips.

NOTE

If any void described in step (a) above is within 1.0 inch of voids described in step (b), then the void in step (a) is to be included in the area limitations of step (b). Voids on both sides of the blade are to be included in area limitations.

(b) Voids between the center abrasive strip and the reinforcement doubler (box beam doubler) shall not exceed **40.0** square inches in any single void. If voids are closer than **1.0** inch to each other they shall be considered one single void. Maximum total area of voids shall not exceed **150.0** square inches. Chordwise width of voids shall not exceed **1.75** inches. If total area of voids exceed **300.0** square inches, blade should be forwarded to depot maintenance.

(c) Voids within **0.38** inch of the aft edge of the abrasive strip are not acceptable.

(4) Voids in the spar assembly, inboard of station 100.

NOTE

Any void described in this paragraph which is apparent at the butt end will be sealed with adhesive.

(a) **1.0** wide (maximum) void between abrasive strip and nose block is acceptable.

(b) Voids between abrasive strip and reinforcement doubler not exceeding **10.0** square inches with a maximum of **2.0** square inches in any single void are acceptable. Minimum spacing between void centers to exceed **3.0** inches.

(c) No voids within **0.38** of edge of the abrasive strip except at the butt end, per 2.(a) above are acceptable.

(5) Voids in the retention area, inboard of station 100.

(a) Single edge voids of **0.060** inch maximum depth on leading edge of doublers and **0.100** inch on trailing edge of doublers are acceptable if sealed with adhesive. Single edge voids of **0.06** inch maximum depth and **2.0** inch maximum length are acceptable on grip and drag plates but must be sealed. Edge voids are not acceptable in outboard **7.0** inches of each finger of the doublers. Edge voids in the outer **3.0** inches of the grip plate

and outer **1.5** inches of the drag plate are not acceptable.

(b) Voids between the doublers or innermost doubler and skin **2.0** inches wide maximum (chordwise) by **4.0** inches long maximum (spanwise) are allowable, provided they are not closer than **1.0** inch to the edge of the doubler or to another void. Total allowable area of voids between all doublers shall not exceed **20.0** square inches.

(c) Voids between the skin and the core, in a **5.0** inch wide region running adjacent to the trailing edge extrusion, not wider than **1.0** inch nor longer than **20.0** inches, with a minimum width of **1.0** inch of good bond between them, are permissible. In the remaining area, the width of the void may not exceed **0.5** inches. The total area of all voids is not to exceed **60.0** square inches.

(d) Edge voids between the edge of the skin and the trailing edge extrusion, that are less than **0.06** inches wide by any length or less than **0.25** inches wide by **7.0** inches long are acceptable if they are sealed with adhesive.

(e) Voids running into the main retention bolt hole, in any bondline, are not permissible.

(f) Other voids between the skin and trailing edge extrusion which do not exceed one-half the width of the faying surfaces by **10.0** inches long are acceptable.

(g) Voids between the skin and the box beam reinforcement doubler wider than **0.25** inches are not acceptable.

k. Nonreparable damage inspection. If crack, void, or liquid in honeycomb is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

NOTE

This Inspection is to determine disposition of removed blades. Installed blades are to be inspected using preceding inspection procedures.

NOTE

Main rotor blades having any one or more of the following deficiencies should be condemned, demilitarized and scrapped locally rather than returned to a repair facility.

(1) Trailing edge.

(a) Trailing edge extrusion cracked.

(b) Any hole through the trailing edge extrusion.

(c) Any nick/dent in the trailing edge extrusion deeper than **0.120** inch. Inboard of trim tab, or deeper than **0.250** inch outboard of trim tab.

(d) Any blade that is bent more than **0.50** inch. Position the blade horizontally with the leading edge on the bottom and the trailing edge up. Stretch a string along the trailing edge from root to the tip of the blade and measure the maximum distance between the trailing edge and the string.

(2) Leading edge.

(a) Any hole through the leading edge spar.

(b) Erosion at the tip that penetrates completely through the skin at the tip.

NOTE

Damage or erosion of the leading edge strip and nose block is reparable and the blade should be returned to an approved repair facility.

(3) Skin and honeycomb core.

(a) Skin cracked.

(b) Water in honeycomb core.

(c) Corrosion that penetrates entirely through skin.

(d) Holes in skin exceeding patch limitation.

(e) Single voids between honeycomb and skin larger than 25.0 square inches.

(f) Any crack that develops from a previously repaired area.

(4) Doublers.

(a) Any hole through the doublers.

(b) Edge voids deeper than 0.060 inch on the leading edge.

(c) Edge voids deeper than 0.100 inch on the trailing edge.

(5) Any blade that has reached retirement life.

(6) Any blade that is within 200 hours of retirement life and requires depot level repair.

5-32 MB **Repair or Replacement-Main Rotor Blade.**

a. Repair skin as follows:

(1) Nicks and scratches on skin exceeding allowable limits of table 5-4 may be patched the same as a hole. Do not exceed limits shown on figure 5-26.

NOTE

Minor skin punctures which do not require cleanup may be repaired without cutting skin by filling puncture with adhesive (C28) and applying an overlap patch as described below.

(2) Remove corrosion from skin using abrasive cloth (C1). Abrasive cloth in grit grades 120, 150, 240, and 320 are available.

(3) Holes in the main rotor blade skins, if within limits, may be patched as follows:

CAUTION

Repairs inboard of station 210 must be Inspected daily for cracks.

(a) Remove paint from area to be patched. Protect core if exposed, so as not to contaminate while cleaning.

(b) Draw a circle around damaged area large enough to encompass damage.

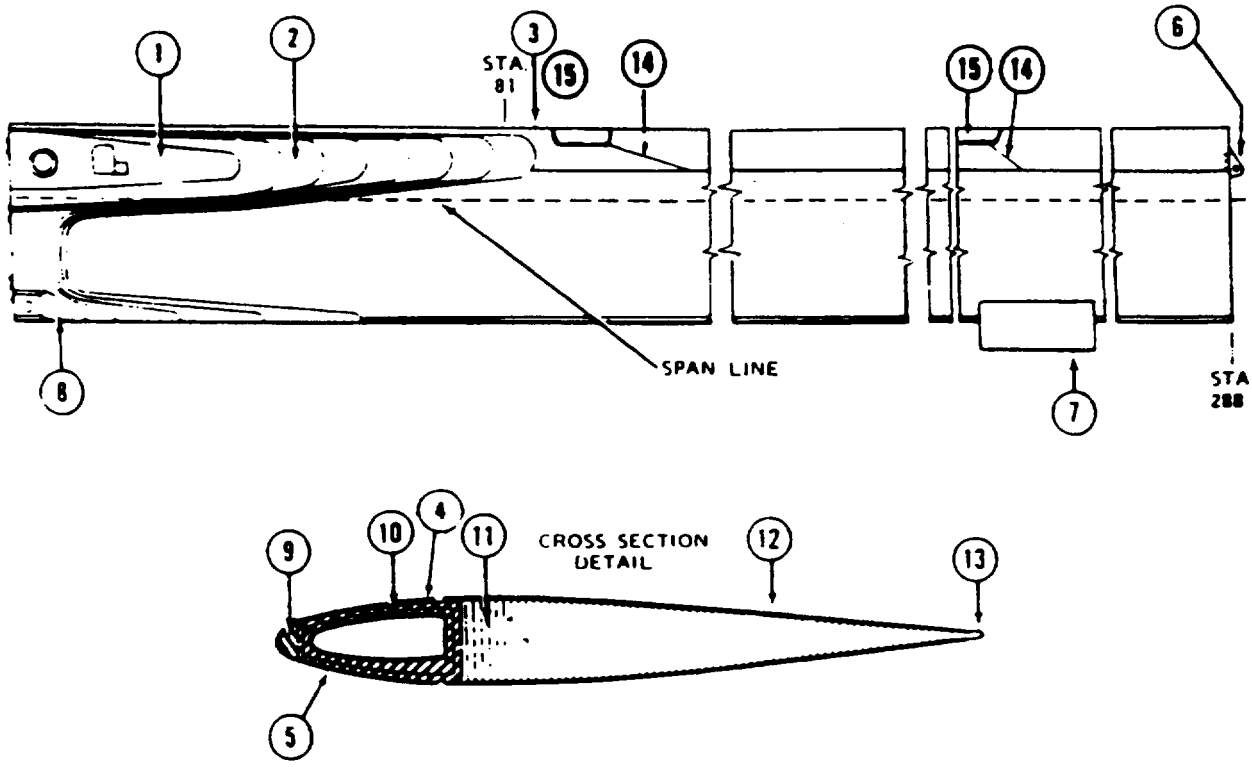
(c) Cut out skin around damaged area. This may be accomplished by using a hole saw or scribing through skin with a sharp instrument.

CAUTION

Two holes on either bottom surface of blade or two holes on top surface of blade on same chord line may not be repaired, except in outer 48 inches of the blade. One hole on bottom surface and one hole on top surface of blade located on same chord line may be repaired. Maintain 2.0 inches minimum between patches on two or more holes on either side of blade. (See figure 5-26.)

NOTE

If a circular hole is cut out to remove damaged area, It shall not exceed 2.0 inches in diameter. It is permissible to cut out an oblong hole if general direction of hole falls within 15 degrees of a line parallel to leading edge or trailing edge of blade. Maximum size of oblong hole shall not exceed 1.8 inches wide by 4.0 inches long. Ends of hole shall have a minimum radius of 0.25 inch, to break comers. It Is not necessary to cut a hole if defect can be polished smooth without leaving skin in area so thin 1t can be dented with fingernail pressure. In these cases, ares still must have a patch applied In same manner as though a hole existed. Maximum diameter of this type is to be 5.0 inches with at least 0.75 Inch of bonded area around perimeter of dent.



1. GRIP PIATE
2. DOUBLERS
3. INBOARD ABRASION STRIP
4. DOUBLER
5. OUTBOARD ABRASIVE STRIP
6. TIP CAP
7. TRIM TAB
8. DRAG PLATE
9. NOSE BLOCK
10. SPAR
11. HONEYCOMB CORE
12. SKIN
13. TRAILING EDGE EXTRUSION
14. SCARF JOINT
15. SCARF JOINT CAP

Figure 5-25. MB **Main Rotor Blade Inspection Diagram**

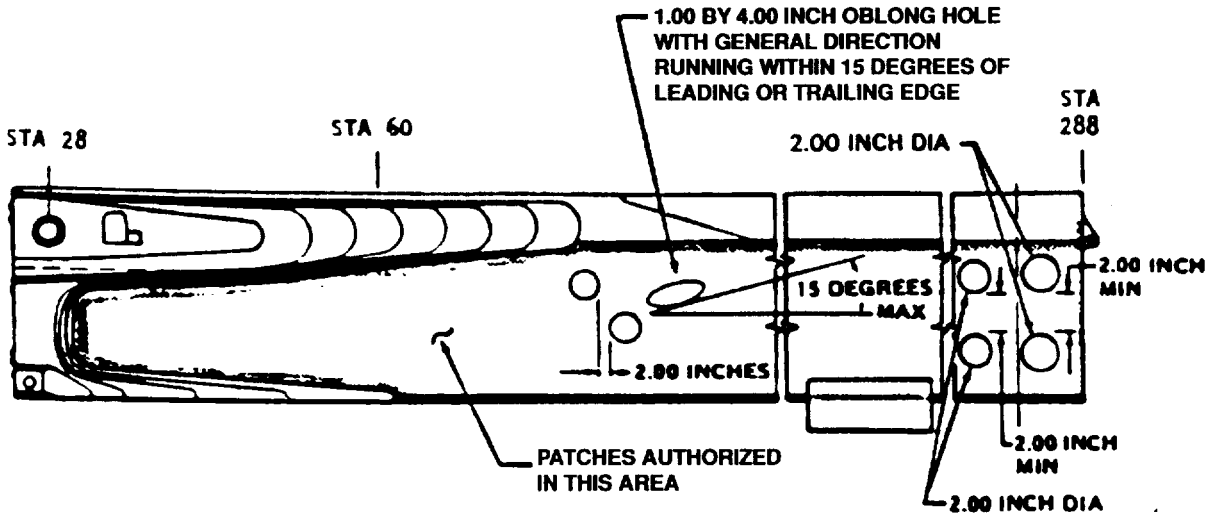
(d) Remove skin in cut out area, disturbing core as little as possible. It is desirable to heat cut out disk to a maximum of 200 degrees F (93 degrees C) and lift out disk while still heated.

NOTE

If the core Is damaged or damaged In an area In excess of 0.75 inch diameter, replace It with core of same type.

(e) Deburr eches of hole, ensuring skin is free of scratches and nicks.

(f) Prepare a patch of 2024-T3 aluminum alloy 0.020 inch thick. Patch must be large enough to overlap hole at least 0.75 inch all around perimeter. Deburr edges of batch.



NOTE:

1. No patches authorized within one inch of the doublers, sper, trailing edge strip, or tip of blade. This is the shaded area shown above. The spar extends 5.400 Inches aft of the feeding edge. The trailing edge strip extends 2.800 inches forward of the trailing edge from butt end to STA 60 and tapers uniformly to 0.750 inch et STA 210 and remains constant to the tip.

2. Damage to the same chordline is permitted outboard of STA 240 only. inboard of STA 240 minimum chordwise spacing is 2 inches.

MAXIMUM DAMAGE LIMITS:

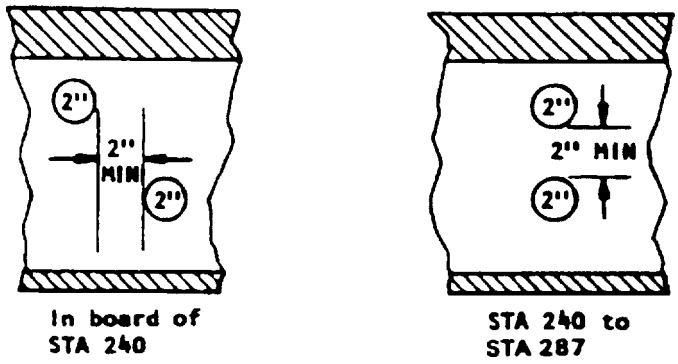


Figure 5-26. MB Main Rotor Blade — Areas of Repair

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(9) Sand mating surfaces of blade and patch, using No. 400 grit paper (C1). All paint and primer must be removed from bond surface and blade. Wipe both surfaces clean with a rag dampened with methyl-ethyl-ketone (C177) and dry with clean cloth.

CAUTION

Area to be bonded must be clean, dry, and free of grease, oil, wax, etc.

(h) Apply adhesive (C32) or adhesive (C29) to bond areas of patch and blade.

(i) Apply patch to blade, moving patch slightly back and forth under pressure, to seat properly and expel air pockets in adhesive. Blend out excess adhesive around edges.

(j) Patch may be held in place while curing with rubber bands made from inner tube or other mechanical means.

(k) If adhesive (C29) is used, cure at 75 'F (23.9°C) minimum for 5 days or at 180°F (82.2°C) for 60 minutes. If adhesive (C32) is used, cure at 70 TO 90°F (21.1 TO 32.2°C) for 24 hours or at 145 TO 155°F (62.8 TO 68.3°C) for 30 minutes.

(1) Refinish patch and adjacent area (paragraph 5-34).

b. Blades with damaged or loose trim tab should be sent to depot maintenance.

c. Blade with damage to doublers, grip plates, drag plates, or abrasive strip which exceed reparable limits of paragraph 5-31 should be sent to depot maintenance.

d. Scarf joint repair.

NOTE

Repair of scarf joint is acceptable if:
- Corrosion has not extended under the leading edge of the abrasive strip.
- All corrosion between the scarf joint is removed or treated before repair.
- Abrasive strip Is not voided in excess of manual limits.

(1) Clean joint with naphtha (C178).

(2) Fill scarf joint with adhesive (C29).

(3) Smooth adhesive and fair to contour prior to curing. Allow adhesive to setup (cure) overnight.

(4) Polish smooth using abrasive cloth, 250 grit (C5).

(5) Refinish with primer (C312) and lacquer (C14).

NOTE

Polyurethane tape bonded in place over the scarf joint is recommended for dusty/sandy environments as protection for the scarf joint filler material.

(6) Application of scarf joint protective tape.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(a) Clean leading edge with naphtha (C178).

(b) Cut a piece of tape (C280) seven inches long.

(c) Center the tape chordwise over the scarf joint. Press in place. Allow tape to age for four hours before turning up rotor.

(d) Replace tape when worn or as required.

Pages 5-49 and 5-50 deleted.

d.1. Scarf joints covered with scarf joint caps (Taco Shells) repair.

CAUTION

Do not exceed 200 degrees F (93 degrees C) during scarf joint cap removal or damage to rotor blade could result.

(1) Heat damaged or unsecure scarf joint cap to 200 degrees F (93 degrees C) maximum, using a heat gun and maintain that temperature during removal process.

WARNING

Scarf joint cap will be extremely hot to touch. Handle with appropriate tools and place in a safe location while allowing to cool. Allow rotor blade to cool completely before repairing scarf joint.

(2) Remove cap using a putty knife or other suitable tool, being careful not to damage the rotor blade. Repair scarf joint in accordance with paragraph 5-32d.

e. Void repair.

(1) Any voids not in excess of allowable limits which are apparent at the butt or tip end of the blade are to be sealed with adhesive (C28), (C32), or (C29).

(2) Blades with voids which exceed allowable limits should be forwarded to depot for evaluation and repair.

f. Blade with loose tip weights (except as defined in paragraph 5-31, i,(2)) or loose or distorted tip weight stubs should be sent to depot for repair.

g. Retention bolt bushings corrosion/mechanical damage shall be polished out using 240 grit abrasive cloth or finer, or by honing. If reaming process is used, the surface finish must be polished using 240 grit abrasive cloth or finer. If ID exceeds 2.504 inches, return blade to depot.

h. Deleted.

5-33. Installation — Main Rotor Blade

Premaintenance requirements for installation of main rotor blade

Condition	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T34)(T41)(T45) (T49)(T85)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	Three
Consumable Materials	(C86)
Special Environmental Conditions	None

CAUTION

Some Main Rotor Grips may have a shim installed at the main rotor blade mating surface. If that shim was found loose during blade removal It must be reinstalled with adhesive (C29) prior to Installation of the rotor blade.

NOTE

If blades are being reinstalled on the same rotor hub from which they were removed, the drag braces need no further adjustment. To avoid disturbing rotor balance, reinstall blades and blade retaining bolts in grips as originally installed.

NOTE

Damage to root closure could occur during removal/replacement of the blade. Extreme care should therefore be exercised during removal and replacement.

a. Support main rotor hub on stand (T34) equipped with plate (T85). When stand is not available, a shipping container for main rotor hub can be used for a buildup stand in the following manner.

(1) Remove top of shipping container.

(2) Remove eight bolts and lift out of frame of container base.

(3) Relocate frame 90 degrees on container base and secure with four cam lock fasteners.

(4) Position rotor hub 90 degrees to frame, and tighten center nut.

b. Be sure that grip positioning link (T41) is installed between pitch horn and stud on pillow block (figure 5-2).

c. Apply corrosion preventive compound (C86), to bladeretaining bolt holes in hub grips and blade butts, and to drag brace and drag plate bolt holes.

CAUTION

Foreign material or misalignment of bolt holes will result in damaged parts.

d. Insert blade (5, figure 5-24) into grip, observing color coding. Apply a thin coat of corrosion preventive compound (C86) to bolt shank (4), but not to threads. Align bolt holes and insert bolt (4) through grip and blade from top. To find best alignment, gently move tip of blade up and down while inserting bolt.

e. Support end of installed blade. Assemble washer (15) with counter bore up, and nut (13) on retaining bolt.

Do not fully tighten nut.

f. Align clevis of drag brace (8) on bolt hole of the blade drag plates. Install shims equally between clevis and upper and lower drag plates to obtain 0.000 TO 0.005 clearance. Install bolt (7) and secure with two washers (9) and nut (10) on lower end.

g. Install opposite blade in same manner.

h. Perform blade alignment check in accordance with paragraph 5-7.

CAUTION

Support end of blade during torque application on each blade retaining bolt nut (13) to compensate for the 23/4 degree precone of the main rotor blade grips. Assemble washer (15) with counterbore up and nut (13) on retaining bolt.

NOTE

Install washer (12) against the castillated nut (13) regardless of the direction that screw (14) is installed.

i. Tighten nut (13) on each retaining bolt to a torque of 260 TO 300 footpounds, using wrench (T45). Align a notch in the nut with a hole in the bolt. Safety each nut by installing screw (14) with head in a direction so that centrifugal force will keep the locking screw in (Screw (14) may be installed from the outside or inside of the bolt). Install washer (12) and nut (11).

i.1. . Torque nuts (10) on outer drag brace bolts (7) 100 TO 120 foot pounds.

j. Torque nuts (17) on inner drag brace bolts (18) 125 TO 150 footpounds.

5-34. MB Touchup Refinish Procedure Main Rotor Blade.

NOTE

The following procedures are for touch up and refinishing of repaired areas of blades only.

a. Remove tip cap assembly and protect screw holes and spar cavity to prevent entry of cleaning and refinishing materials.

b. Degrease with aliphatic naphtha (C178) or any good degreasing solvent.

c. Remove all lacquer locally by hand wiping with cloth dampened with MEK (C177). Do not allow cloth to lie on blade without hand wiping. Repeat as necessary to remove lacquer.

NOTE

Blade must have all scratches, nicks, dents, etc. repaired within inspection limits before continuing.

d. Using Scothbrite (Cl 1) and a solution of mild soap, thoroughly scrub repaired aluminum areas to remove all surface oxides and all aged chemical conversion coatings.

CAUTION

Do not use carbon steel or carbide abrasive materials or tools on aluminum surfaces.

e. Using 240 grit abrasive paper (C11.5) with a circular motion, thoroughly sand aft portion of abrasive strip if leading edge of aluminum skin is to be refinished.

f. Wash all repaired areas with a solution of mild soap. Achieve water breakfree surface, which will be evident by a continuous unbroken film of water on surface after thoroughly rinsing soap from surface.

NOTE

After wash, surfaces to be refinished should not be handled with bare hands until final paint has dried.

g. On all bare aluminum surfaces, apply protective coating. (Refer to TM 1-1500-344-23)

h. Allow cleaned surface to thoroughly dry. Apply one coat of epoxy polyamide primer (C206) to repaired orbare areas only. Allow to air dry from 1 hour to 8 hours maximum.

NOTE

Mix EC2216 (C28) per manufacturers instructions. Then mix 13% to 15% (by weight) of epoxy polyamide primer into the EC2216. Mix thoroughly. Thin to a sprayable consistency by adding methyl-ethyl-ketone not to exceed 50% by volume of the mixed EC2216 (approximately 35% by volume will produce a sprayable consistency). Pot life of the thinned EC2216 is approximately 3 hours.

i. If leading edge of aluminum skin is eroded to bare metal or butt joint filler material is exposed, apply three thin coats of adhesive mixture approximately two inches wide, centered on the joint between the skin and abrasive strip (at the eroded area). Allow to dry 45 TO 60 minutes between coats. Allow final coat to air dry at room temperature for 16 T0 24 hours. Also apply mixture to tip end of spar to protect bond lines.

j. Apply one final thin coat of epoxy polyamide primer over the repaired area. Apply top coat within 8 hours.

k. Apply 2 coats of acrylic lacquer (C14) to repaired areas. Allow 1 hour drying time minimum between coats. Use the same color as adjacent areas.

5-34.1 Preparation for Storage or Shipment of Main Rotor Blades.

a. Condemn, demilitarize, and locally dispose of any blade which has incurred nonreparable damage per para. 5-31, step k.

b. Tape all holes in the blade such as bullet damage, tree damage, or foreign object damage to protect the interior of the blade from moisture and corrosion.

c. Thoroughly remove foreign matter from the entire exterior surface of blade with mild soap and water.

d. Protect blade outboard eroded surfaces with a light mating of corrosion preventive (C73) or primer coating (C215).

e. Protect blade main bolt hole bushing, drag brace retention bolt hole bushing, and any exposed bare metal (i.e., grip and drag pads) with a fliht coating of corrosion preventive (C91).

f. Place barrier material (C115) shiny side next to blade at all locations where the blade will contact the hogs-hair container supports (5 places).

g. Secure blade to shock-mounted support and secure container lid.

h. Place properly completed DA Form 2410, material condition tag DA Form 1577-2, and any other blade records in a waterproof bag and insert into container record tube.

L Obliterate old markings from the container which pertained to the original shipment or to the original item which it contained. Stencil blade NSN and serial number on container.

5-34.2 CB COMPOSITE MAIN ROTOR BLADE.

NOTE

When operating aircraft in geographical areas where excessive blade erosion will occur, refer to TB 1-1615-351-23 for instructions for applications of anti-erosion tape procedures.

5-34.3 CB Description - Composite Main Rotor Blade. The composite main rotor blade is comprised of composite materials and constructed using the latest manufacturing methods and processes. The blade consists of a front spar and afterbody skins supported by nonmetallic honeycomb core and a trailing edge strip. See figure 5-26.1. The spar is a filament wound, D-shaped structure, constructed of S-2 fiberglass in an epoxy matrix. The fibers are unidirectional, oriented spanwise, and are encased in an outer torque wrap of unidirectional fiber that is *45 degrees to the span. The afterbody skins consist of E-TYPE fiberglass (±45 degrees) material in an epoxy matrix. The leading edge of the blade is protected from erosion with three nonmetallic abrasions strips. The leading edge of the outboard abrasion strip is covered with a nickel rain guard strip. The blade is protected from lightning strike damage by a copper-filled polyurethane conductive paint coating. Internal weights are used for static balance for interchangeability.

5-34.4 CB Cleaning – Composite Main Rotor Blade (Installed or Removed).

a. Clean main rotor blade with a mixture of one part cleaning compound (C66.1) and nine parts water. If blade is damaged, do not clean in damaged area. Water and solvents will contaminate blade core.

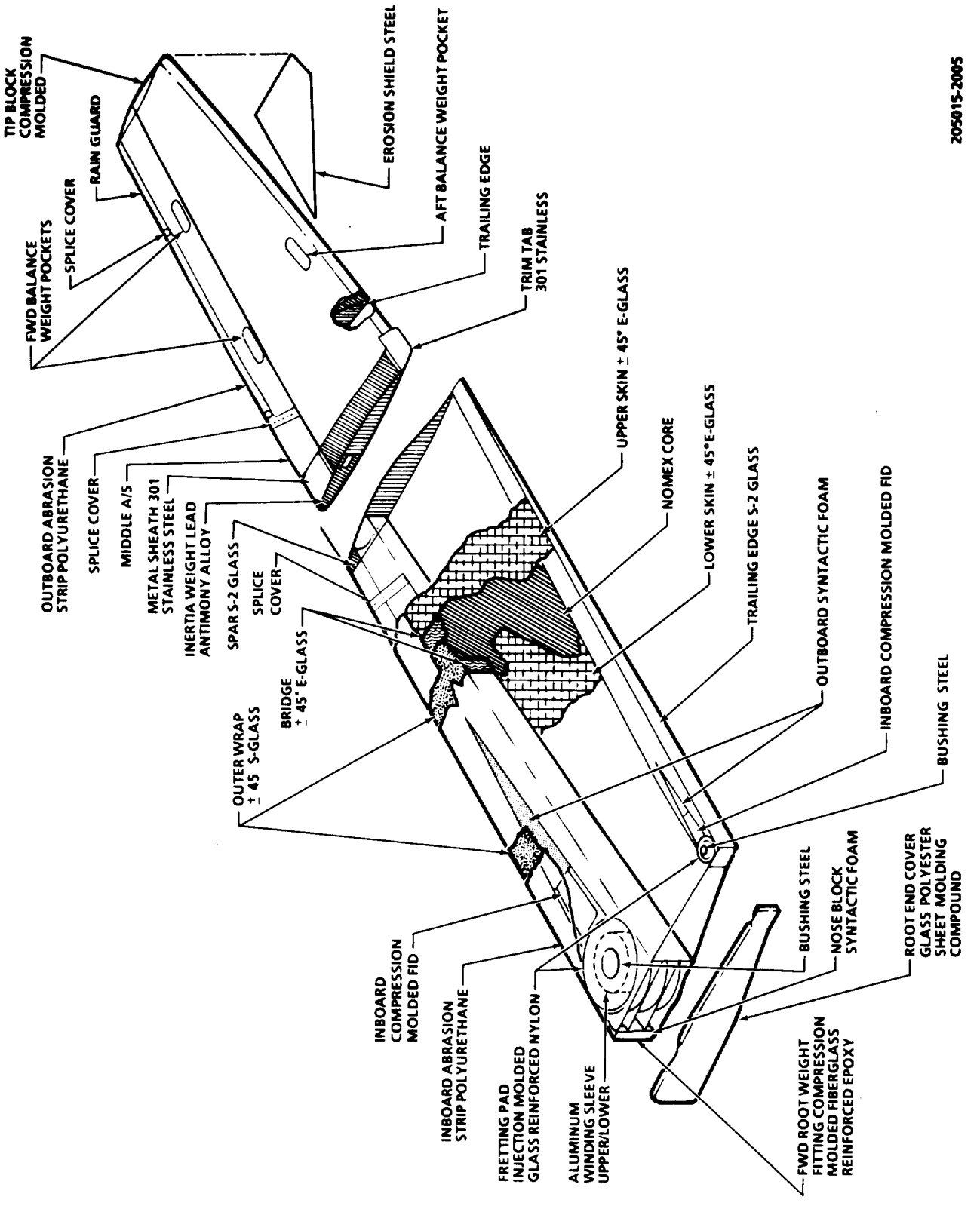


Figure 5-26.1. CB UH-1H Composite Main Rotor Blade

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Do not clean abrasion strip with solvent. The abrasion strip is very susceptible to solvents. Use care to prevent spillage or runoff of solvents onto the abrasion strip.

b. Remove stubborn deposits from all surfaces of blade, except the abrasion ship, using a clean cloth lightly dampened with drycleaning solvent (C261).

5-34.5 CB Preliminary Inspection — Composite Main Rotor Blade.

NOTE

Once a plug patch or skin patch has been installed, it is not possible to determine which type of patch has been applied.

Repairs of all types will be logged on DA Form 2408-13 and -16.

a. Inspect blade for damage. Classify damage as acceptable, reparable, or non-reparable. Acceptable damage need not be repaired. Reparable damage shall meet all the following requirements:

(1) Damage listed as acceptable need not be repaired.

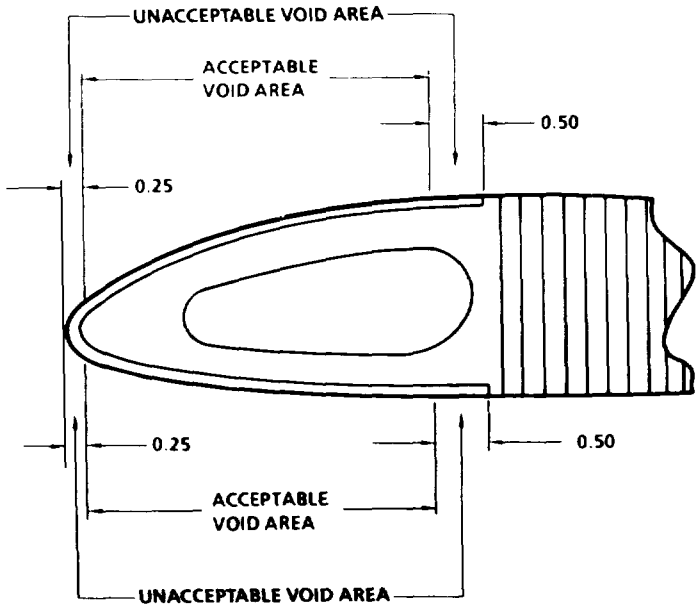
(2) Repairable damage shall be within limits shown in figures 5-26.2 through 5-26.8.

b. Main rotor blades not meeting the requirements of preceding step a. shall be scrapped at local level.

5-34.6 CB Repair — Composite Main Rotor Blade (AVIM).

Premaintenance Requirements for Repair of Composite Main Rotor Blade

Condition	Requirements
Model	UH-1H
Part No. or Serial No.	All Part No. 205-015-150-101 Main Rotor Blades
Special Tools	(T100) (T101) (T102)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C42) (C61) (C110) (C177) (C244) (C280) (C218) (C269) (C288) (C2) (C5) (C231) (C10) (C47) (C259) (C237) (C245.1) (C120.1) (C247) (C70.1) (C218.1) (C120.7) (C29) (C29.2) (C256) (C11 .2) (C11.4) (C1l.5) (C1l.6) (C114.1) (C222) (C29.3) (C11.1) (C269.1) (C284.1) (C197.1) (C48.1) (C273.1) (C203.1) (C257.1) (C70.2) (C39.1) (C222.1) (C120.3) (C111.1) (C29.4) (C314) (C315) (C316) (C67.1)
Special Environmental Conditions	Moisture Free



NOTES

1. **A void less than 2.00 square inches is acceptable, if void is within acceptable void area, and no more than 0.50 inch wide. Maximum void size is 5 X 4 inches.**
2. **A void larger than 2.00 square inches, but less than 16.00 square inches, provided the void is no more than 2.00 inches wide chordwise, shall be repaired by injecting with EA956 (C29.2), if void is within acceptable void area. Maximum void size is 2 X 8 inches.**
3. **The abrasion strip shall be replaced if these limits are exceeded.**
4. **All dimensions are in inches.**

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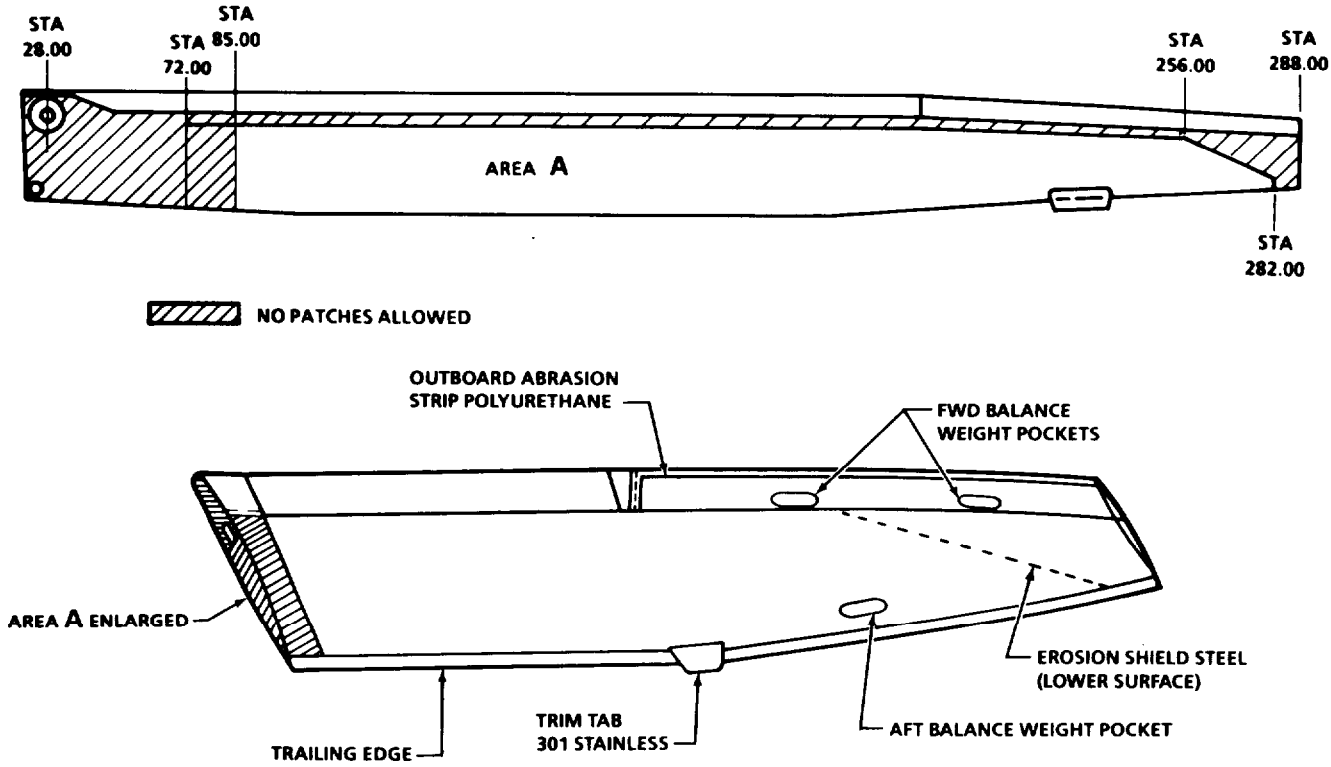
Figure 5-26.2 CB Inboard/Middle/Outboard Abrasion Strip Void Limits



NOTES

1. Voids between the skin and core and skin and erosion shield

   A single void under the erosion shield shall not exceed 3.00 square inches in area, with a maximum chordwise width of 1.00 inch. The total area of all voids shall not exceed 6.00 square inches. Edge voids are not acceptable. Acceptable voids shall not be within 0.50 inch of the edge of the erosion shield. Single voids between the skin and core shall not exceed 5.00 square inches in area, with a chordwise width of 1.00 inch. The total area of voids shall not exceed 25.00 square inches. The voids in any square foot of bonded area shall not exceed 5.00 square inches.

   Skin to core voids exceeding requirements shall be repaired by removing unbended skin and replacing with a skin patch. Skin to erosion shield voids shall be repaired by adhesive injection following procedure in paragraph 5-34.6, step l.

2. Voids between the skin and trailing edge.

   Voids shall not exceed one-fourth the width of the faying surfaces by 20.00 inches in length. Acceptable voids shall not be within 0.50 inch of the edge of the skin. Edge voids are not acceptable. The total area of voids shall not exceed 10.00 square inches.

   Voids exceeding requirements shall be repaired using adhesive injection following procedure in paragraph 5-34.6, step l.

3. Voids between the trim tab and the skin.

   Voids between the trim tab and skin or under the trim tab shall not exceed 1.00 inch chordwise by 1.00 inch spanwise nor be closer than 0.50 inch from the edge. The maximum area of total voids shall not e xceed 2.00 square inches per side, Edge voids are not acceptable.

   Trim tab shell be replaced when void requirementa are exceeded.

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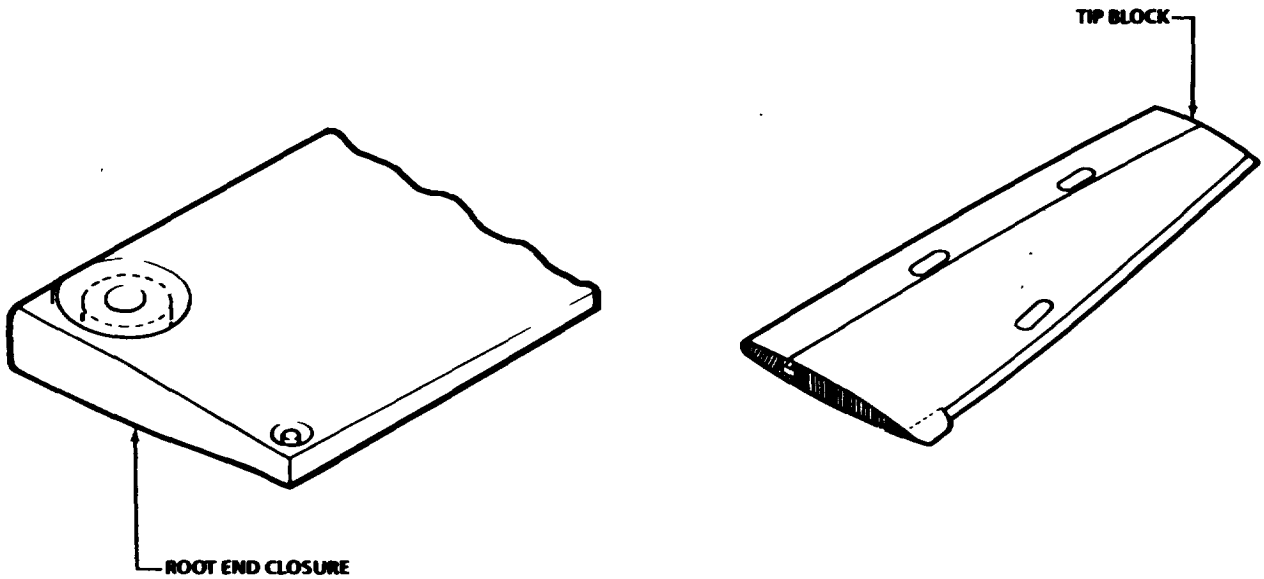
Figure 5-26.3. CB Skin, Erosion Shield, Trailing Edge, and Trim Tab Void Limits



NOTES

1. Voids Between the Skin and Root Closure

   Acceptable voids shall not be closer than 0.25 inch to the edge of the root closure. Acceptable voids shall not exceed 6.00 inches in length. Edge voids are not acceptable. Voids within 1.00 inch of each other shall be considered as one void. Voids exceeding these requirements will be repaired with adhesive injection method following procedure in paragraph 5-34.6, step l.

2. Voids Between the Skin and Tip Block

   Acceptable voids shall not be closer than 0.50 inch to the edge of the tip block (end of blade) (upper or lower surface). Single voids between the skins and tip block shall not exceed 2.00 square inches in area, with a chordwise width of 1.00 inch. Edge voids are not acceptable. Voids exceeding these requirements will be injected with adhesive per injection method procedure in paragraph 5-34.6, step l.

3. All edge voids or voids not meeting edge requirements shall be opened up and sealed with adhesive per injection method procedure in paragraph 5-34.6, step l.

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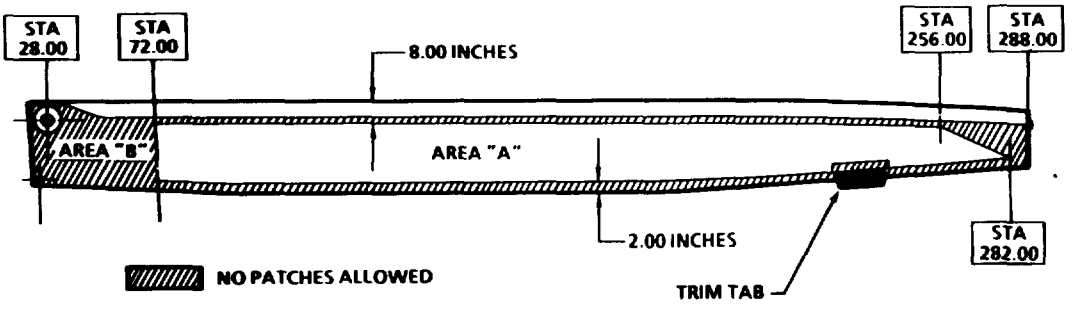
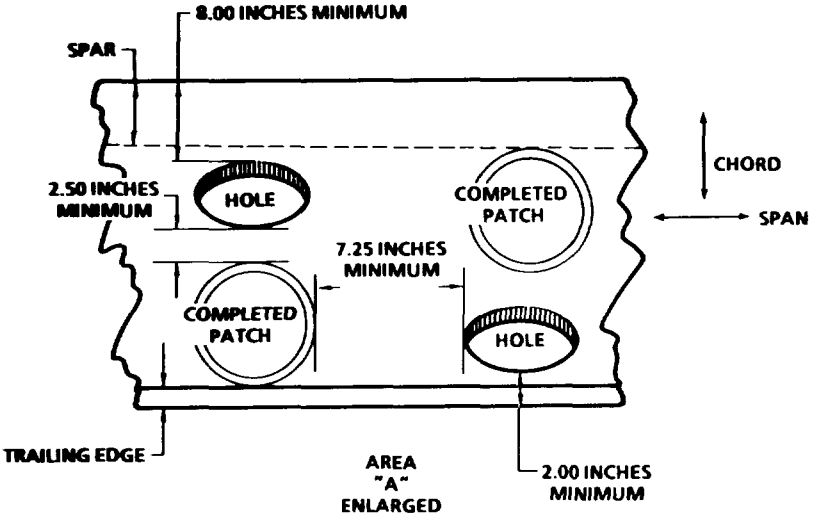
Figure 5-26.4.. CB Root Closure and Tip Block Void Limits





EVALUATION OF CORE DAMAGE

Core damage must be containable within a hole routed out to plug diameters shown in Table 5-5.1. The minimum distance from edge of routed out hole must be:

1. Deleted	
2. Deleted	
3. To the edge of any completed plug patch skin cover parallel in blade chord direction	2.50 inches
4. To the edge of any completed plug patch skin cover parallel in blade span direction	7.25 inches
5. To any edge of a skin patch	2.50 inches
6. To any edge of a trailing edge patch	4,00 inches
7. To the forward edge of blade	8.00 inches
8. To the trailing edge of blade	2.00 inches
9. To the trim tab	3.00 inches

Note - the completed plug patch skin (over will overla edge of hole distance minimums described above by a 1.00 inch margin.

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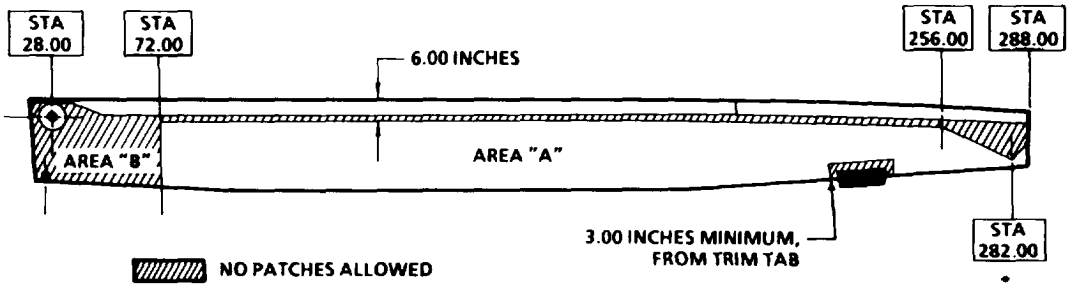
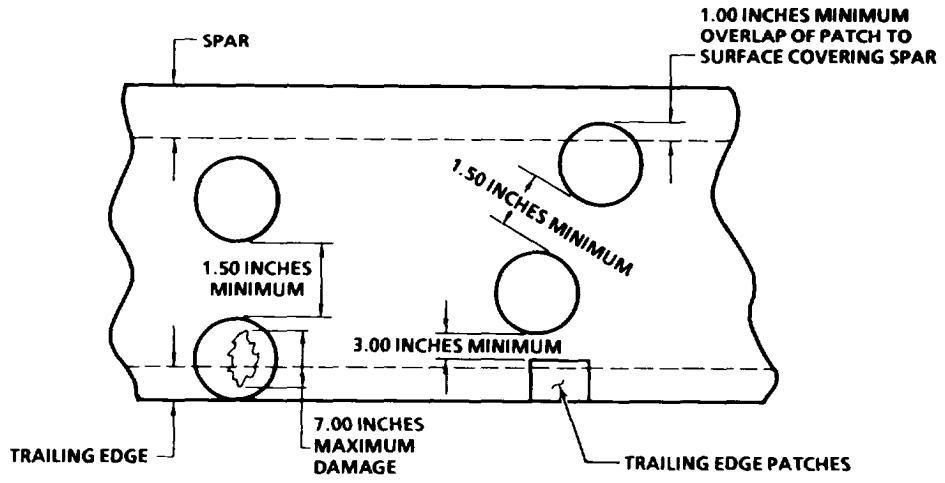
Figure 5-26.5. CB Proximity Limits for Plug Patches





ZONE "A" ENLARGED

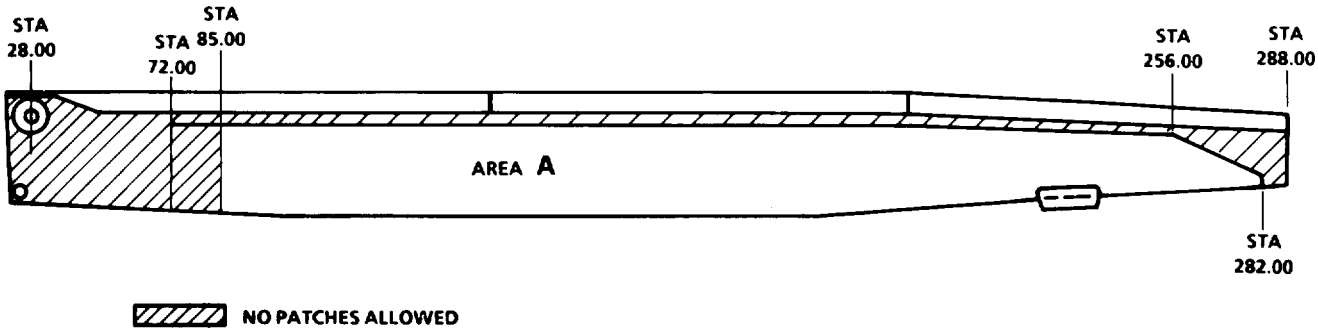
NOTES

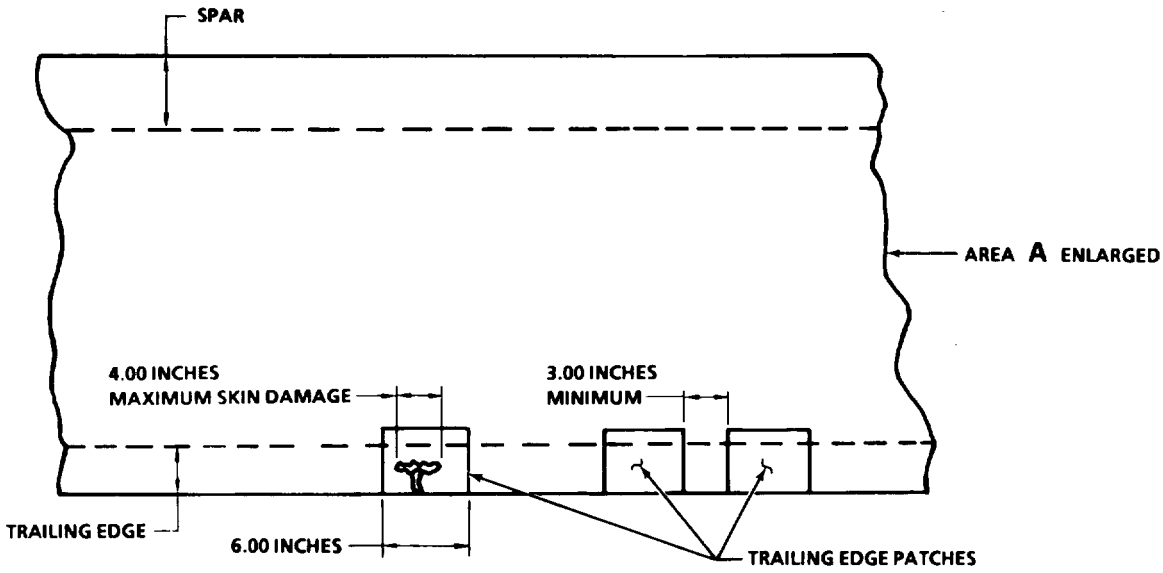
Minimum Proximity of:

1. Skin patch to plug patch= 1.50 inches
2. Skin patch to trailing edge patch= 3.00 inches
3. Maximum standard skin patch= 9.00 inches diameter to cover maximum allowable skin damage of 7.00 inches in diameter and maintain minimum edge overlap of 1.00 inch.

205015-2007-1

Figure 5-26.6. CB Proximity Limits for Skin Patches



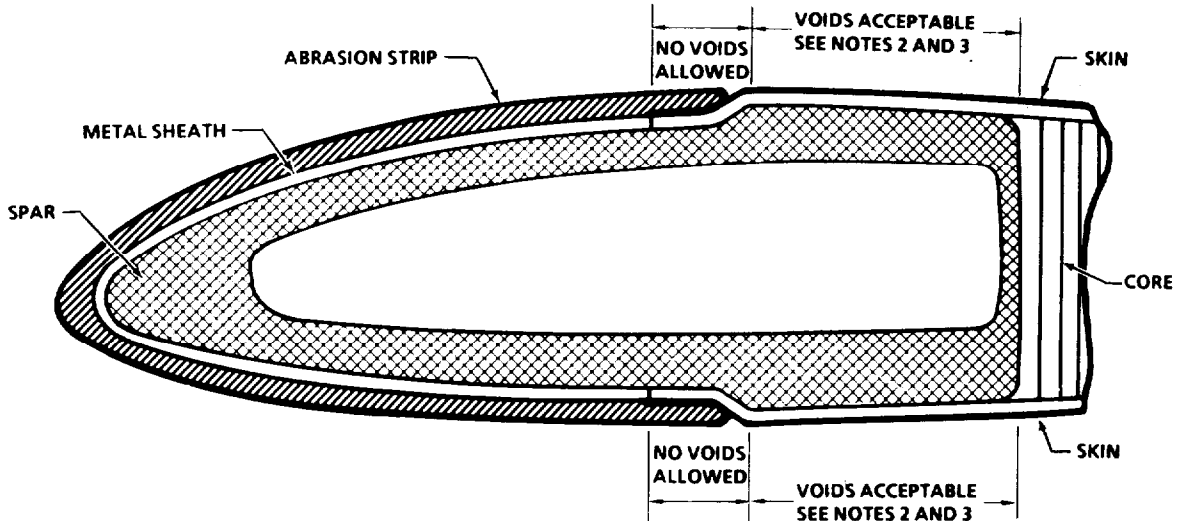


NOTES

1. Minimum limits between trailing edge patches are also minimum limits between any other type of patch, erosion shield and trim tab.
2. Repair on trailing edge is limited to damage which penetrates outer skin ply only.
3. Trailing edge patch must cover damage by 1.00 inch on all three sides.

205015-2011

Figure 5-26.7. CB Trailing Edge Patch Limits



NOTES

1. No skin voids allowed from forward edge of skin to aft edge of abrasion strip,
2. Voids within acceptable zone must not exceed 0.50 inch width by 20.00 inches length.
3. Total area of all voids in acceptable zone must not exceed 15.00 square inches per side.
4. Voids exceeding these requirements shall be injected using adhesive per paragraph 5-34.6, step k.

205015-2012

Figure 5-26.8. CB Skin to Spar Void Limits

a. Before Repair. Before performing any repair, ensure blade assembly will meet requirements of paragraph 5-34.5a(2) after repair is completed.

b. The following repairs are assigned step numhers as indicated:

Paragraph No. 5-34.6	Title
e.	Application of skin patch
f.	Installation of plug patch
g.	Application of trailing edge doubler patch
h.	Replacement of trim tab
i.	Inboard/middle/outboard leading edge abrasion strip replacement
j.	Inboard/middle/outboard leading edge abrasion strip restoration (paint on method)
k.	Void repair for abrasion strip, injection method
l.	Void repair, injection method
m.	Erosion shield replacement
n.	Weight pocket seal repair
o.	Replacement of root closure
p.	Repair of root closure crack or hole
q.	Paint refinishing
r.	Replacement of rain guard splice cover

c. The following protective equipment must be used as required when working with fiberglass repair kits:

(1) Respirator, chemical cartridge.

(2) Respirator, disposable half-mask.

(3) Gloves, Plastic (C120.2).

(4) Apron, impermeable, duck, rubber coated.

(5) Goggles, industrial for chemical handling.

(6) Faceshield, industrial hinged window.

d. Consumable items included in blade repair kits are not identified with a (C) number. Consumable items identified must be procured locally.

e. Application of skin patch.

CAUTION

Only lead pencils shall be used for marking repair areas. Pencil marks other than specified in instructions can weaken repair.

NOTE

Consumables not identified with a (C) number in this procedure are included in the skin patch repair kit.

(1) Ensure that blade will meet proximity limits of any type of patch previously applied to blade, as shown in figure 5-26.6.

(2) Position blade for access to damaged area. Support blade to prevent movement and droop.

NOTE

Droop can be defined as any contour other than manufactured specification. Support of blade should be as not to allow blade to deflect from nominal contour.

(3) Measure diameter of damage. Maximum skin damage is **7.0** inches diameter.

(4) Obtain adhesive (C29).

(5) Obtain skin patch repair kit, no larger than necessary to overlap damage 1.0 inch all around. Skin patch kits are available in sizes as indicated.

Repair Kit Materials (Skin Patches)

Kit No.	Patch Diameter
K747-201-1	3.00 inches
747-201-3	5.00 inches
747-201-5	9.00 inches

(6) Damage passing through both skins with core damage of less than **1.0** inch diameter shall be repaired by applying a skin patch to both top and bottom sides of blade.

(7) Place kit template on blade; position inner circle to enclose damage. Hold template from slipping and draw a pencil line around outer circle of template (figure 5-26.9).

CAUTION

Excessive sanding will weaken blade skin. Sand only until yellow color is removed.

(8) Starting with No. 120 grit and finishing with No. 220 grit abrasive paper (kit), sand paint and yellow primer from blade from the area within the guide circle. Sand only until yellow color is removed. Do not sand skin fibers. Sand off any damaged material raised above normal contour of blade (figure 5-26.9).

(9) Wipe or vacuum all sanding dust from blade.

NOTE

If both upper and lower skin is punctured but core Is not damaged beyond the one inch diameter limitation. Vacuum the sanding dust from the core area prior to application of skin patches.

(10) Use template to redraw guide circle.

(11) Cut short lengths of tape (kit C315) and mask around the outside of guide circle (figure 5-26.9).

(12) Put on cotton gloves and then plastic gloves (kit C315). Leave gloves on until completion of adhesive application.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Care shall be taken to prevent isopropyl alcohol from entering core area of blade. Spillage shall be avoided.

Surfaces to be bonded must be clean, dry, and free of fingerprints and all foreign material.

(13) Dampen clean cheesecloth (C61) with isopropyl alcohol (C42) and clean inside circle. Wipe with clean, dry, cheesecloth, before dampness evaporates.

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect the skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins or curing agent from skin with warm water and soap. Do not use solvents to clean adhesive from skin.

(14) Mix adhesive (C29) per manufacturers instructions. Stir with wooden spatula until all streaks have disappeared and color is uniform.

NOTE

Pot life of adhesive is 15 minutes at 72°F (22.0°C) . It is shorter at higher temperature. Always check package dates to make sure adhesive shelf life has not expired. Repair procedures shall be completed without delay.

(15) Using new paint brush, trim bristles to 0.5 inch and apply a light coat of adhesive to blade skin within guide circle and to underside of skin patch (figure 5-26.9).

(16) Center skin patch within guide circle, with stenciled arrow pointing outboard (spanwise), and press firmly into place. Slide patch back and forth slightly under hand pressure to smooth out adhesive. Use light hand pressure to squeeze the patch from center to edge to work out any air bubbles.

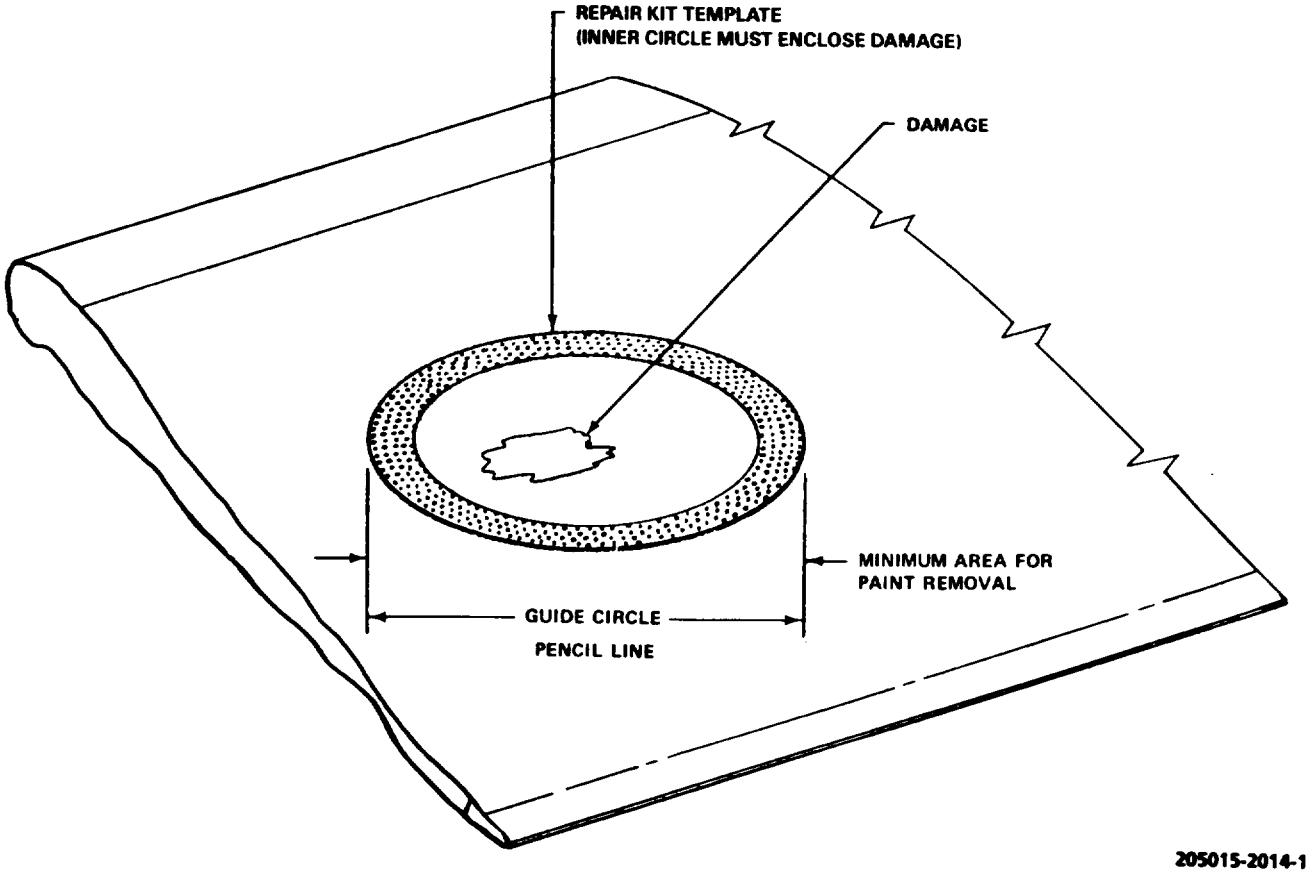


Figure 5-26.9. CB Application of Skin Patch (Sheet 1 of 2)

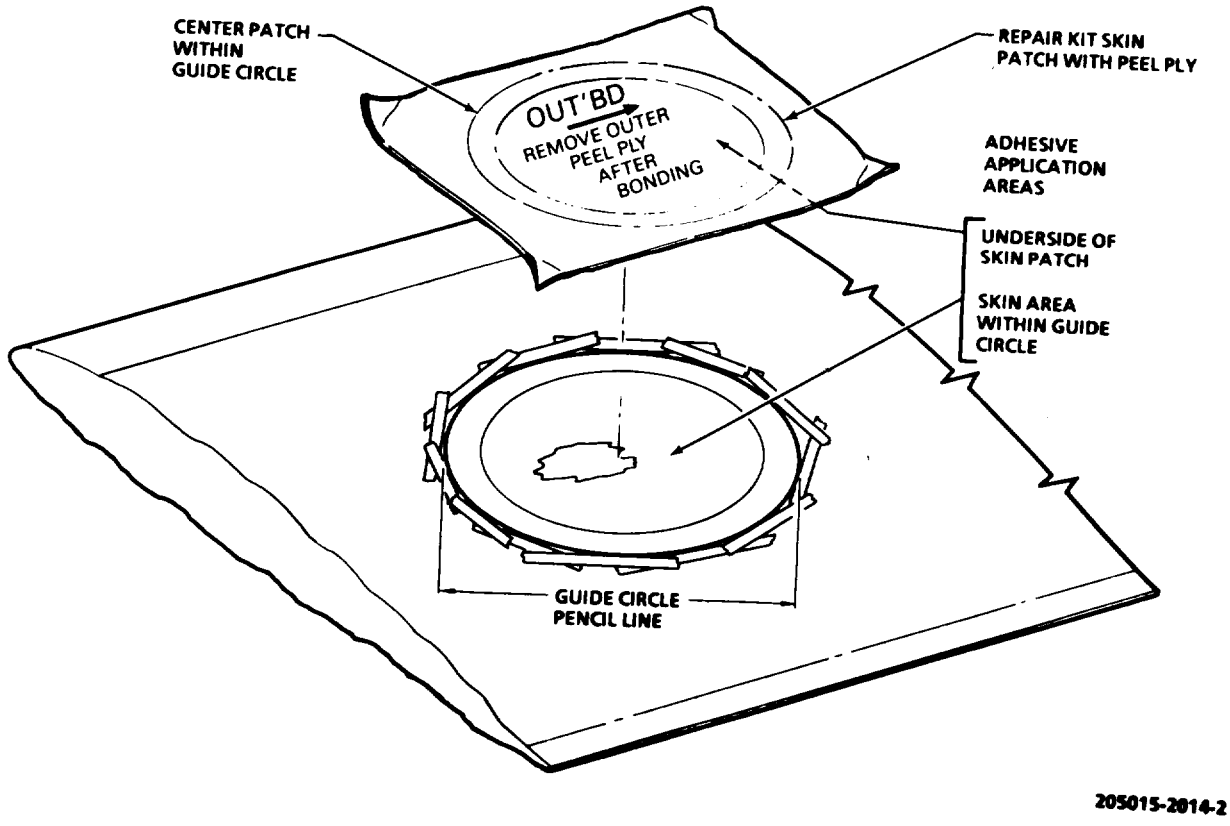


Figure 5-26.9. CB Application of Skin Patch (Sheet 2 of 2)

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Care shall be taken to prevent isopropyl alcohol from entering core area of blade. Spillage shall be avoided.

(17) Using clean cheesecloth (C61) dampened with isopropyl alcohol (C42), temporarily lift edges of peel-ply and wipe off excess adhesive. Smooth and tape peel-ply in place.

(18) Place tape (kit C315) over edge of patch in four places to prevent movement of patch. Place two long pieces of tape at right angles and centered over the patch spanwise and chordwise and extending beyond the dimensions of the blade repair fixture bladder. (For centering repair fixture.)

NOTE

The forward slots In the blade repair fixture channels may have to be extended to accommodate repairs close to the leading edge.

(19) Install blade repair fixture (T-100) (figure 5-26.10).

(a) Install fixture from trailing edge side of blade.

(b) Center bladder over repair area and tighten bladder position locking knobs.

(c) Center pad opposite bladder.

CAUTION

Tightening of locking knobs so that metal skirt around bladder is closer than 0.125 inch to blade can damage blade.

(d) Tighten leading and trailing edge knobs until metal skin around bladder is approximately 1/8 inch from blade skin,

(e) Actuate hand pump to obtain 4 TO 6 psi reading on pressure gage. Disconnect pump hose clamp from air valve

NOTE

During curing, it may be necessary to periodically reconnect hose, and to actuate pump to maintain 4 TO 6 psi. Cure time starts when temperature gage reaches 160 ± 10 °F.

(f) Connect 110-volt ac electrical power for 2 hours curing time.

(9) At end of curing time, disconnect electrical power and relieve air pressure by lifting center portion of relief valve.

(h) Remove repair fixture from blade.

(20) Refinish repair area.

(a) Remove peel-ply from blade patch and tape from blade.

CAUTION

Sanding skin fibers can weaken blade.

(b) Using No. 220 (C11.4) or finer grit abrasive paper, feather edge of adhesive squeeze-out around patch. An orbital sander and No. 220 grit abrasive paper may be used.

(c) Paint repair area in accordance with step q.

(d) Enter blade repair data and patch location in DA Form 2408-13 and -16.

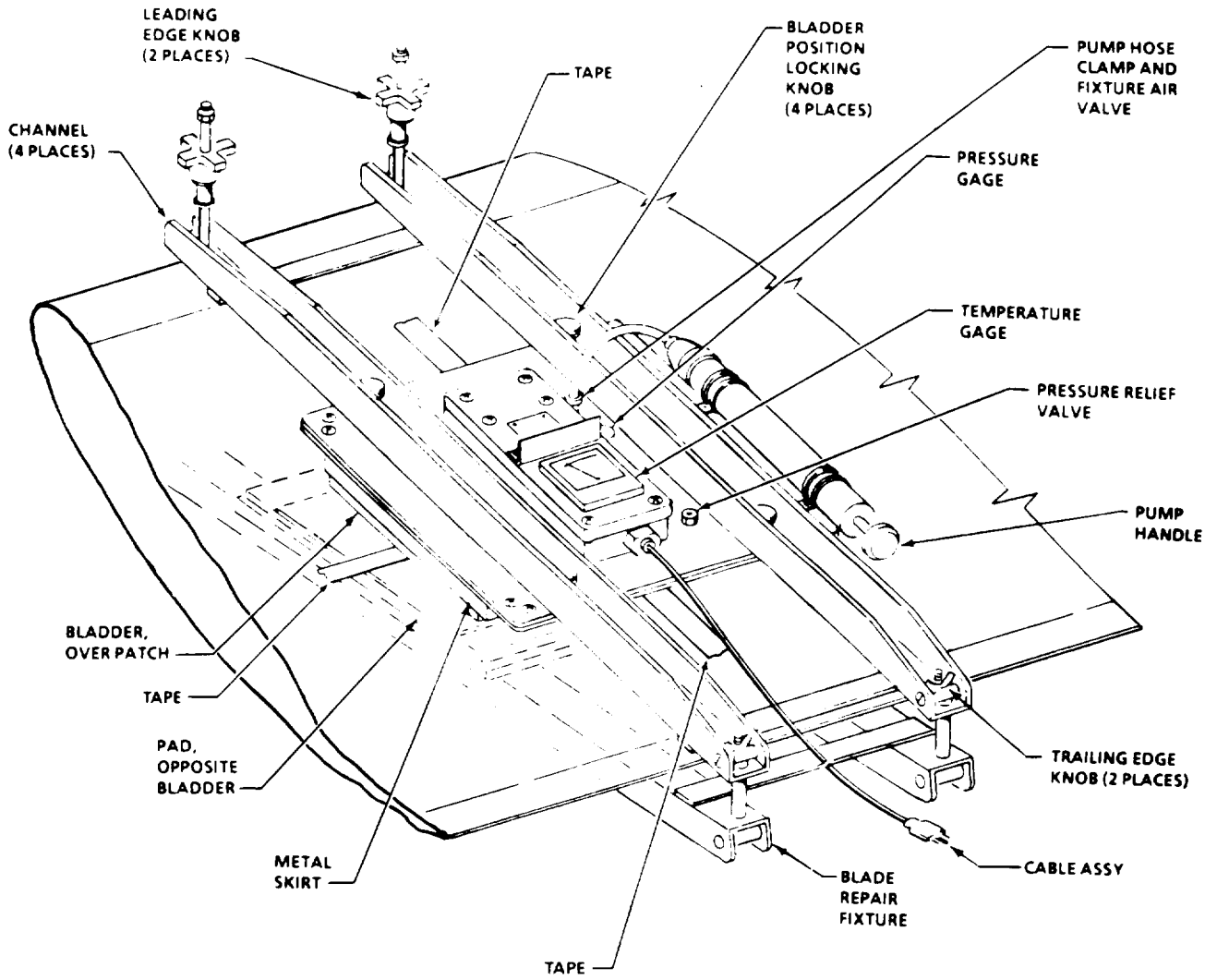
f. Installation of Plug Patch

NOTE

Consumables not identified with a (C) number in this procedure are included in the plug patch repair kit (C314).

(1) Ensure that blade will meet proximity limits of figure 5-26.6 after repair is completed.

(2) Position blade for access to damaged area. Support blade to prevent movement and droop.



NOTE

Forward slots in blade fixture channels may need to be extended to accommodate repairs to leading edge.

Figure 5-26.10. CB Curing Patch with Blade Repair Fixture (K747-401-1)

(3) Measure diameter and depth of damage.

(4) Select plug patch repair kit (C314) and adhesive (C-29). Select a patch no larger than necessary to repair damage.

(5) Damage deeper than can be repaired with a single patch or damage that passes completely through the blade and larger than **1.0** inch diameter, will be repaired by installing plug patches from both top and bottom sides of blade. Install plug patch of larger diameter and depth first as shown in figure 5-26.11.

CAUTION

Grease pencils shall not be used, only lead pencil lines shall be made as shown. Pencil marks other than those specified in the instructions can weaken the repair.

It is absolutely necessary to take every precaution not to damage spar and traiing edge during routing. The spar in leading edge and trailing edge can be located by the difference in sound when blade surface is tapped with a coin.

(6) Place kit template on blade; position inner circle to enclose damage. Hold template from slipping and draw pencil lines around inner and outer circles of template (view A, figure 5-26.12).

WARNING

Disconnect router cord from outlet before changing or installing bits or end mills or making adjustments.

Ensure router switch is in off position before connecting router to electrical power.

Keep hands and fingers away from routing bite and end mills.

Guide router with both hands on router grip.

Use personnel protection equipment, respirator, goggles, apron, etc.

CAUTION

During all routing operations, long dimension of router base shall be kept in spanwise direction. Move router in a clockwise direction.

NOTE

End mills will burn out if used to cut blade skin.

(7) Obtain router from blade repair fixture (T100). Insert rasp-type bit, P/N 4-BR, in router collet. Set router to **0.05 to 0.10** inch depth. Rout a complete circle through the skin, inside of, and following circle A (view B, figure 5-26.12).

(8) Using duckbill pliers, lift edge and peel-cut circle of skin off core (view B, figure 5-26.12). After removing skin, check depth of core at trailing edge of circle. Core thickness at trailing edge side less than depth of plug selected will require use of more shallow plug patch.

WARNING

if router is sat deeper than thickness of core on trailing edge, opposite skin will be damaged.

(9) Unplug router electrical cord and insert end mill in router collet. Set router depth of cut to match depth of plug plus thickness of kit wafer (view C, figure 5-26.12). Reconnect router electrical cord and rout out core by first routing a complete circle following inside circle A, then rout out remainder of core moving router in chordwise direction (view D, figure 5-26.12).

CAUTION

Excessive sanding will weaken blade skin. Sand only until yellow color is removed.

(10) Vacuum dust and debris from core cavity following removal of damaged core. Then proceed by starting with No. 120 grit and finishing with No. 220 grit abrasive paper (kit C314), sand paint and yellow primer from blade area between circles A and B. Sand only until yellow color is removed. Do not sand skin fibers.

(11) Wipe off all cuttings, sanding dust, etc., from repair area. Vacuum dust and debris from core cavity.

Table 5-5.1 CB Repair Kit Materials for Plug Patches

KIT PART NO.	PLUG' DIA.	PLUG DEPTH	* CURE TIME IN MINUTES USING BLADE REPAIR FIXTURE
K747-201-7	3 inches	0.250 inch	30
K747-201-9	3 inches	0.500 inch	30
K747-201-101	3 inches	1.250 inches	30
K747-201-103	3 inches	1.750 inches	.30
K747-201-105	7 inches	0.250 inches	30
K747-201-107	7 inches	0.500 inches	30
K747-201-109	7 inches	1.250 inches	30
K747-201-111	7 inches	1.750 inches	30

* Cure time starts when temperature gage reaches 160° ± 10° F

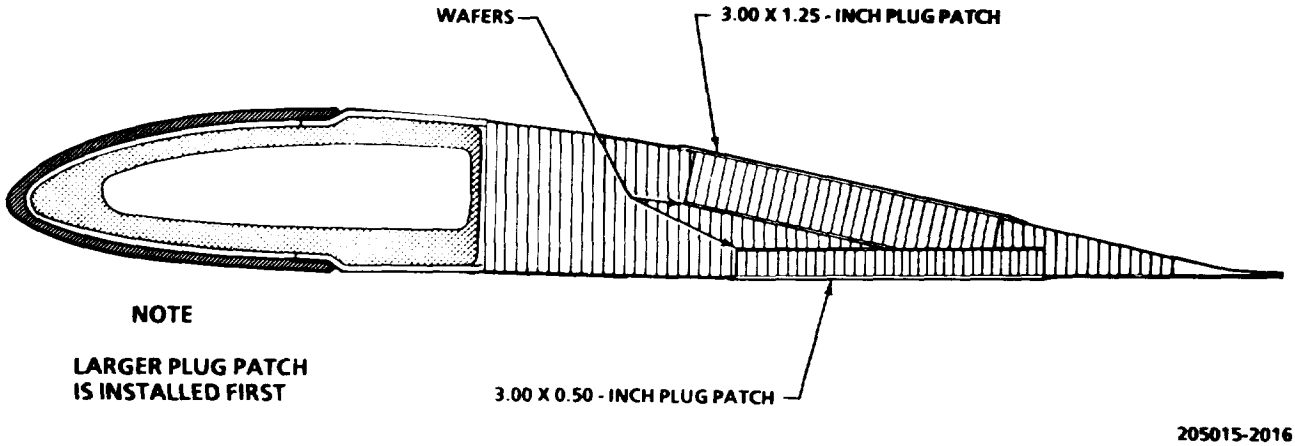
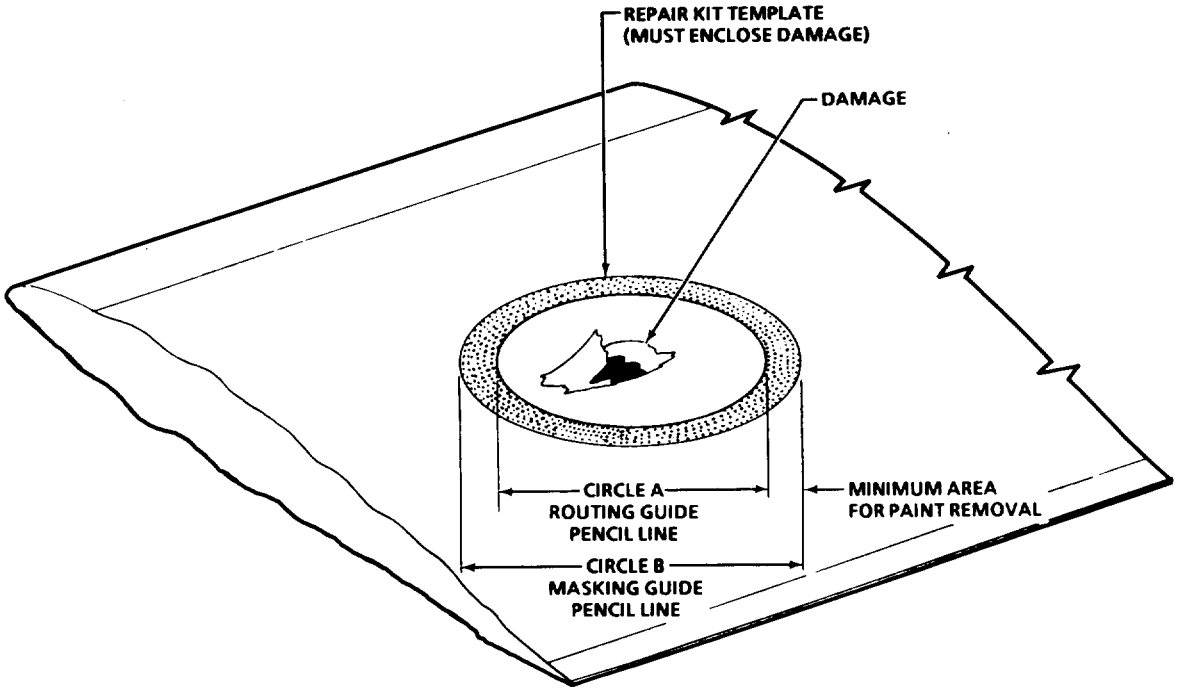


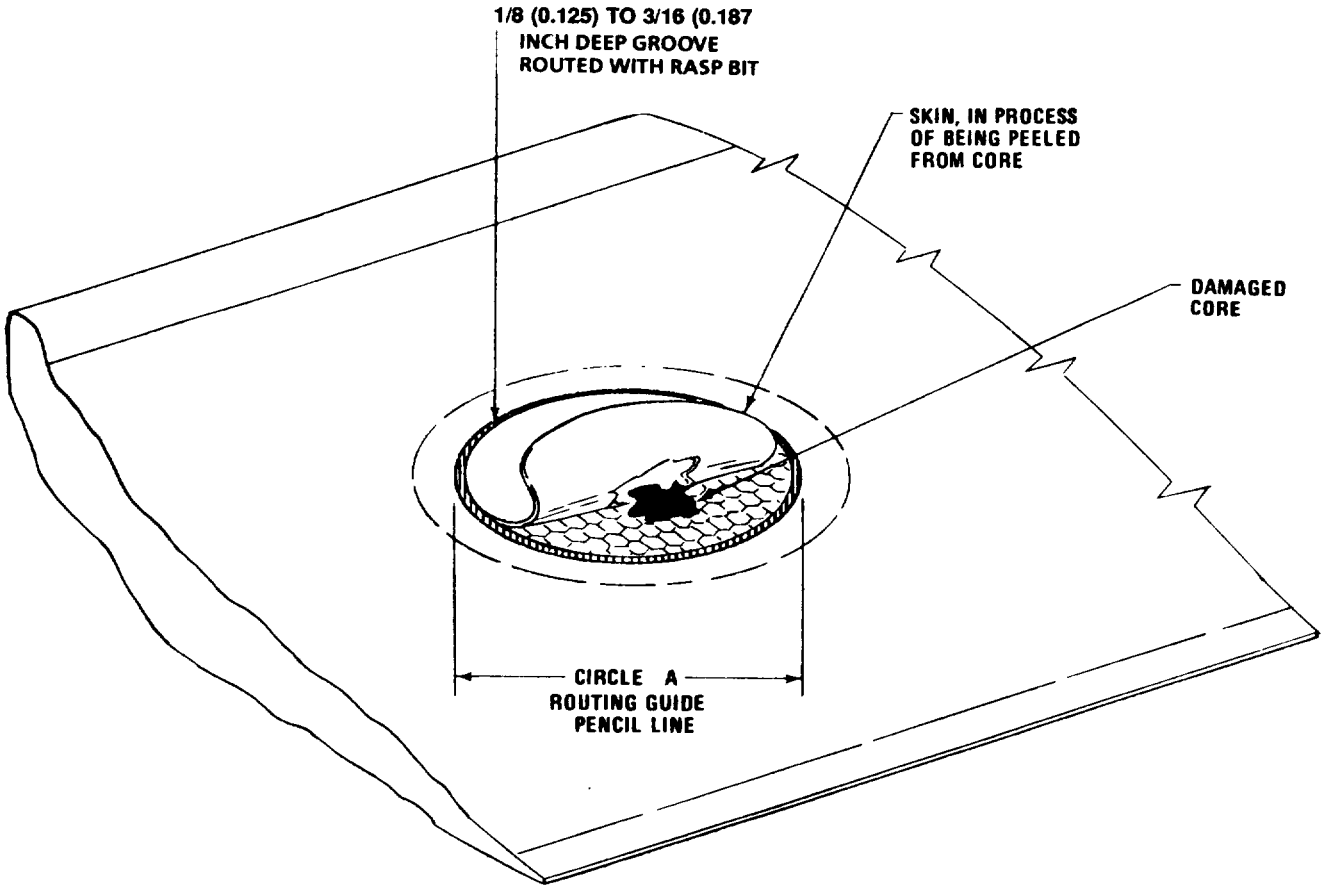
Figure 5-26.11. CB Typical Double Plug Patch Repair



VIEW A. MARKING WORK AREA

205015-2015-1

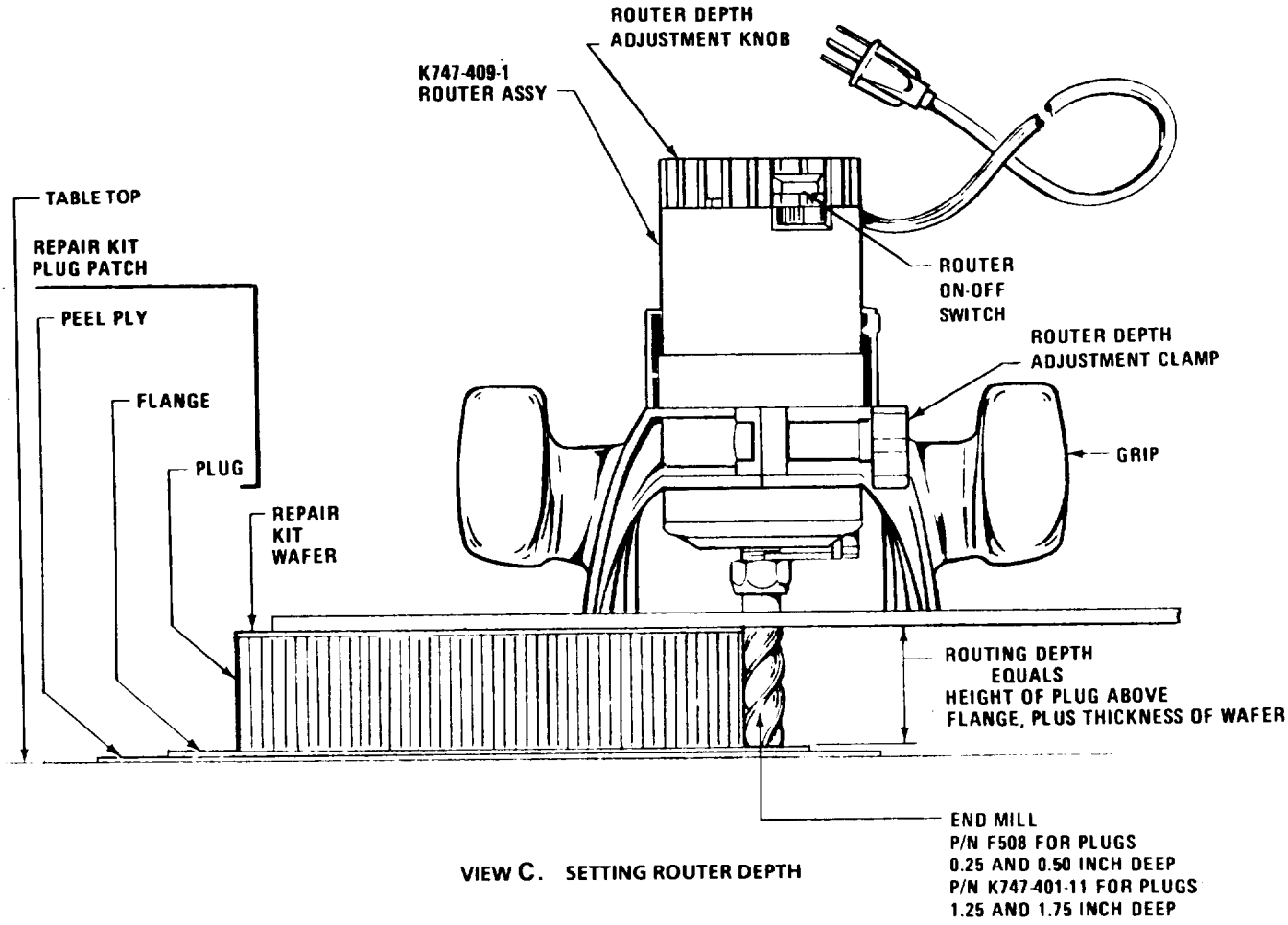
Figure 5-26.12. CB Installation of Plug Patch (Sheet 1 of 4)



VIEW B. REMOVAL OF DAMAGED SKIN

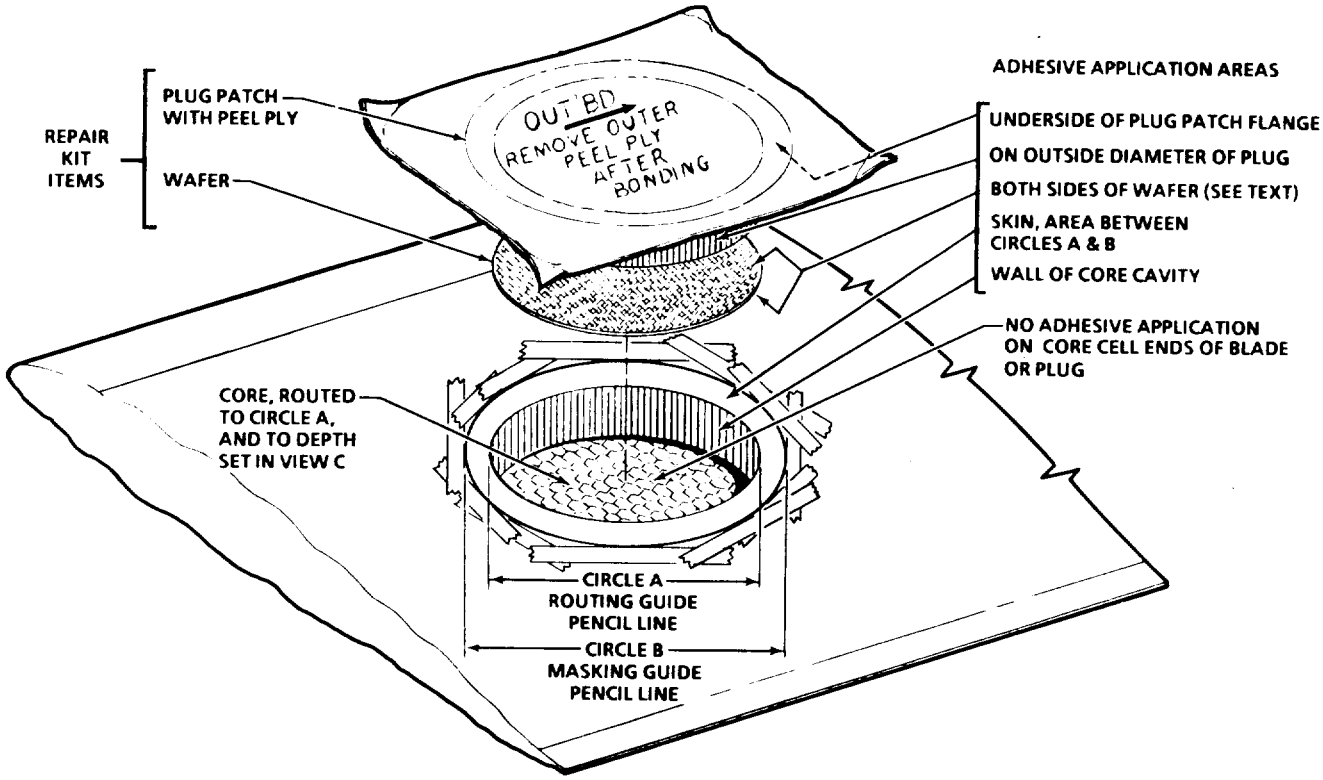
205015-2015-2

Figure 5-26.12. CB Installation of Plug Patch (Sheet 2 of 4)



VIEW C. SETTING ROUTER DEPTH

Figure 5-26.12. CB Installation of Plug Patch (Sheet 3 of 4)



VIEW D. INSERTION OF PLUG PATCH

205015-2015-4

Figure 5-26.12. CB Installation of Plug Patch (Sheet 4 of 4)

(12) Use template to redraw circle B (view A, figure 5-26.12).

(13) Cut short lengths of masking tape (kit) and mask around the outside of circle B (view D, figure 5-26.12).

(14) Put on cotton gloves and then plastic gloves (kit). Leave gloves on until completion of sealant application.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Care shall be taken to prevent isopropyl alcohol from entering core area of blade. Spillage shall be avoided.

Surfaces to be bonded must be clean, dry, and free of fingerprints and all foreign matter.

(15) Dampen clean cheesecloth (C61) with isopropyl alcohol (C42) and clean skin inside circle B. Clean both sides of kit wafer and underside of plug patch flange. Wipe with clean, dry, cheesecloth before dampness evaporates.

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect the skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning adhesive from skin.

(16) Mix adhesive (C29) per manufacturers instructions. Stir with wooden spatula until all streaks have disappeared and color is uniform. Repeat if more than one package is required.

NOTE

Pot life of adhesive is 15 minutes at 72°F (22°C). it is shorter at higher temperatures and when larger amounts are mixed. Repair procedure shall be completed without delay.

(17) Using new paint brush, trim bristles to 0.5-inch and apply a liberal coat of adhesive to one side of wafer (view D, figure 5-26.12).

CAUTION

Adhesive should not be packed into cells of blade core or plug patch. Excess adhesive can cause blade to be out of balance.

(18) If repair is on top of blade, place wafer in routed cavity with adhesive side down.

(19) If repair is on bottom of blade, place adhesive side of wafer against plug with open ends of plug core up.

(20) Using spatula or brush, apply a liberal coat of adhesive to walls of cavity in blade core.

(21) Using brush, apply a light coat of adhesive to:

(a) Blade skin inside circle B area around core cavity.

(b) Plug patch flange surrounding plug.

(c) Outside diameter of plug.

(d) Second side of wafer (wafer was previously coated and placed in step (18) or (19).

(22) Position plug patch in cavity with stenciled arrow pointing outboard (spanwise) and press firmly into place. Use light hand pressure to squeeze patch skin area overlapping blade skin to expel excess adhesive and air bubbles.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Care shall be taken to prevent isopropyl alcohol from entering core area of blade. Spillage shall be avoided.

(23) Using clean cheesecloth (C61) dampened with isopropyl alcohol (C42), temporarily lift edge of peel-ply and wipe off excess adhesive. Smooth and tape peel-ply to blade skin.

(24) Place two long pieces of masking tape at right angles, centered over the patch spanwise and chordwise and extending beyond the dimensions of the blade repair fixture bladder.

(25) Install blade repair fixture (T100) as follows:

(a) Install fixture from trailing edge side of blade only.

(b) Center bladder over repair area and secure.

(c) Center pad opposite bladder, and secure.

CAUTION

Tightening of locking knobs so that metal skirt around bladder is closer than 0.125 inch to blade can damage blade.

(d) Tighten fixture channel locking knobs until metal skirt around bladder is approximately 0.125 inch from blade skin.

(e) Actuate hand pump to obtain 4 TO 6 psi reading on pressure gage. Disconnect pump hose clamp from air valve.

NOTE

During curing it may be necessary to periodically reconnect hose, and to actuate pump to maintain 4 TO 6 psi.

(f) Connect 110-volt ac electric power for curing time shown in table 5-5.1.

(g) At end of curing time, disconnect electrical power, and relieve air pressure by lifting center portion of relief valve.

(h) Remove repair fixture from blade.

(26) Refinish repair area.

(a) Remove tape covering patch.

(b) Remove peel-ply from patch.

(c) Remove tape from blade.

CAUTION

Sanding skin fibers can weaken blade skin.

(d) Using No. 220 grit abrasive paper (C1 1.4), feather edge of adhesive squeeze-out around plug patch. An orbital sander and No. 220 grit abrasive paper may be used.

(e) Paint repaired area in accordance with step q.

(27) Make proper DA Form 2408-13 and -16 repair entries.

g. Application of trailing edge doubler patch.

NOTE

Consumables not identified with a (C) number are included in trailing edge repair kit.

(1) Ensure Made has met repair limits of figures 5-26.6 and 5-26.7.

(2) Position blade for access to damage area.

(3) Support blade to prevent movement and droop.

(4) Obtain trailing edge doubler patch repair kit, P/N K747-201-113, and adhesive (C29).

CAUTION

Grease pencils shall not be used; only lead pencil lines shall be made as shown. Pencil marks other than those specified in the instructions can weaken the repair.

(5) Place kit template on blade, centering spanwise over damage. Hold template from slipping and draw a pencil line around template on both top and bottom of blade (view A, figure 5-26.13).

CAUTION

Excessive sanding will weaken blade skin. Sand only until yellow color is removed.

(6) Starting with No. 120 grit and finishing with No, 220 grit abrasive paper (kit), sand paint and yellow primer from blade in area within guide lines on both sides of blade and along trailing edge (view B, figure 5-26.13). Sand only until yellow color is removed. Sand off any material that may be raised above the normal contour of the blade at edges of damage. Do not sand undamaged skin fibers. An orbital sander and No. 120 grit abrasive paper followed by No, 220 grit abrasive paper may be used as a substitute for hand sanding.

(7) Wipe off all cutting, sanding dust, etc., from repair area.

(8) Use template to redraw guidelines.

(9) Put on cotton gloves and then plastic gloves (kit). Leave gloves on until completion of adhesive application.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

Adhesive contains toxic ingredients. Provide adequate ventilation and protect the skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning the skin.

CAUTION

Surfaces to be bonded must be clean, dry, and free of fingerprints and all foreign matter.

(10) Cut short lengths of tape (kit 316) and mask around the outside of guide marks.

(11) Dampen clean cheesecloth (C61) with isopropyl alcohol (C42) and clean skin inside masked area. Wipe with clean, dry, cheesecloth before dampness evaporates.

(12) Mix adhesive (C29) per manufacturers instructions. Stir with wooden spatula until all streaks have disappeared and color is uniform.

NOTE

Pot life of adhesive is 15 minutes at 72°F (22°C). Time is shorter at higher temperatures. Repair procedures shall be completed without delay.

(13) Using new paint brush, trim bristles to 0.5-inch and apply a light coat of adhesive to inside surfaces of doubler patch (view B, figure 5-26.13) and blade trailing edge.

(14) Center double patch within guide lines and press into place. Slide patch back and forth slightly under hand pressure to smooth out adhesive. Push patch firmly against trailing edge and center within guide lines. Use light hand pressure to squeeze the patch from the center to edge to work out any air bubbles,

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(15) Using clean cheesecloth (C61) dampened with isopropyl alcohol (C42), temporarily lift edges of peel-ply and wipe off excess adhesive.

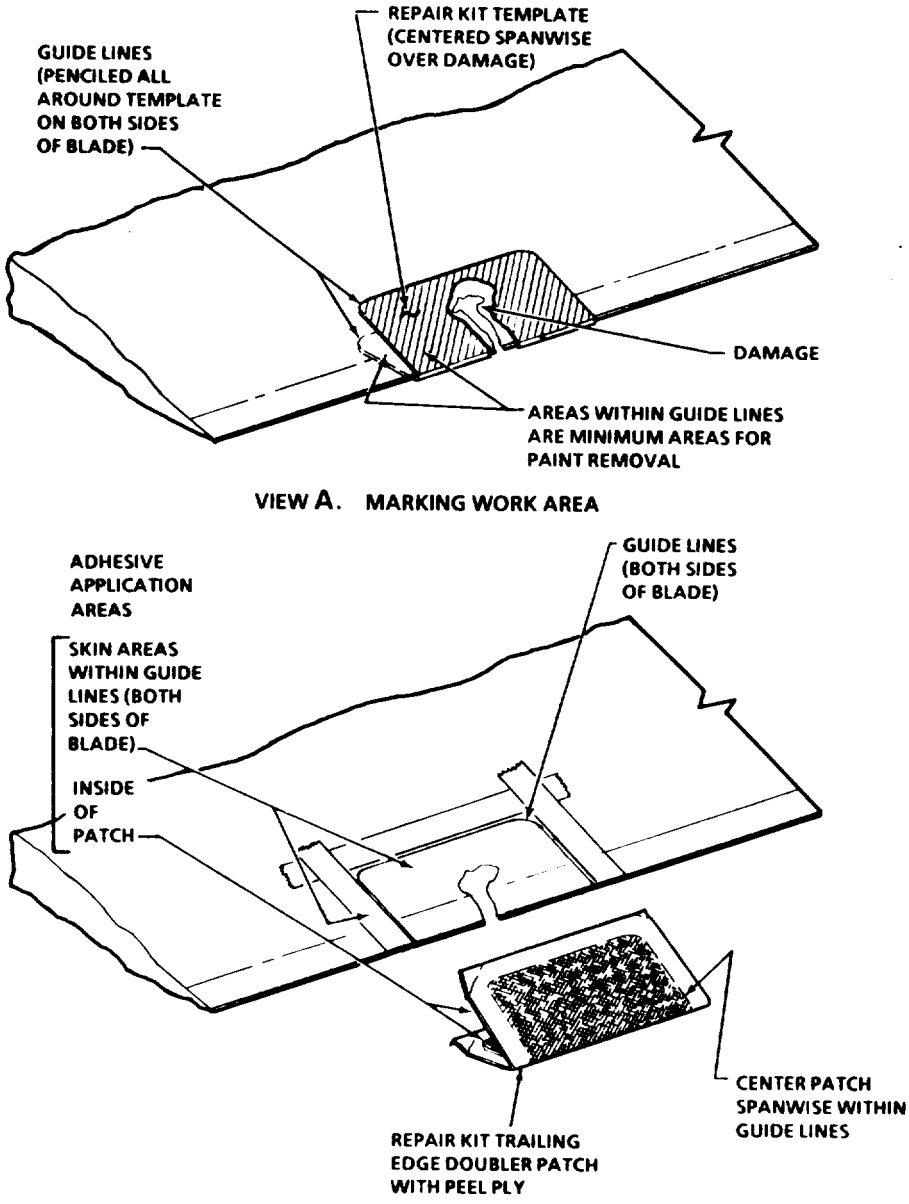


Figure 5-26.13. CB Application of Trailing Edge Doubler Patch

(16) Place high temperature tape (C273.1) over edges of patch to prevent movement of patch. Pull patch forward and tape tightly to blade skin.

(17) Install blade repair fixture (T100) from trailing edge side of blade with bladder over repair. Center pad opposite bladder and secure.

CAUTION

Tightening of locking knobs so that metal skirt around bladder is closer that 0.125 inch to blade can damage blade.

(18) Tighten fixture channel locking knobs until metal skirt around bladder is approximately 0.125 inch from blade skin.

(19) Actuate hand pump to obtain 4 TO 6 psi reading on pressure gage. Disconnect pump hose from air valve.

NOTE

During 30 minutes curing time, it may be necessary to periodically reconnect hose and to actuate pump to maintain 4 TO 6 psi. Cure time starts when temperature gage reads 160°F ± 10°F.

(20) Connect 110-volt ac electrical power for 30 minutes.

(21) At end of 30 minutes cure, disconnect electrical power and relieve air pressure by lifting center portion of relief valve.

(22) Remove repair fixture from blade.

(23) Refinish repair area as follows:

(a) Remove tape covering patch.

(b) Remove peel-ply from patch.

(c) Remove tape from blade.

CAUTION

Sanding fibers can weaken blade skin.

(d) Using No. 220 grit abrasive paper, feather edge of adhesive squeeze-out around patch. An orbital sander and No. 220 grit abrasive paper may be used.

(e) Paint repaired area in accordance with step q.

(24) Make proper DA Form 2408-13 and -16 entry for repair.

h. Replacement of trim tab.

(1) Ensure blade has met. requirements of paragraph 5-34.5.

NOTE

Trim tab replacement will be required if trim tab is cracked, debonded, bent, or dented to an extent that it cannot be straightened, or if void limits of figure 5-26.3 are not met.

(2) Position blade for access to damaged trim tab. Support blade to prevent movement and droop.

(3) Obtain replacement trim tab and adhesive kit (C29).

CAUTION

Grease pencil shall not be used; only lead pencil lines shall be made as shown. Pencil marks other than those specified in the instructions can weaken the repair.

Extreme care must be taken to prevent damage to underlying skin to which trim tab is bonded.

(3.1) Mark location of trim tab prior to removal.

(4) Trim off the old tab approximately 0.125 inch aft of the blade trailing edge.

NOTE

Use a standard wood chisel (bevel side down), or equivalent, to carefully pry up corner tab. Once a corner is raised, grip trim tab with pliers and peel back while continuing to pry with chisel.

(5) On the upper surface, start at the outboard, forward corner of the tab and work loose in the aft and inboard direction.

(6) On the lower surface, start at the outboard, forward corner and work loose in the aft and inboard direction.

(7) After removal of trim tab, inspect underlying area of blade for damage.

(8) Lightly sand blade faying surface using No. 220 grit abrasive paper (C11.4).

(9) Wipe off all sanding dust using cheesecloth (C61).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(1 O) Dampen clean cheesecloth (C61) with isopropyl alcohol (C42) and clean skin in sanded areas. Wipe with clean, dry cheesecloth before dampness evaporates,

CAUTION

Dislocation of trim tab will disturb blade balance.

(11) Prepare new trim tab:

(a) Remove peel-ply from inner surface of trim tab.

CAUTION

Ensure all peel-ply is removed from new trim tab.

(b) Trim excess adhesive (purple) from all edges of new trim tab.

(c) Lightly sand new trim tab faying surface with 120 grit abrasive paper (C11.2).

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning adhesive from skin.

(12) Mix adhesive (C29) per manufacturers instructions. Stir with wooden spatula until all streaks have disappeared and color is uniform.

NOTE

Pot life of adhesive is 15 minutes at 72°F (22°C). Time Is shorter at higher temperatures. Repair procedures shall be completed without delay.

(13) Using new one-inch paint brush, trim bristles to 0.5-inch and apply a light coat of adhesive to top and bottom blade skin and to inside of new trim tab.

(14) Install trim tab in original position and press forward firmly into place. Slide trim tab back and forth slightly under hand pressure to smooth out adhesive. Use light hand pressure to squeeze trim tab from center to edges to work out any air bubbles. See figure 5-26.14.

WARNING

Cleaning solvent Is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

CAUTION

Care shall be taken to prevent isopropyl alcohol from entering core area of blade. Spillage shall be avoided.

(15) Using clean cheesecloth (C61) dampened with isopropyl alcohol (C42), wipe off excessive adhesive around trim tab.

(16) Check that trim tab is located at blade station 250.15. Wrap tape (C273.1) over edges of trim tab to prevent movement of tab. Apply additional tape chordwise so that trim tab cannot move aft,

CAUTION

Other materials shall not be substituted for peel-ply. Substitutes can cause repair fixture to be bonded to blade.

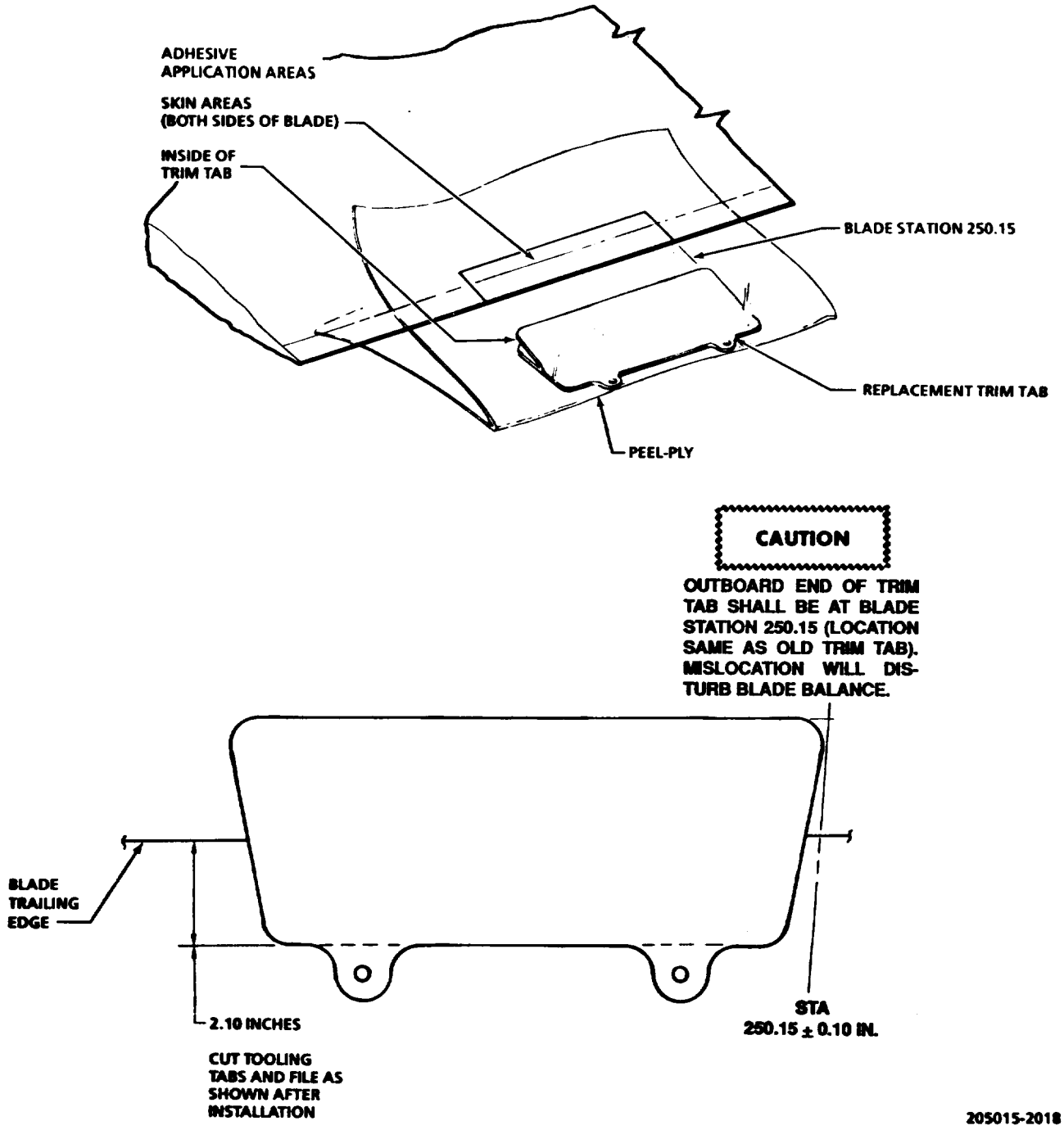


Figure 5-26.14. CB Replacement of Trim Tab

(17) Place peel-ply (C197.1) on blade to completely cover both top and bottom of work area. Place tape over edges of peel-ply to prevent movement,

(18) During the bonding process the repair fixture will maintain a constant pressure and a controlled temperature to bonding area. Install blade repair fixture (T100) from the trailing edge of blade only.

(19) Position bladder over trim tab with aft edge of bladder aligned with joggle in trim tab and tighten bladder position locking knobs.

(20) Center pad opposite bladder.

CAUTION

Tightening of locking knobs so that metal skirt around bladder is closer than 0.125 inch to blade can damage blade.

(21) Tighten leading and trailing edge knobs until metal skirt around bladder is approximately 0.125 inches from blade skin.

(22) Actuate hand pump to obtain 4 TO 6 psi reading on pressure gauge. Disconnect pump hose from air valve.

NOTE

During the following l-hour curing time, it may be necessary to periodically reconnect hose and to actuate pump to maintain 4 TO 6 psi. Cure time starts when temperature gage reaches 160° ± 10°F.

(23) Connect 110-volt ac electrical power.

(24) At end of 1 hour cure time, disconnect electrical power and relieve air pressure by lifting center portion of relief valve.

(25) Remove repair fixture from blade.

(26) Refinish repair area as follows:

(a) Remove peel-ply and tape from blade.

CAUTION

Sanding fibers can weaken blade skin.

(b) Using No. 220 grit abrasive paper (Cl 1.4) feather edge of adhesive squeeze-out around trim tab. An orbital sander and No. 220 grit abrasive paper may be used.

(c) Trim replacement trim tab as shown in figure 5-26.14.

(d) Paint repaired area in accordance with step q.

(27) Make proper DA Form 2408-13 and -16 entry for repair.

i. Abrasion Strip. Inboard/middle/outboard leading edge abrasion strip replacement.

(1) Position blade for access to the leading edge abrasion strip. Support the blade to prevent movement and droop.

(2) Peel off old abrasion strip. Use care to avoid damage to spar surface.

NOTE

The leading edge spar contains a coating of cured AF163-2K adhesive (purple color). It Is not necessary to remove this adhesive during the sanding process; however, removal does not affect the bonding of new abrasion strip.

(3) Use No. 180 to No. 240 grit abrasive paper (C11.3 and C11.5) to remove the abrasion strip adhesive. Avoid removing any of the spar material. Spar material will appear as white dust. An orbital sander and No. 120 grit abrasive paper (C11.2) followed by No. 220 grit abrasive paper (C11.4) may be used as a substitute for hand sanding.

(4) Ensure that old adhesive in gap between abrasion strip and skin is removed.

(5) Obtain replacement abrasion strip splice covers and adhesive kits (C29.2).

(6) Position abrasion strip on spar to check fit.

CAUTION

Make sure that the abrasion strip leading edge Is located on the leading edge of the blade.

NOTES

Trim ends of abrasion strip to butt joint with end of adjoining abrasion strip.

Trim outboard end of outboard abrasion strip to be flush with blade tip.

Trim aft edges of the abrasion strip (up and lower surfaces) to provide approximately 1/8-inch gap between abrasion strip and skin.

(7) Trim the abrasion strip to fit as follows and as shown in figure 5-26.15.

(a) Apply a strip of No. 280 pressure sensitive tape (1) (C273.1) along the blade radius to provide a 1/8-inch gap at location (2) between the tape edge and the blade skin.

(b) Install abrasion strip (3) and tape securely in place using No. 280 pressure tape (4) at six-inch spacing.

(c) Apply another strip of No. 280 pressure sensitive tape (5) over the abrasion strip (3) make edge of tape (5) flush with edge of tape (1).

(d) Mark abrasion strip along edge of tape at location (6).

(e) Remove abrasion strip, then using scissors cut abrasion strip where marked.

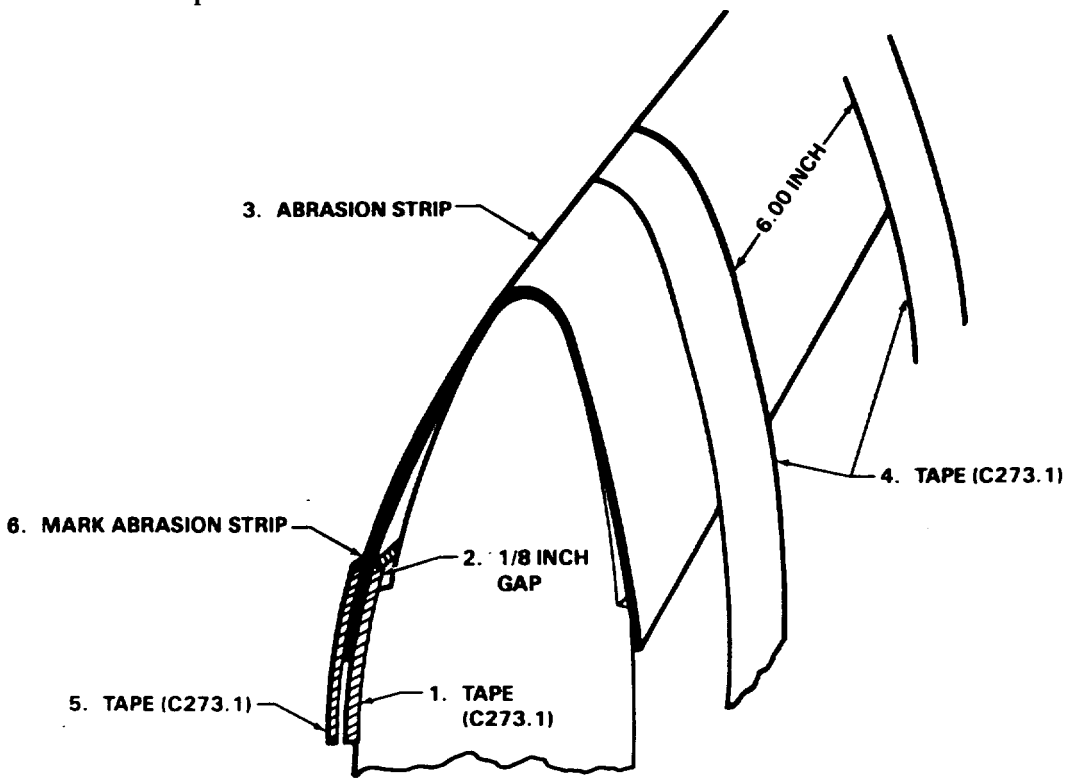


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Figure 5-26.15. CB Prefit and Trim of Abrasion Strip

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of vapors.

(f) Remove tape from blade.

(8) Clean the spar leading edge.

(a) Sand the spar leading edge to provide a smooth, even surface using No. 220 grit abrasive paper (C11.4).

NOTE

Any imperfections on the blade surface will show up following installation of the abrasion strip.

(b) Put on cotton gloves (C120.1) followed by plastic gloves (C120.2).

(c) Using cheesecloth (C61), wet with isopropyl alcohol (C42), wipe blade surfaces thoroughly. Repeat until contamination is removed and cheesecloth is clean. On final wipe, use dry cheesecloth (C61) before the isopropyl alcohol (C42) is allowed to evaporate,

CAUTION

if the repair is temporarily baited following step (d) above for more than two hours or if the conditions allow surfaces to become contaminated, step (d) should be repeated just prior to continuing repair operations.

(9) Apply high temperature tape (C273.1) around the perimeter of the abrasion strip, flush with the trailing edge. Apply another strip of high temperature tape (C273.1) on the blade upper and lower skins, flush with the leading edge of skin, for the full length of the abrasion strip.

(10) Cut peel-ply (C197.1) and bleeder fabric (C48.1) to extend two to three inches on to the upper and lower surfaces of the blade skins (Two to three inches larger than the abrasion strip - all sides).

(11) Cut the vacuum bag film (C114.1) to extend five to six inches beyond the peel-ply (C197.1), and bleeder fabric (C48.1) on all sides.

CAUTION

Do not remove the paper backing from the bag sealing compound at this time.

(12) Apply bag sealing compound (C245.1) on the blade around the perimeter of the abrasion strip outside the peel-ply and bleeder fabric.

WARNING

Adhesive contains toxic Ingredients. Provide adequate ventilation and protect the skin and eyes from contact with uncured resin or curing agent. Wash off uncured resin and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning the skin. Protective equipment must be used when performing these repairs.

(13) Put on cotton gloves (C120.1) followed by plastic gloves (C120.2).

(14) Prepare the splice cover(s) and abrasion strip mating surfaces as follows:

WARNING

Cleansing materials are flammable and toxic. Avoid skin contact and breathing of vapors.

(a) Wash mating surfaces of abrasion strip and splice cover with cleaning compound (C67.1).

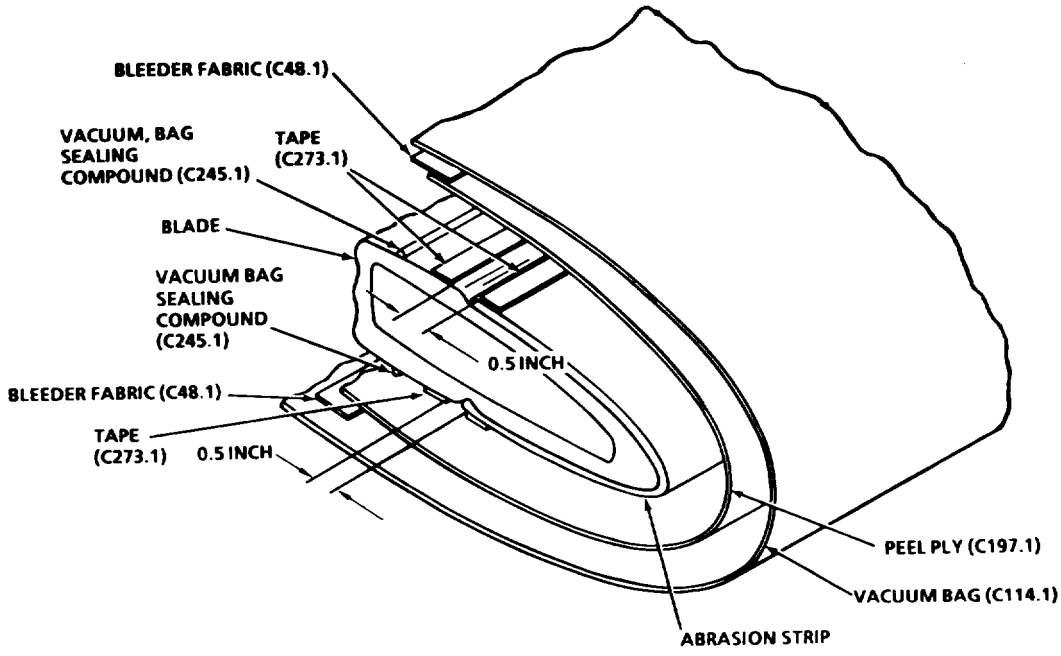


Figure 5-26.16. CB Abrasion Strip Bonding Layup

(b Sand surfaces with 60 grit abrasive paper (C11.1).

(c) Wash mating surfaces again using cleaning compound (C67.1).

(d) Allow surfaces to dry.

CAUTION

Do not remove fiberglass ply from inner surface of abrasion strip.

(e) Peel the peel-ply from inner surface of abrasion strip.

(f) Set the splice covers and abrasion strip aside in a clean location until ready for use.

(15) Mix adhesive (C29.2) per manufacturers instructions. Stir with wooden spatula until all streaks have disappeared and color is uniform.

CAUTION

It Is of upmost Importance that a thin, even coat of adhesive be applied to mating surfaces; otherwise, the abrasion strip surface will not be smooth and uniform.

Pot life of adhesive is 15 minutes at 72°F (22°C). Time is shorter at high temperature. Repair procedures shall be completed without delay.

(16) Apply a thin, even coat of adhesive to mating surfaces of blade spar and inner surface of the abrasion strip.

(17) Using a plastic spreader (C203.1), remove excess adhesive by raking to obtain a thin uniform coating on spar and abrasion strip.

(18) Install abrasion strip on blade leading edge. Force strip aft, as far as possible, to ensure that an adhesive void (air space) does not exist on the apex of the blade. Tape abrasion strip to the blade at approximately 6. 0-inch spacing using No. 280 high temperature tape (C273.1). Begin at inboard end of abrasion strip and tape top and bottom working toward outboard end. Pull tape aft, top and bottom, and tape to blade skin,

CAUTION

Do not allow abrasion strip to slip forward or twist.

(19) Install splice cover(s) on the abrasion strip.

(a) Lightly coat the mating surfaces of the abrasion strip and splice cover(s) with adhesive (C29.2).

(b) Using a plastic spreader (C203.1), remove excess adhesive by raking to obtain a thin uniform coating on the abrasion strip and splice cover(s).

(c) Install splice cover(s) on the abrasion strip and tape firmly in place using No. 280 high temperature tape (C273.1).

(20) Tape peel-ply (C197.1) and bleeder fabric (C48.1) (cut in Step 10) over the abrasion strip (install peel-ply first).

(21) Install vacuum bag (C114.1) and vacuum fitting (T105).

(a) Remove paper backing from bag sealing compound (C245.1) on the blade lower edge.

(b) Install edge of vacuum bag film (C114.1) on bag sealing compound (C245.1) by pressing film to compound.

(c) Fold film upward over blade and abrasion strip.

(d) Cut hole in film and install vacuum fitting (T105).

(e) Place a piece of folded cheesecloth (C61) between vacuum fitting and bleeder cloth to prevent vacuum from pulling the vacuum fitting against repair and forming a seal.

(f) Remove remainder of paper backing from bag sealing compound.

(9) Install and seal vacuum bag film (C114.1) on top and ends of blade.

(22) Connect vacuum pump (T103) and apply vacuum slowly, Smooth vacuum bag over abrasion strip, top and bottom, for full length of strip as a minimum of 25 inches of vacuum is applied.

CAUTION

If a minimum of 25 inches of vacuum is not obtained, a leak exists. Repair leaks, as required, using bag sealing compound (C245.1).

(23) Use plastic spreader (C203.1) to remove air bubbles from beneath abrasion strip. Start at leading edge of strip and rub air bubbles toward the trailing edge. Accomplish for entire length of abrasion strip, top and bottom. Inspect blade to ensure that no air bubbles exist. Repeat as necessary until all air bubbles have been removed.

(24) Install heater blankets (T101) and tape into place using No. 280 high temperature tape (C273.1).

(25) Connect electrical power and allow to cure for 1 hour at 150° TO 170°F (66° TO 77°C). Cure time begins when temperature reaches 150°F.

(26) Turn off vacuum pump and disconnect electrical power and vacuum hose.

(27) Remove vacuum bag, bleeder cloth, peel-ply, bag sealing compound, and tape.

(28) Inspect abrasion strip for proper bonding.

NOTE

If a void exists, refer to figure 5-26.2.

(29) Remove excess adhesive by sanding using No. 120 grit abrasive paper (C11.2).

NOTE

The adhesive squeezed out during bonding will normally fill the gap along the trailing edge (upper and lower surfaces) of the abrasion strip (see substep (7)).

(30) When a gap exists or is not to blade contour, fill and fair as follows:

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect the skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning

(a) Obtain adhesive (C39.1). Mix per manufacturers instructions, using a wooden spatula, until all streaks have disappeared and color is uniform.

(b) Apply strips of No. 280 high temperature tape (C273.1) on each side of gap to protect the abrasion strip and blade skin.

(c) Using a wooden spatula, or equivalent, fill and fair gap to height of tape.

(d) Allow adhesive to air dry at room temperature until hard (sandable).

(e) Sand to blade contour using No. 240 grit abrasive paper (C11.5).

(f) Touch up paint, if required, per step q.

j. Inboard/middle/outboard leading edge abrasion strip restoration (paint on method).

NOTE

This repair procedure (paint-on method) is used for replacing small areas of erosion material which have been removed by erosion, tears, etc. The durability of the material does not equal that of the original material and should, therefore, be used for areas less susceptible to damage and to prevent having to replace the entire abrasion strip section.

(1) Obtain adhesive repair material kit (C29.3).

(2) Position blade for access damaged leading edge abrasion strip areas. Support blade to prevent movement and droop.

(3) Using No. 240 grit abrasive paper (C11.5), sand the old adhesive from spar. Remove areas that are unbended. Sand edges of abrasion strip in eroded area.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(4) Clean sanded and adjacent are a thoroughly with cheesecloth (C61) saturated with isopropyl alcohol (C42). On final wipe, use dry cheesecloth before the isopropyl alcohol is allowed to evaporate.

(5) Put on rubber or plastic gloves (C120.2).

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning skin. Protective equipment must be used when performing these repairs.

NOTE

Pot life of the TSK-L-100 (C29.3) adhesive kit repair material is 10 to 15 minutes at 72°F (22°C). Time is shorter at higher temperatures. Repair procedures shall be completed without delay.

(6) Mix the two parts of adhesive thoroughly,

(7) Apply a strip of No. 280 high temperature tape (C273.1) along lower surface of abrasion strip (below damage) to contain adhesive during application.

(8) Using a new paint brush, test adhesive to determine when adhesive is viscous enough to adhere to abrasion strip without dropping off.

NOTE

Adhesive will become warm in mixing container shortly after mixing. At this time, the viscosity of the material is beginning to increase.

(9) Using a paint brush or spatula, apply a light coat of material to sanded area. Continue adding coats until area is built up beyond contour of abrasion strip. Remove any air bubbles.

(10) Apply and overlap layers of No. 280 high temperature tape (C273.1) on adhesive and maintain slightly beyond contour of surrounding abrasion strip contour. Do not pull tape below contour of abrasion strip.

(11) Using a knife or razor blade, slit tape in several places to allow air to speed cure.

(12) Use a heat gun, heat lamp, or heat blanket to apply heat to 120° TO 140°F (49° TO 60°C) to taped area until adhesive cures. Do not overheat.

(13) Allow to cure at 120° TO 140°F (49° TO 60°C) temperature for a minimum of 1 hour.

NOTE

If heat Is not used In sub-step (12), allow adhesive to cure at ambient temperature for 2 hours.

NOTE

The adhesive material will develop optimum durability In approximately six to eight hours.

(14) Remove tape from repaired area.

(15) Using No. 240 grit abrasive paper (C11.5), sand material to conform to blade contour.

(16) Inspect repair.

k. Void repair for abrasion strip, injection method.

(1) Ensure void is within repair limits (figure 5-26.2).

(2) Position blade for access to void and support blade to prevent movement and droop.

(3) Assess damage.

CAUTION

Grease pencils shall not be used; only lead pencil lines shall be made as shown. Pencil marks other than those specified In the instructions can weaken the repair.

(4) Outline void.

CAUTION

Do not drill Into spar.

(5) Drill a 0.060 inch diameter hole through abrasion strip (not blade spar) at each end of void,

WARNING

Cleaning solvent Is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(6) Wipe repair area with cheesecloth (C61) lightly dampened with isopropyl alcohol (C42).

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning skin.

(7) Obtain adhesive kit (C29.2).

(8) Mix adhesive (C29.2) per manufacturers instructions. Stir with a wooden spatula until all streaks have disappeared and color is uniform.

NOTE

Pot life of TSK-L-100 adhesive kit repair materials Is 10 to 15 minutes at 72°F (22°C). Time is shorter at a higher temperatures. Repair procedures shall be completed without delay.

(9) Place mixed adhesive in a syringe (C269).

(10) Inject adhesive into each hole (previously drilled) until adhesive flows from other hole.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

NOTE

In some cases, it may be necessary to install a vacuum bag; apply vacuum pressure to pull the adhesive through the void from the hole being Injected.

(11) Using cheesecloth (C61) lightly dampened with isopropyl alcohol (C42), wipe off excess adhesive.

(12) Heat repair area (void) to 150° TO 170°F (66° TO 77°C) for 30 minutes using a heat gun, heat lamp, heat blanket or allow to cure at ambient temperature for 24 hours.

(13) Sand adhesive to abrasion strip contour using No. 220 grit abrasive paper (C11.4).

(14) Inspect repair.

l. Void repair, injection method,

NOTE

The injection method for void repair is applicable to the following void locations.

Skin to leading edge spar void
Skin to erosion shield void
Skin to trailing edge spar void
Skin to trim tab void
Skin to root end closure void
Skin to tip block void

(1) Position blade for access to void. Support blade to prevent movement and droop.

(2) Assess damage.

CAUTION

Grease pencils shall not be used; only lead pencil lines shall be made as shown. Pencil marks other than those specified In the instructions can weaken the repair.

(3) Outline void.

WARNING

Cleaning solvent Is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(4) Wipe repair area with cheesecloth (C61) dampened with isopropyl alcohol (C42).

(5) If the void is enclosed (not on edge or part), drill a 0.060 inch diameter hole in void at each end of void.

NOTE

If the void is located on the edge of the part, drill 0.060 inch holes in edge of void as far from edge of part as possible.

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning skin.

(6) Obtain adhesive kit (C29.2).

(7) Mix adhesive (C29.2) per manufacturers instructions. Stir with a wooden spatula until all streaks have disappeared and color is uniform.

NOTE

Pot life of adhesive is 15 minutes at 72°F (22°C). Time is shorter at higher temperatures. Repair procedures shall be completed without delay.

(8) Place adhesive in a syringe (C269).

(9) inject adhesive into each hole (drilled in preceding step (5)) until adhesive flows from the other hole.

WARNING

Cleaning solvent Is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(10) Using cheesecloth (C61) dampened with isopropyl alcohol (C42), wipe off excess adhesive.

(11) Heat repair area to 150° TO 170°F (66° TO 77°C) for 30 minutes using a heat gun, heat lamp, heat blanket or allow to cure at ambient temperature for 24 hours.

(12) Sand cured adhesive using No. 220 grit abrasive paper (C11.4) to contour.

(13) Inspect repair.

(14) Touch up paint (step q).

m. Erosion shield replacement.

(1) Position blade for access to erosion shield. Support blade to prevent movement and droop.

(2) Assess damage.

NOTE

The leading edge of erosion shield Is beneath trailing edge of the abrasion strip for approximately 0.50 Inch from span station 257.00 to 288.00.

(3) Remove erosion shield as follows:

(a) Peel the abrasion strip forward approximately 1.00 inch from Span Station 254.00 (34.00 inches inboard from tip) to outboard blade tip. Use high temperature tape (C273.1) to secure abrasion strip clear of erosion shield.

(b) Peel up inboard end of erosion shield (Span Station 256.00) (32.00 inches inboard from blade tip).

(c) Insert tool (local manufactured per figure 5-26.16) in peeled up end of defective erosion shield starting at inboard end, roll defective shield up and off blade by turning tool.

NOTE

Small sections of the blade outer skin may be removed when the erosion shield is peeled off.

(4) Sand old adhesive from erosion shield blade surface using No. 220 grit abrasive paper (C11.4) to prepare surface. Remove loose strips of damaged blade skin. Make sure adhesive is removed along leading edge where erosion shield step is located.

(5) Remove peel-ply from the erosion shield. Ensure all peel-ply is removed.

(6) Apply a strip of No. 280 high temperature tape (C273.1) around erosion shield repair area; except beneath the abrasion strip.

CAUTION

Surfaces to be bonded must be clean, dry, and free of fingerprints and all foreign material.

(7) Put on cotton gloves (C120.1) and then plastic gloves (C120.2) . Leave gloves on until completion of cleaning and bonding procedures.

WARNING

Cleaning solvent Is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(8) Dampen cheesecloth (C61) with isopropyl alcohol (C42) and clean inside masked area. Wipe with clean, dry, cheesecloth (C61) before alcohol evaporates.

(9) Obtain adhesive (C29).

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning skin.

(10) Mix adhesive (C29) per manufacturers instructions. Stir with wooden spatula until all streaks have disappeared and color is uniform. Repeat for the other kit.

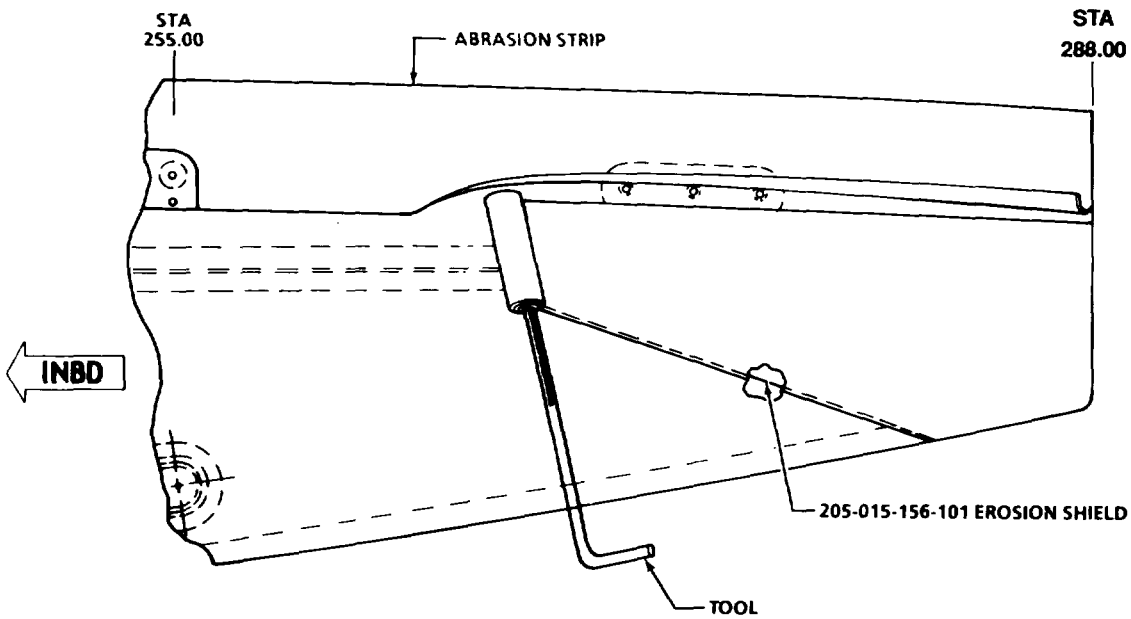
NOTE

Pot life of adhesive Is 15 minutes at 72°F (22°C). Time is shorter at higher temperatures. Repair procedures shall be completed without delay.

(11) Using new 1 inch paint brush (C194.1), trim bristles to 0.5-inch and apply a light coat of adhesive to blade and erosion shield mating surfaces. Use plastic spreader (C203.1) to remove excess adhesive. Avery thin layer is desired.

(12) Position erosion shield in place and tape all edges, except leading edge using No. 280 high temperature tape (C273.1). Using a plastic spreader, smooth excess adhesive from beneath erosion shield by working from center toward edges. Loosen tape and remove excess adhesive by wiping with cheesecloth.

(13) Retape edges of erosion shield



TOOL SHOWN IS NOT TO SCALE.

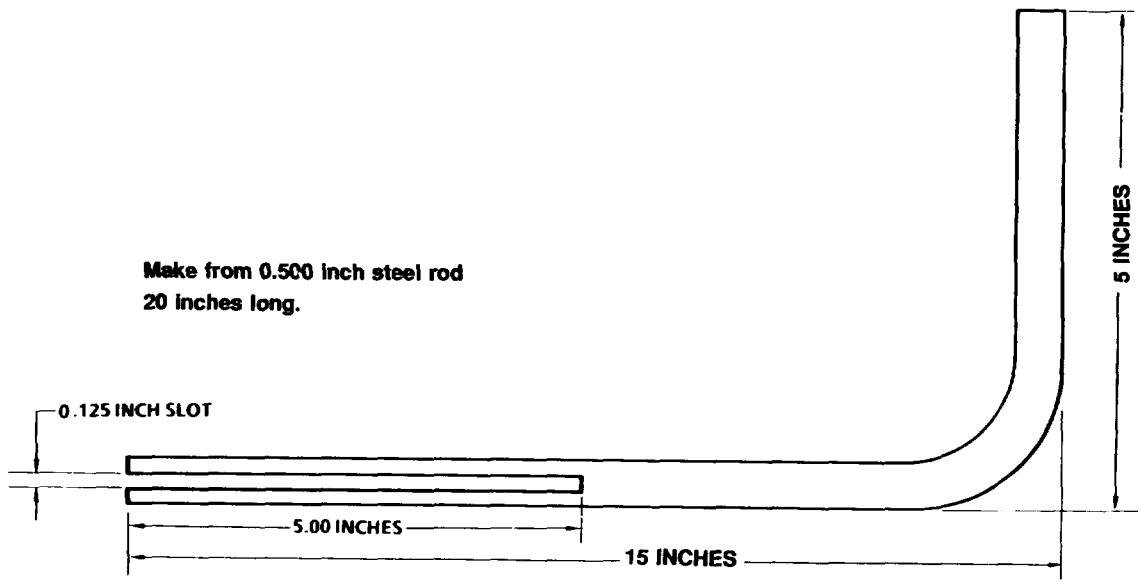


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Figure 5-26.17. CB Erosion Shield Removal Tool – Work Aid

(14) Rebond abrasion strip to erosion shield as follows:

(a) Using a new paint brush, trim bristles to 1 inch and apply a thin coat of adhesive on leading edge of erosion shield and the inner mating surface of abrasion strip.

(b) Fold down abrasion strip over erosion shield. Remove excess adhesive from bonding surface by rubbing abrasion strip toward trailing edge.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(c) Using cheesecloth (C61) dampened with isopropyl alcohol (C42), remove excess adhesive.

(d) Ensure erosion shield is still positioned correctly and install caul sheet (local manufacture per figure 5-26.17) to overlap erosion shield by approximately 0.50 inch on all sides. Tape erosion shield securely in place using No. 280 high temperature tape (C273.1).

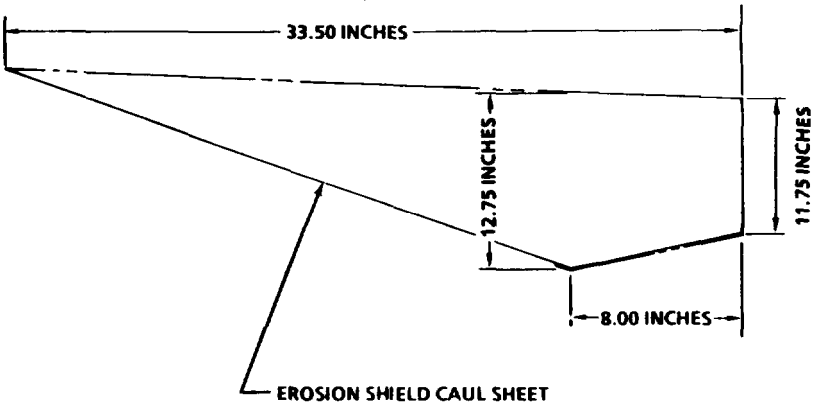
(e) Tape a layer of peel-ply (C197.1) over the caul sheet.

CAUTION

Protect vacuum bag from punctures from trim tab by wrapping trim tab with cheesecloth.

(f) Install vacuum bag (C114.1) over blade tip and erosion shield.

(g) Install vacuum fitting and seal bag with sealing compound (C245.1) at each end around blade.



Make from aluminum sheet 0.020 - 0.030 inch thick or rubber sheet 0.250 thick 12.75 inches wide and 33.50 inches long.

205015-2010

Figure 5-26.18. CB Erosion Shield Caul Sheet – Work Aid

(h) Connect and apply vacuum, make sure that vacuum bag over caul sheet is reasonably wrinkle free. Vacuum gage must read at least 25 inches vacuum.

(i) Check aft edge and end of blade to determine if erosion shield is property positioned (has not slipped).

NOTE

Cure cycle starts when temperature gage reaches 150°F.

(j) Apply heat to repair area, using heat pad for 30 minutes at 150° TO 170°F (66° TO 77°C).

(k) Disconnect vacuum and remove bagging, caul sheet, and tape.

(I) Remove excess adhesive by sanding with No. 220 grit abrasive paper (C11.4).

(m) Inspect repair.

(n) Paint repaired area in accordance with step q.

n. Weight pocket seal repair.

(1) Remove screws, weight pocket cover and weights.

(2) Using a wood chisel remove old sealant from weight pocket.

(3) Obtain premixed sealant (C244).

(4) Using a tongue depressor, or equivalent, apply sealant to faying surface of weight pocket.

(5) Remove (wipe) excess material from area on which weights will be reinstalled.

(6) Reinstall same weights previously removed.

(7) Reinstall cover and secure with screws.

o. Replacement of root end closure.

(1) Remove blade from helicopter. (Refer to paragraph 5-30.)

(2) Remove root end closure from blade.

CAUTION

If disc sander Is used, exercise extreme caution to prevent damage to blade.

(a) Sand or file through radius of root closure around entire end of blade.

(b) Remove end of closure.

(c) Use a wood chisel or equivalent to remove remaining strip of closure.

(d) Using No. 120 grit abrasive paper (C11.2), remove any remaining closure to prepare blade surfaces for bonding on new closure.

(3) Use No. 220 grit abrasive paper (C11.4) to remove glaze from mating surface of replacement closure.

(4) Prefit replacement closure on blade root end.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(5) Put on cotton gloves (C120.1) and then plastic gloves (C120.2). Leave gloves on until completion of adhesive application.

(6) Use cheesecbth (C61) moistened with isopropyl alcohol (C42) to wipe bonding surfaces of blade and closure.

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning skin. Protective equipment must be used when performing these repairs.

CAUTION

Surfaces to be bonded must be clean, dry, and free of fingerprints and all foreign matter.

(7) Obtain adhesive (C29).

(8) Mix adhesive (C29) per manufacturers instructions. Stir with wooden spatula until all streaks have disappeared and color is uniform.

NOTE

Pot life of adhesive is 15 minutes at 72°F (22°C). Time is shorter at higher temperatures. Repair procedures shall be completed without delay.

(9) Using a clean paint brush, trim bristles to 0.5-inch and apply a light coat of adhesive to mating surfaces of replacement closure and blade.

. (10) Install replacement closure, beginning at leading edge of blade and working toward trailing edge.

(11) Ensure closure is completely seated against blade. Light tapping along the radius of the closure is permitted.

(12) Use cheesecloth (C61) dampened with alcohol (C42) to remove excess adhesive.

(13) Apply No. 280 high temperature tape (C273.1) in several locations, pulling tight, to hold closure in place.

(14) Apply heat, using heat gun or equivalent, around closure at 120° TO 140°F for 15 minutes or allow to cure at ambient temperature for 24 hours.

(15) Paint in accordance with step q.

(16) Inspect closure.

(17) Reinstall blade on helicopter.

p. Repair of root closure crack or hole.

NOTE

Damage to root closure could occur during removal/replacement of the blade. Extreme care should therefore be exercised during removal and replacement.

(1) Assess damage (crack or hole).

(2) Use a knife blade, or equivalent, to remove loose, frayed edges of the root closure.

(3) Use No. 120 grit abrasive paper (C11.2) followed by No. 220 grit abrasive paper (C11.4) to remove paint for approximately 1.00 inch surrounding damage.

WARNING

Sealant compounds contain toxic ingredients. Provide adequate ventilation and protect skin and eyes from contact. Wash off with warm water and soap. Avoid use of solvents for cleaning the skin.

NOTE

Body putty (C49.1) may be used as a substitute for sealant (C237). Allow body putty to cure for 30 minutes at ambient temperature.

(4) Obtain sealant (C237). Allow sealant to warm to ambient temperature. Mix 100 parts (by weight) base and 12 parts (by weight) accelerator. Mix until color is consistent.

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(5) Dampen cheesecloth (C61) with isopropyl alcohol (C42) and wipe sanded area on root closure. Wipe with dry, clean, cheesecloth (C61) before alcohol evaporates.

NOTE

It is acceptable to apply a layer of high temperature tape (C273.1) inside hole to assist in holding sealant in place. Tape may remain in blade.

(6) Using a spatula or wooden tongue depressor, apply sealant to completely cover damage and previously sanded area.

(7) Heat repair to 120° TO 140°F, using heat blanket or heat lamp, for 15 minutes.

(8) Use No. 220 grit abrasive paper (C11.4) to sand repair area flush with surrounding closure,

(9) Inspect repair.

(10) Paint in accordance with step q.

q. Paint refinishing.

CAUTION

The only paint refinishing authorized is the touch-up of repaired areas. This restriction is necessary to maintain lightning protection.

NOTE

The paint coating system for the composite blade consists of a urethane compatible primer, a copper-filled polyurethane conductive coating and aliphatic polyurethane paint. The copper-filled polyurethane conductive coating is intended for use as a lightning strike protective coating and a static bleed off coating on the composite blade. A 12 ounce aerosol can (C70.3) is available for touch-up of small areas.

NOTE

When actual operational emergencies require Immediate use of the helicopter, touch-up painting may be deferred until termination of the emergency.

(1) Apply urethane compatible primer (C218.1) to the repair area as follows:

CAUTION

Extreme care must be exercised during sanding to prevent damage to glass blade skin fibers.

(a) Remove glaze from blade surface by sanding with No. 180 (C2) to No. 250 (C5) grit abrasive cloth.

WARNING

Toluene is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(b) Remove sanding residue with cheesecloth (C61) dampened with toluene (C288).

NOTE

Spray guns shall be capable of spraying a urethane compatible primer film of 0.60 to 1.20 mil (0.0006 to 0.0012 Inch) thickness.

Compressed air shall be trapped and filtered to render It moisture and oil free.

Sixty-five pounds (65 psi) of air pressure must be available for paint spray atomization at the nozzle.

Air gages and regulators should be installed on atomization lines.

(c) Obtain urethane compatible primer (C218.1).

CAUTION

Only material from the same kit shall be mixed, except that two or more kits may be mixed in the same vessel, provided the kits are all manufactured by the same vendor. Do not mix base or activator from different manufacturers. Establish mixing ratios must be followed closely; otherwise the primer will exhibit unsatisfactory film properties, such as poor adhesion, poor chemical resistance, or inadequate drying. The activator shall always be added to base.

The mixing ratio is one art (by volume) base with one part (by volume) activator.

(d) Mix primer thoroughly.

CAUTION

Primer shall be overcoated within eight hours following mixing. If primer is not overcoated within eight hours, the primer must be scuffsanded with Scotchbrite (C11) and a mist coat or urethane compatible primer (C218.1) must be added.

(e) Spray area to be primed with one coat, 0.003 inch minimum thickness.

(f) As an alternate method, following substeps (a) through (e), primer may be brush coated using a new paint brush to provide a 0.003 inch minimum thick coat.

(2) Apply two coats of copper-filled polyurethane conductive coating (C70.2) over the primer coat as follows:

(a) Obtain copper-filled polyurethane conductive material (bulk or kit) (C70.2).

CAUTION

Only material from the same kit shall be mixed, except that two or more kits may be mixed In the same vessel, provided the kits are all manufactured by the same vendor. Do not mix base or activator from different manufacturers. Established mixing ratios must be followed closely.

The mixing Is one part (by volume) base with one part (by volume) activator.

(b) To one part base add one part hardener (by volume). Mix thoroughly and allow mixed material to stand a minimum of 30 minutes prior to spraying. Discard mixed material if not used within 8 hours.

CAUTION

Conductivity of coating can be severely degraded If applied too wet or heavy. Do not sand the conductive coating.

(c) Spray conductive coating with spray gun 10 TO 12 inches from surface to obtain a dry spray.

(d) Check conductive coating for conductivity prior to over coating. Reading shall be 1 ohm maximum between points.

(e) If conductivity test fails, proceed as follows:

1 Allow coating to dry a minimum of 4 hours.

2 Lightly sand conductive coating with No. 280 grit abrasive paper (C11.6).

WARNING

Toluene is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

3 Wipe with clean cloth dampened with toluene (C288).

4 Repeat primer and conductive coating application allowing 1 hour minimum flash-off of primer prior to application of conductive coating.

5 Repeat conductivity test.

(f) As an alternate method following preceding sub-steps (a) through (c), conductive coating may be brush coated to provide a thickness of 1.0 mil ± 0.2 roils (0.001 ± 0.0002 inch).

(3) Apply aliphatic polyurethane coating (C70.1) over the conductive coating as follows:

(a) Obtain aiiphatic polyurethane coating kit (C70.1).

NOTE

The polyurethane conductive coating consists of two components, a resin base component and an activator. These are provided as a kit and are mixed in a ratio of 1:1. The activator will always be added to the resin.

After mixing, adjust the viscosity to 17 to 23 seconds (Zahn No. 2) with urethane thinner (C284.1).

(b) Mix polyurethane coating thoroughly.

CAUTION

Immediately prior to spraying, wipe surface with tack rag (C269.1).

(c) Adjust spray equipment and apply a minimum of 2 wet topcoats of the polyurethane coating to a dry film thickness of 0.85 TO 1.15 mils (0.00085 TO 0.00115 inch) each.

NOTE

The drying time between coats must be a minimum of 30 minutes.

(d) As an alternate method following preceding sub-steps (a) and (b), the polyurethane coating may be applied using a new paint brush.

CAUTION

Below 50°F (10°C) the drying time may be more than doubled.

(e) Dry at ambient temperature 70°F (21°C) for 30 minutes for tack free and 8 hours for hard dry. Drying time may be accelerated by heating to 90° TO 120°F (32° TO 49°C).

r. Replacement of rain guard splice cover.

(1) Position blade for access to damaged rain guard splice cover. Support blade to prevent movement and droop.

(2) Remove rain guard splice cover from rain guard.

NOTE

Use a standard wood chisel (bevel side down), or equivalent, to carefully pry up rain guard splice cover. Once a corner Is raised, grip rain guard splice cover with pliers and peel back while continuing to pry with chisel.

(3) Lightly sand faying surface of rain guard using 120 grit abrasive paper (C11.2). Do not remove purple colored adhesive from faying surface.

(4) Remove all sanding dust from sanded surface of rain guard by wiping area with cheesecloth (C61).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(5) Dampen clean cheesecloth (C61) with isopropyl alcohol (C42) and clean sanded surface of rain guard. Wipe with clean, dry cheesecloth (C61) before dampness evaporates.

(6) Obtain replacement rain guard splice cover and adhesive (C29).

(7) Prepare new rain guard splice cover.

(a) Remove peel-ply from faying surface of rain guard splice cover.

(b) Lightly sand faying surface of rain guard splice cover using 120 grit abrasive paper (C11.2).

(c) Remove all sanding dust from sanded surface of splice cover by wiping area with cheesecloth (C61) dampen with alcohol (C42).

WARNING

Adhesive contains toxic ingredients. Provide adequate ventilation and protect skin and eyes from contact with uncured resins or curing agent. Wash off uncured resins and curing agent from skin with warm water and soap. Avoid use of solvents for cleaning adhesive from skin.

(8) Mix adhesive (C29) per manufacturers instructions. Stir with wooden spatula until all streaks have disappeared and color is uniform.

NOTE

Pot life of adhesive is 15 minutes at 72˚F (22˚C). Time is shorter at higher temperatures. Repair procedures shall be completed without delay.

(9) Using new paint brush, trim bristles to **0.5**-inch and apply a light coat of adhesive (C29) to top and bottom faying surface of blade rain guard and to faying surface of rain guard splice cover.

(10) Install rain guard splice cover on rain guard and press together firmly. Slide rain guard splice cover back and forth slightly while still under hand pressure to smooth out adhesive (C29).

WARNING

Cleaning solvent is flammable and toxic. Provide adequate ventilation. Avoid prolonged breathing of vapors and contact with skin or eyes.

(11) Using clean cheesecloth (C61) dampened with isopropyl alcohol (C42), remove excess adhesive (C29) around rain guard splice cover.

(12) Apply high temp tape (C273.1) over rain guard splice cover, pull down firmly, and attach high temp tape (C273.1) to rain guard and abrasion strip to maintain pressure.

(13) Cure adhesive (C29) at room temperature for 24 hours.

(14) Remove high temp tape (C273.1) and remove exposed cured adhesive (C29) around edges of rain guard splice cover by lightly sanding with 120 grit abrasive paper (C11.2).

SECTION IV. MAIN ROTOR CONTROLS

5-35. STABILIZER BAR ASSEMBLY.

5-36. Description — Stabilizer Bar Assembly. Stabilizer bar assembly is a weighted rotating unit mounted above and across main rotor on supports bolted to rotor hub trunnion. Each side of bar frame is connected through a control tube to a damper on mast. Mixing levers of bar are connected to main rotor control linkage, by control tubes from scissors levers and by pitch links to pitch horns of rotor hub.

WARNING

Rotor Controls Parts Kit, P/N 204-1629-2, must be replaced as a kit. Replacement of individual bolts within the kit is not authorized (see figure 1-15, Rotor Controls Parts Kit).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

5-37. Cleaning — Stabilizer Bar Assembly. Clean stabilizer bar using solvent (C261) and clean cloths.

5-38. Lubrication — Stabilizer Bar Assembly. Refer to figure 1-6 for stabilizer bar lubrication.

5-39. Inspection — Stabilizer Bar and Control Tubes (Installed).

a. Visually inspect exposed components for corrosion or damage. Refer to paragraph 5-43 for detailed inspection of components.

b. Inspect outer tube assembly for cracks four inches outboard from frame assembly. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

b.1. Check stabilizer bar with cable assemblies installed for proper clearance of **0.005** inch between retainer.

b.2. Deleted.

c. Check bearings of stabilizer bar for freedom of operation and indications of damage.

d. Inspect bearing in mixing levers for wear as follows:

(1) Maximum wear allowed in bearing in mixing lever outboard end is **0.010** inch axial, and **0.007** inch radial.

(2) Maximum wear allowed in bearings in mixing lever inboard end is **0.010** inch axial, and **0.010** inch radial.

(3) Bearings exceeding these limits require replacement.

e. Inspect center frame support bearings for wear. Maximum allowable is **0.005** inch axial, and **0.012** inch radial.

f. Check bearings of pitch change links (8, figure 5-27) and damper link tubes (18) for indications of wear exceeding the maximum allowable axial and radial tolerances stated below.

(1) Damper link rod end: (roller bearing) **0.030** inch axial, and **0.010** inch radial. Damper link rod ends: (teflon P/N 47-140-252) **0.012** inch axial, and **0.012** inch radial.

(2) Pitch change link universals: **0.017** inch axial, and **0.0085** inch radial.

(3) Pitch change link rod-ends **0.010** inch axial and radial (can be extended to **0.020** inch axial and radial provided excessive vertical vibration does not occur).

(4) Bearings exceeding these limits require replacement.

(5) Pitch link barrel for nicks, dents, gouges, scratches, and corrosion to a maximum depth of **0.010** inch.

(6) Pitch Link Clevis: nicks, dents, gouges, scratches, and corrosion to a maximum depth of **0.005** inch per side on lugs and body, and a maximum depth of **0.002** inch on the radius of the threaded areas.

g. Inspect all control tubes attached to stabilizer bar for damage as follows:

(1) Inspect control tubes at connecting link for elongated rivet holes, deformed rivets, or looseness of the connection. None allowed.

(2) Scratches, nicks, dents, and gouges in control tubes less than **0.005** inch in depth, or corrosion less than **0.0025** inch in depth may be polished out.

(3) Control tubes with damage exceeding these limits require replacement. If void is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

5-40. Removal — Stabilizer Bar and Control Tubes. Item numbers below refer to figure 5-27 unless otherwise indicated.

WARNING

Rotor Controls Parts Kit, P/N 204-1629-2, must be replaced as a kit. Replacement of individual bolts within the kit is not authorized (see figure 1-15, Rotor Controls Parts Kit).

a. Disconnect pitch links (8) from main rotor pitch horns (10) by removing cotter pin (6), nut (5), washers (7) and bolt (9).

b. Install grip positioning links (T41) to hold blades in normal position as shown in figure 5-2.

c. Disconnect control tube (21, figure 5-27) from scissors (25) by removing cotter pin (24), nut (23), two washers (20 and 22), and bolt (19).

d. Disconnect control tubes (18) from damper levers (13) by removing cotter pin (15), nut (16), two washers (14 and 17), safety washer (12), and bolt (11).

e. Secure loose tube assemblies with tape and protective padding to prevent scratches and dents.

f. Support stabilizer bar with a suitable hoist. Remove lockwire and remove bolts (1 and 3) with washers (2).

g. Lift stabilizer bar assembly from main rotor.

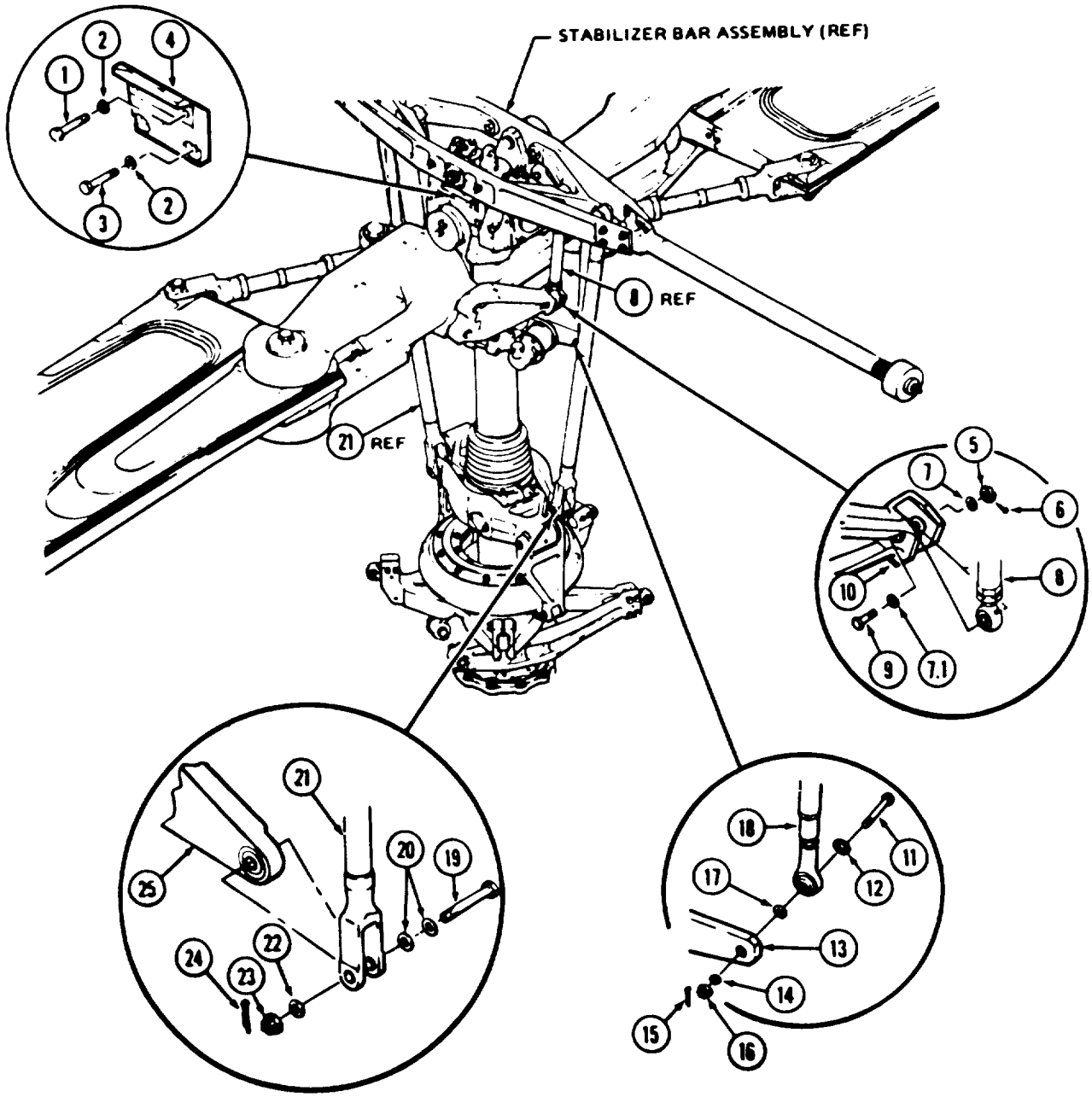
h. Remove control tubes (18 and 21) and pitch change link (8).

NOTE

If control tube (18) is removed from stabilizer bar ensure that special washer (27) (P/N 206-010-324-1) is retained for installation between bolt head and bearing.

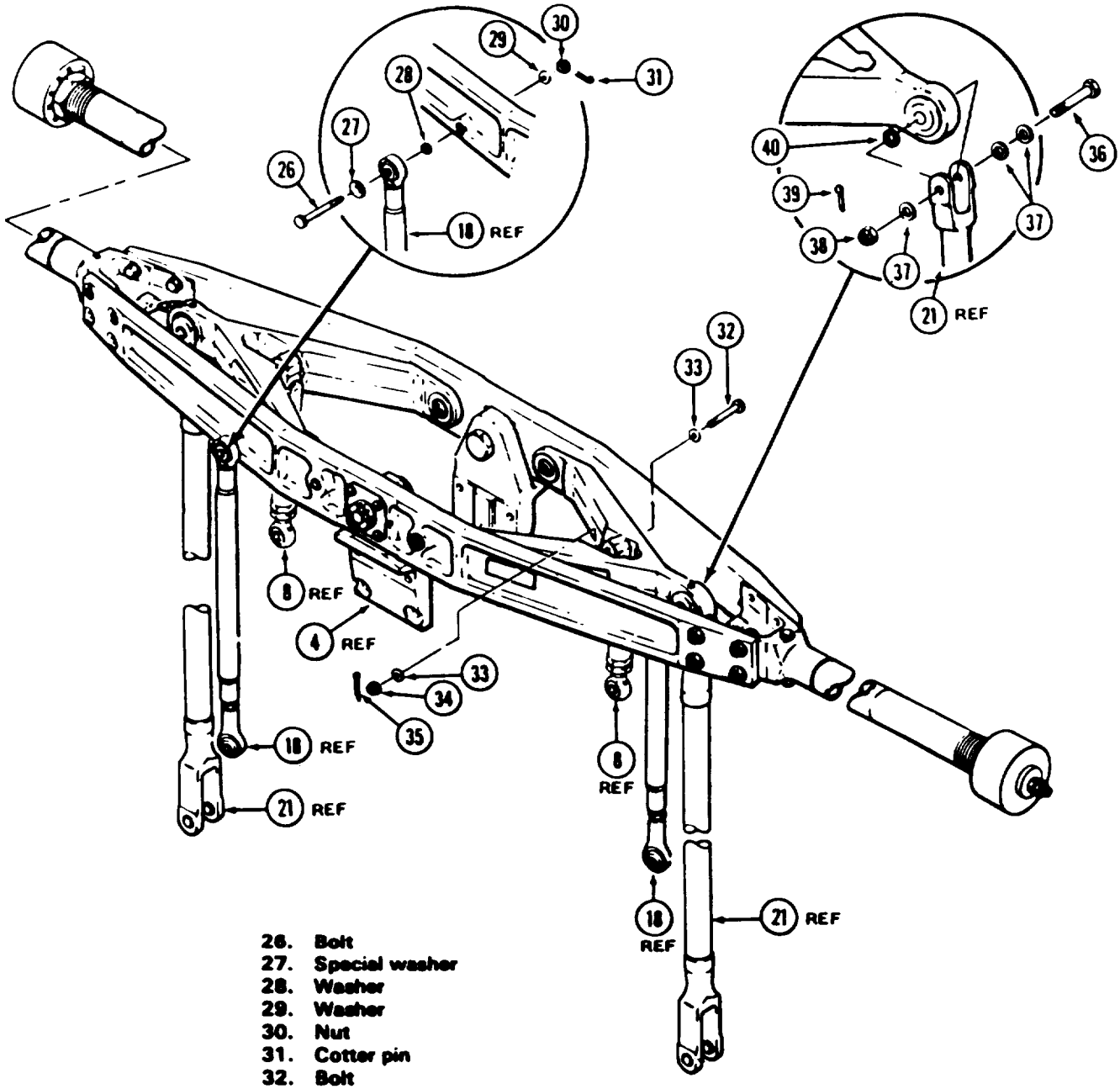
(1) Remove cotter pin (31), nut (30), washers (28 and 29), special washer (27) and bolt (26). Remove tube (18).

(2) Remove cotter pin (39), nut (38), washers (37), and bolt (36). Remove tube (21) and rubber washer (40).



1. Bolt
2. Washer
3. Bolt
4. Support
5. Nut
6. Cotter pin
7. Washer
7.1 Washer, Recessed
8. Link pitch
9. Bolt
10. Pitch horn
11. Bolt
12. Special washer
13. Damper lever
14. Washer
15. Cotter pin
16. Nut
17. Washer
18. Tube
19. Bolt
20. Washer
21. Control tube
22. Washer
23. Nut
24. Cotter pin
25. Scissors lever

Figure 5-27. Stabilizer Bar Removal (Sheet 1 of 2)



26. Bolt
27. Special washer
28. Washer
29. Washer
30. Nut
31. Cotter pin
32. Bolt
33. Washer
34. Nut
35. Cotter pin
36. Bolt
37. Washer
38. Nut
39. Cotter pin
40. Rubber washer

Figure 5-27. Stabilizer Bar Removal (Sheet 2 of 2)

(3) Remove cotter pin (35), nut (34), washers (33), and bolt (32). Remove link (8).

5-41. Disassembly - Stabilizer Bar and Control Tubes. (AVIM) Item numbers below refer to figure 5-28 unless otherwise indicated. Disassemble stabilizer bar only to the extent necessary to accomplish inspection and repair.

a. Remove cotter pins (5), nuts (4), washers (6), and bolts (12) attaching supports (11) to center frame (1). Remove support assemblies.

WARNING

When replacing mixing lever pivot bearings, do not pry mixing lever from assembled stabilizer bar assembly. Do not compress forks with "C" clamps, upper pitch change link attaching bolts or other means.

b. Remove cotter pins (18), nuts (17), washers (16 and 15), and bolts (13) attaching levers (14) to center frame (1), and remove levers.

c. Remove nuts (8), washers (9), and bolts (10) attaching tube assemblies (23) to center frame (1).

d. Remove nuts (31), retainer (30), bushings (28 and 29), and packing (27).

d.1. Deleted.

e. Cut lockwire and back off nut (25) until lock (24) is free of slot in weight (26). Remove weight (26), nut (25) and lock (24) from tube (23).

f. Remove cable assembly (22) by removing nut (21), bolt (19), and seal washers (20).

g. Cut lockwire and remove screws (3) attaching bearing retainers (2) to center frame (1). Remove pivot bearing sets (7).

5-42. Cleaning - Stabilizer Bar.

a. Remove sealant from weights and outer tubes using a plastic scraper.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

b. Clean parts with solvent (C261) and dry with compressed air. Do not clean bearings of lever assembly (14, figure 5-28) with solvent. Do not spin dry bearing (7).

5-43. Inspection - Stabilizer Bar. (Disassembled) (AVIM)

a. Visually inspect all parts for corrosion, damage, and general condition (figure 5-29).

b. Inspect bushings (1, 2, 5, and 8, figure 5-30) for wear. If evidence of wear is found, dimensionally check bushing ID (figure 5-30). Scoring shall not exceed **0.002** inch and elongation **0.003** inch maximum.

c. Inspect sleeve (3) and liner (7) for looseness. Replace if looseness is detected.

d. Inspect bearings (7, figure 5-28), and (4 and 6, figure 5-30) for smooth operation, seal condition, and wear. Wear on bearing (7, figure 5-28) is **0.005** inch axial.

e. Inspect the following parts by magnetic particle method (Code M) or fluorescent penetrant method (Code F), refer to TM 1-1500-344-23 if cracks are suspected. Item numbers are applicable to figure 5-28. Replace without repair if cracked. Alter inspection method: If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

ITEM	NOMENCLATURE	CODE
1	Centerframe	F
11	Support	F
14	Lever	F
23	Outer Tube	M

f. Inspect cable assembly (22, figure 5-28).

(1) No damage allowed to threaded portion or within **0.125** inch of inboard end of either end fitting.

(2) Replace assembly, if crimps, corrosion damage, or frayed wires is found on cable.

(3) Corrosion damage of **0.005** inch in depth and mechanical damage of **0.010** inch in depth is allowed on end fittings. After cleanup, total depth shall not exceed **0.010** inch.

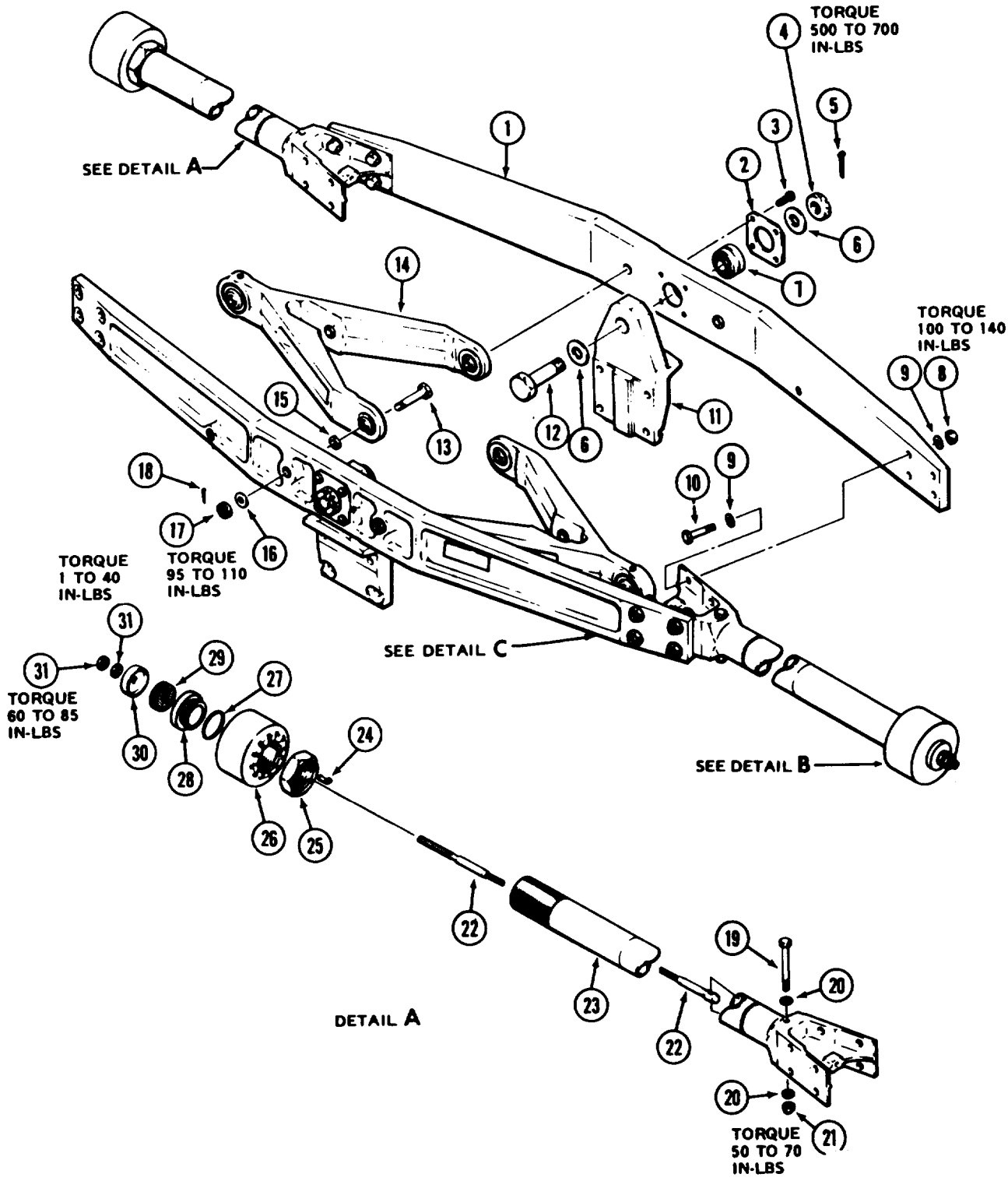


Figure 5-28. Stabilizer Bar Assembly (Sheet 1 of 2)

NOTES

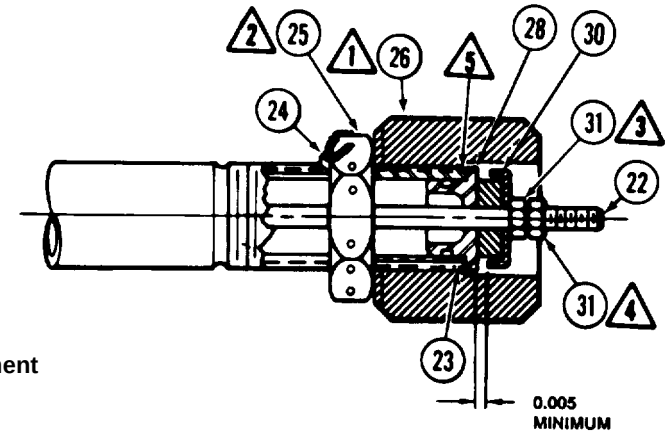
1. On heavy end of bar back off nut (25). Screw weight (26) Inboard to nearest lock position within 51.8 Inches before balancing.

2. Torque nut (25) 133 to 158 foot-pounds. Secure lock (24) with MS20995C32 lockwire.

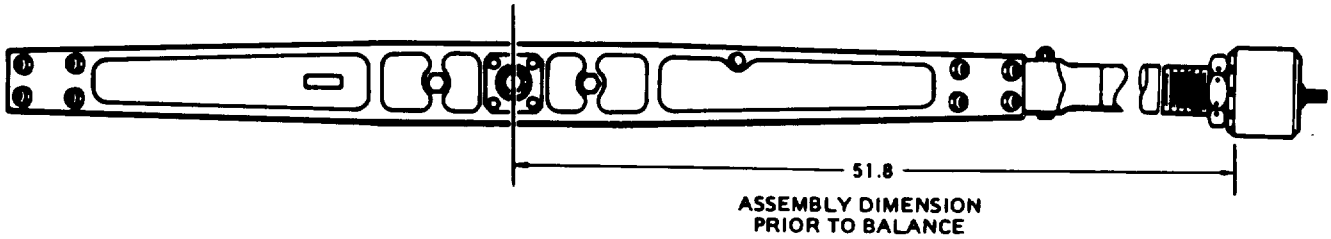
3. Use screwdriver In slot on threaded end of cable assembly (22) to prevent twisting cable. Torque Inboard nut (31) 1 to 40 Inch-pounds to attain 0.005 minimum Inch clearance between bushing (28) and retainer (30).

4. Torque outboard nut 60 to 85 inch-pounds.

5. After balancing, minimum tube (23) engagement weight (26) to be flush with shoulder of counterbore In weight within 0.03 Inch. See Detail A, figure 5-31.



DETAIL B

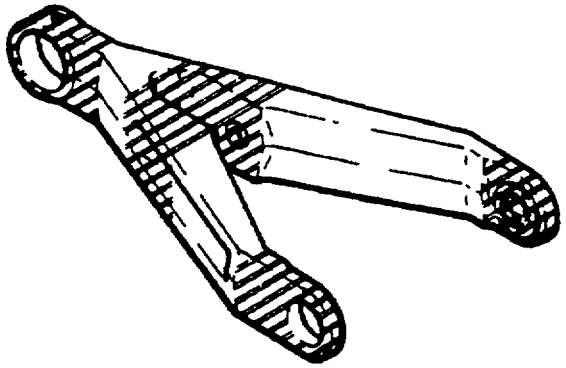


DETAIL C

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

1. Centerframe
2. Retainer
3. Screw
4. Nut
5. Cotter pin
6. Washer
7. Bearing set
8. Nut
9. Washer
10. Bolt
11. Support assembly
12. Bolt
13. Bolt
14. Lever assembly
15. Washer
16. Washer
17. Nut
18. Cotter pin
19. Bolt
20. Seal washers
21. Nut
22. Cable assembly
23. Tube assembly
24. Lock
25. Nut
26. Weight
27. Packing
28. Bushing
29. Bushing
30. Retainer
31. Nuts

Figure 5-28. Stabilizer Bar Assembly (Sheet 2 of 2)



MIXING LEVER

DAMAGE AREA REPAIR SYMBOLS

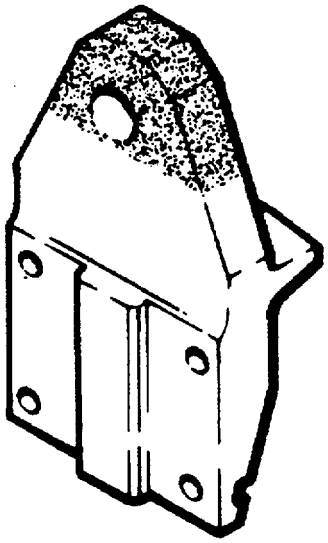
AREA A

AREA B

TYPE OF DAMAGE	MAXIMUM DEPTHS AND DAMAGE AREAS ALLOWED	
NICKS, SCRATCHES, SHARP DENTS	0.010 IN. AFTER REPAIR	0.035 IN. AFTER REPAIR
CORROSION	0.005 IN. BEFORE REPAIR 0.010 IN. AFTER REPAIR	0.017 IN. BEFORE REPAIR 0.035 IN. AFTER REPAIR
AREA OF FULL DEPTH REPAIR	0.010 SQ. IN	0.25 SQ. IN.
NUMBER OF REPAIR AREAS	ONE PER SEGMENT	NOT CRITICAL
EDGE CHAMFER	0.030	0.060

NOTE:
1. No cracks allowed.

Figure 5-29. Stabilizer Damage Limits (Sheet 1 of 5)



SUPPORT

DAMAGE AREA REPAIR SYMBOLS

AREA A

AREA B

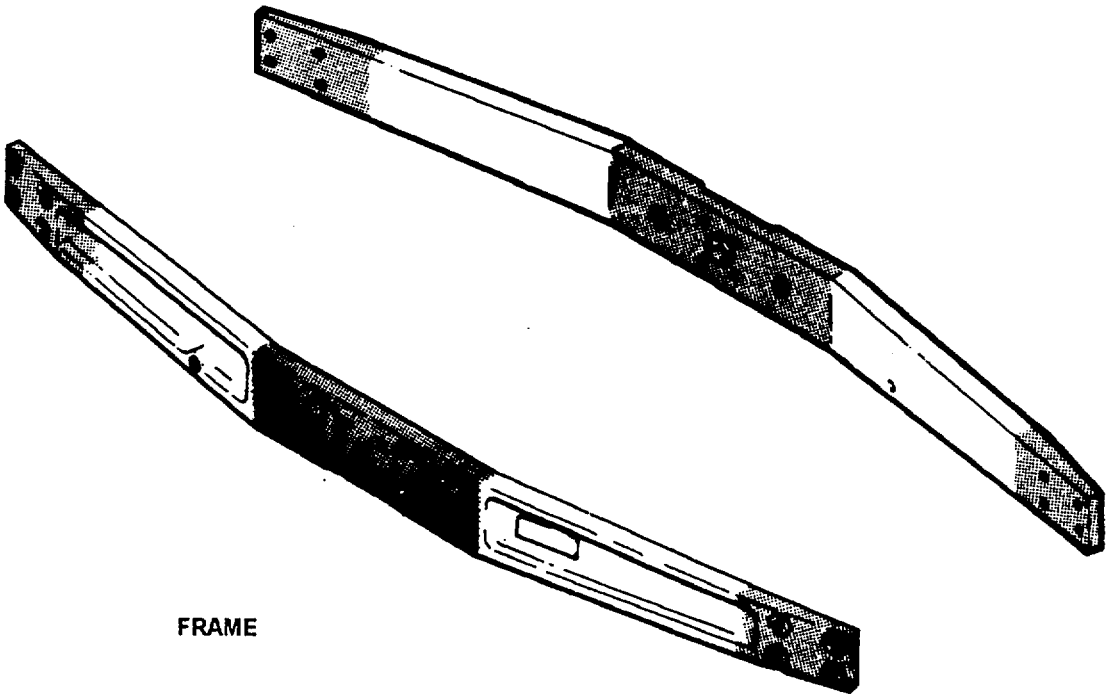
TYPE OF DAMAGE	MAXIMUM DEPTHS AND DAMAGE AREAS ALLOWED	
NICKS, SCRATCHES, SHARP DENTS	0.010 IN AFTER REPAIR	0.035 IN. AFTER REPAIR
CORROSION	0.005 IN. BEFORE REPAIR 0.010 IN. AFTER REPAIR	0.017 IN. BEFORE REPAIR 0.035 IN. AFTER REPAIR
AREA OF FULL DEPTH REPAIR	0.10 IN. SQ.	0.25 IN. SQ.
NUMBER OF REPAIR AREAS	ONE	NOT CRITICAL

BORE DAMAGE: 0.002 INCH FOR ONE-QUARTER CIRCUMFERENCE

MOUNTING HOLE DAMAGE: 0.002 INCH DEEP BY 0.007 INCH WIDE FOR FULL CIRCUMFERENCE

NOTES:
1. Edges may be radiused or chamfered 0.050 inch to remove nicks and dents.
2. No cracks allowed

Figure 5-29. Stabilizer Damage Limits (Sheet 2 of 5)



FRAME

DAMAGE AREA REPAIR SYMBOLS

AREA A

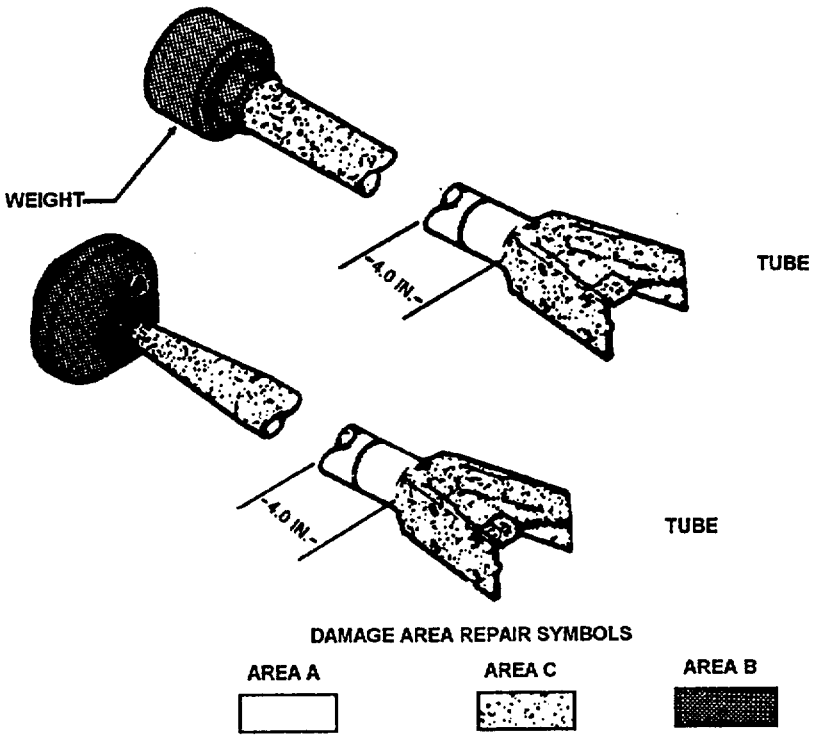
AREA B

TYPE OF DAMAGE	MAXIMUM DEPTHS AND DAMAGE AREAS ALLOWED	
NICKS, SCRATCHES AND SHARP DENTS	0.020 INCH AFTER REPAIR	0.035 INCH AFTER REPAIR
CORROSION	0.010 INCH BEFORE REPAIR 0.020 INCH AFTER REPAIR	0.017 INCH BEFORE REPAIR 0.035 INCH AFTER REPAIR
MAXIMUM AREA PER FULL DEPTH REPAIR	0.050 SQ. IN.	0.75 SQ. IN.
NUMBER OF REPAIRS	TWO PER SEGMENT	NOT CRITICAL
EDGE CHAMFER	0.050 INCH	0.100 INCH

BORE DAMAGE: 0.002 INCH FOR ONE-QUARTER CIRCUMFERENCE

NOTE: 1. No cracks allowed.

Figure 5-29. Stablizer - Damage Limits (Sheet 3 of 5)



TYPE OF DAMAGE	MAXIMUM DEPTHS AND DAMAGE AREAS ALLOWED	
SCRATCHES, DENTS AND NICKS	0.005 IN. AFTER REPAIR	0.010 IN. AFTER REPAIR
CORROSION	0.002 IN. BEFORE REPAIR 0.005 IN. AFTER REPAIR	0.005 IN. BEFORE REPAIR 0.010 IN. AFTER REPAIR
MAXIMUM AREA PER FULL DEPTH REPAIR	0.25 SQ. IN.	0.50 SQ. IN.
NUMBER OF REPAIR AREAS	TWO	NOT CRITICAL
EDGE CHAMFER	NOT APPLICABLE	0.030 INCH
BORE DAMAGE:	0.002 INCH FOR ONE-QUARTERCIRCUMFERENCE	

THREAD DAMAGE:
DEPTH: ONE-THIRD OF THREAD
LENGTH: ONE QUARTER INCH
NUMBER: TWO

NOTES:
1. Deleted.
2. No cracks allowed

Figure 5-29. Stabilizer Damage Limits (Sheet 4 of 5)

NOTES:

3. Area B:
   For the Model 204 components as the following:
   (1) Nut, PN AN315R.
   (2) Retainer, PN 204-011-334-1.
   (3) Bushing, PN 204-011-333-1.
   (4) Washer, PN 204-011-332-1.
   (5) Lock, PN NAS559-5.
   (6) Nut, PN NAS509-12.
   (7) Weight, PN 204-011-303-7 (Area of slots only).
   For the Model 212 components as the following:
   (1) Nut, retainer and bushing as in a. (1), a. (2) and a. (3) above.
   (2) Bushing, PN 540-011-322-1.
   (3) Packing, PN MS29513-119.
   (4) Lock, PN NAS559-9.
   (5) Nut, PN NAS509-24.
   (6) Weight, PN 212-010-306-1 (Area of slots only).
4. Area C may be extended:
   On weight PN 204-011-303-7, to include the outside diameter and sloped sides.
   On weight PN 212-010-306-1, to include the outside diameter only.

Figure 5-29. Stabilizer Damage Limit (Sheet 5 of 5)

5-44. Repair — Stabilizer Bar and Control Tubes. (AVIM)

CAUTION

In all repairs, remove only necessary material required to accomplish repairs. Do not use steel wool on aluminum parts. Use of grinding wheels, patching or plugging of repairs, are not allowed. No repair is allowed within three inches of welds on stabilizer bar tubes.

a. Control Tubes and Pitch Links.

(1) Polish out scratches, nicks, dents, gouges, and corrosion on control tubes (18 and 21, figure 5-27) and pitch links (8) using aluminum oxide abrasive cloth (C6) to a 400 grit finish. Mechanical damage repair shall not exceed the original damage depth. The width of repaired areas at any section shall not exceed one-third of the tube circumference. Corrosion damage should be repaired to twice the depth of the corrosion but must not exceed the mechanical damage limits for depth or width. Apply two coats of primer (C206) to repaired areas.

(2) Inspect clevis ends of control tube (21) for nicks, gouges, and wear resulting from abrasion between the rubber antichafing washer. Burnish and blend smooth any location on the clevis up to a maximum depth of **0.010** inch.

(3) Repair nicks, dents, gouges, scratches, and corrosion on the pitch link clevis not to exceed 0.005 inch in depth on the lugs and body. Repair similar damage not to exceed 0.002 inch in depth on the radius of threaded areas. Repair in accordance with TM 55-1500-243-23.

b. Repair mechanical and corrosion damage on stabilizer bar components by polishing out the damage and blend repair smoothly into surrounding area using fine India stone (C264). Do not exceed depth and area limits of figure 5-29. Treat repaired areas on aluminum surfaces with chemical film (C64). Apply two coats of primer (C206) to repaired area. Apply primer (C312) to repaired areas on steel surfaces.

c. Burnish nicks, dents, gouges or scratches on weights if damage does not exceed 0.036 inch in depth, using a fine India stone (C264). Area and number of repairs is not critical.

d. Replace weights, tubes, fittings, center frames, mixing levers, or supports if nicks, dents, scratches or gouges exceed reparable limits.

e. Deleted.

f. Replace self locking nuts if unserviceable (TM 55-1500-204-25/1.)

g. Replace cable assembly if damage limits are exceeded.

h. Support assembly (11, figure 5-28).

(1) Score marks on the inside surface of holes and bushings shall be polished out if the damage is **0.002** inch or less.

(2) Replace bushing (8, figure 5-30) if wear limits are exceeded:

(a) Press out bushing (8) and clean mating surfaces thoroughly. Coat mating surfaces with wet unreduced zinc chromate primer, (C312), and press new bushing into support.

(b) Ream ID of bushing **0.6242 TO 0.6247** inch, deburr resulting sharp edges. ID of bushing to be square with surface of support adjacent to flange side of bushing within 0.0004 inch.

i. Lever assembly (14, figure 5-28).

NOTE

Repair around any hole must not exceed one-quarter of the surface area within 0.5 inch of that hole.

(1) Score marks on the inside surface of bushings shall be polished out if the damage is 0.002 inch or less.

(2) Replace bushing (5, figure 5-30) if wear limits are exceeded:

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(a) Press out bushing. Clean mating surfaces thoroughly using methyl-ethyl-ketone (C177). Coat mating surfaces with wet unreduced zinc chromate primer (C312). Press new bushings into lever assembly with bushing flange inboard.

(b) Line ream new bushings **0.3744 TO 0.3747** inch, deburr resulting sharp edges.

(3) Replace bearing (4) and sleeve (3) if damage or wear limits are exceeded.

(a) Press bearing and sleeve out of lever assembly.

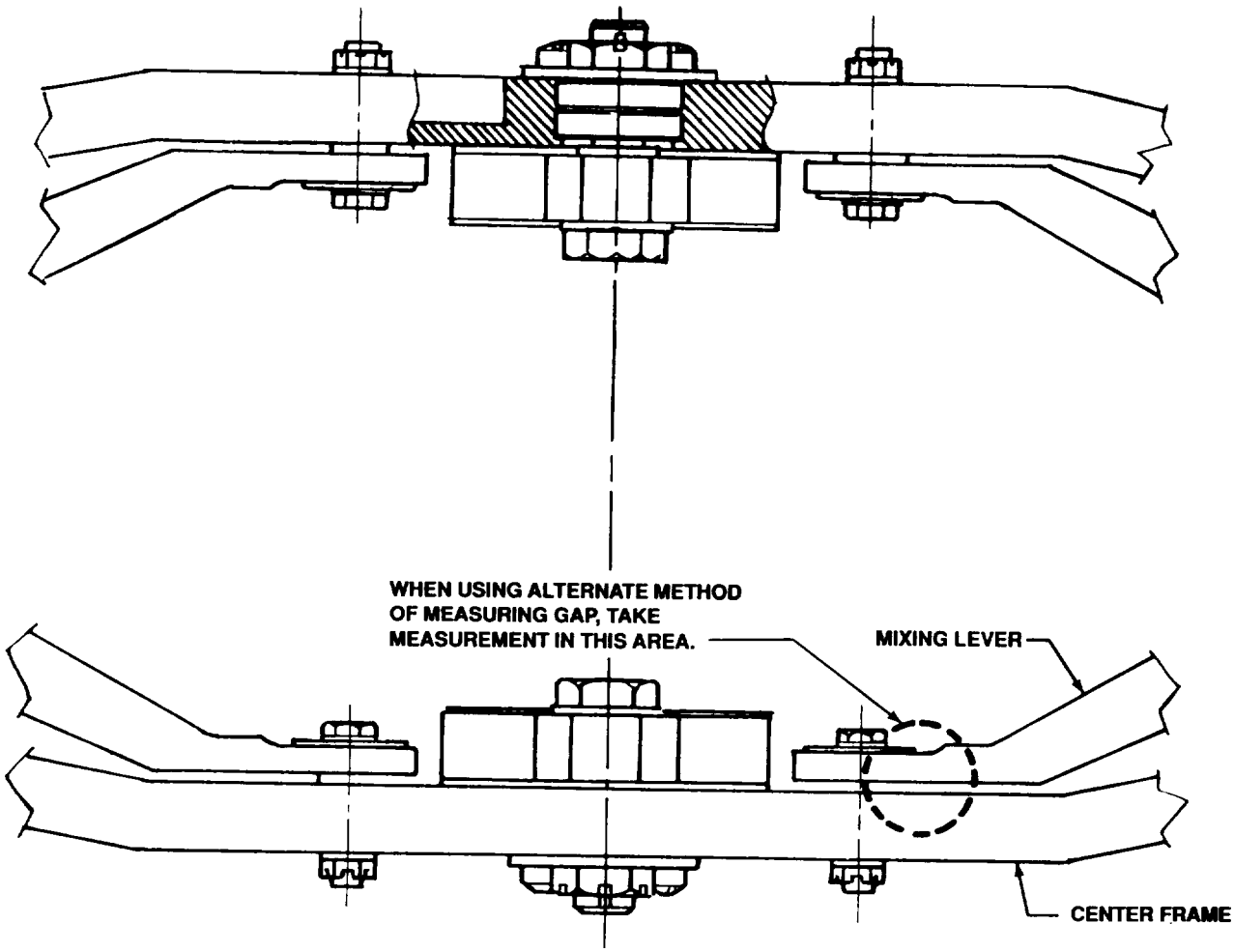


Figure 5-30.1 Shimming Mixing Levers

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(b) Thoroughly clean area from which sleeve was removed with methyl-ethyl-ketone (C177).

(c) Apply wet unreduced zinc chromate primer (C312) to mating surfaces of new sleeve and lever assembly. Press sleeve (3) into lever assembly (figure 5-30, detail A).

(d) Remove lubrication fitting from lever assembly. Using lubrication fitting hole as a guide, drill one **0.1250 TO 0.1265** inch diameter hole through sleeve.

(e) Ream sleeve **1.2485 TO 1.2490** inch diameter, deburr resulting sharp edges. Clean sleeve thoroughly using compressed air.

(f) Apply wet unreduced zinc chromate primer (C312) to mating surfaces of new bearing (4) and sleeve. Press bearing into sleeve.

(g) Ring stake sleeve over bearing and housing on both sides with staking tool (T99.1). (See detail A.) Test after installation by applying proof load of **500 to 800** pounds, on other race only, in both directions.

(h) Replace lubrication fitting.

(4) Replace bearings (6) and liner (7) if damage or wear limits are exceeded:

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(a) Press bearing and liner from lever. Clean mating surfaces using methyl-ethyl-ketone, (C177).

(b) Coat mating surfaces of liner and lever assembly with wet unreduced zinc chromate primer, (C312) and press new liner into lever assembly.

(c) Apply wet unreduced zinc chromate primer, (C312) to mating surfaces of new bearing (6) and liner (7). Press bearing into liner.

j. Cable Assembly (22, figure 5-28). Repair any damage that does not exceed the limits of paragraph 5-43f.

k. Center Frame (1, figure 5-28).

(1) Replace bushings (1, figure 5-30), when limits are exceeded.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(a) Press out bushing and clean hole with methyl-ethyl-ketone (C177).

(b) Coat mating surfaces with wet unreduced zinc chromate primer (C312), and press new bushing into center frame.

(c) Ream ID of bushing **0.3745 TO 0.3750** inch, deburr resulting sharp edges.

(2) Replace bushing (2) when limits are exceeded.

(a) Press out bushing.

(b) Coat mating surfaces with wet unreduced zinc chromate primer (C312), and press new bushing into center frame.

(c) Ream ID of bushing **0.2495 TO 0.2500** inch, deburr resulting sharp edges.

5-45. Assembly — Stabilizer Bar and Control Tubes. (AVIM) item numbers below refer to figure 5-28 unless otherwise indicated.

a. Install bearing set (7) as follows:

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(1) Clean bearing set (7) with solvent (C261) and air dry. Do not spin dry bearings.

(2) Hand pack bearings with grease (C129). Coat bearing cavity in stabilizer bar with thin film of grease (C129).

(3) Position bearing sets with grease seals outboard and open faces together. Install bearings in frame assembly (1). Position retainer (2) on frame and install screws (3). Lockwire (C155) screw heads in pairs.

b. Position tube assembly (23) so that keyway in threaded end is facing down and insert fining end of cable (22) into tube (23) and align hole in cable fitting with hole at inboard end of tube. Install bolt (19), seal washers (20) and nut (21). Torque nut (21) **50 TO 70** inch-pounds.

c. Position both center frames (1) with bushings (2, figure 5-30) on lower side of frames. Align center frames (1, figure 5-28) to fittings on inboard end of tubes (23). Install bolts (10) (heads inboard). Use shorter bolts in outboard holes in centerframe. Position lever (14) in centerframe with lubrication fittings up, install bolts (13) through lever (14) and bushings in centerframe (1). Do not install nuts (17). Temporarily install washers (9) and nuts (8) on bolts (10) on one centerframe at both ends and tighten nuts. On opposite centerframe at both ends, apply zinc chromate (C312) to bolts, centerframe and tube mating surfaces and reassemble while still wet. Install washers (9) and nuts (8) on bolts on prepared centerframe. Torque nuts **100 TO 140** inch-pounds.

d. Position supports (11) on centerframe (1) and install attaching bolts (12), washers (6) and nuts (4). Torque nuts (4) **500 TO 700** inch-pounds. Install rotter pins (5).

CAUTION

During installation and shimming of levers (14) the dimension between the inboard mounting faces of support assemblies (11) shall be maintained at 5. 200+ 0.010 Inches. A main rotor trunnion may be used to maintain this dimension.

NOTE

Holding the 5.200 dimension prevents excessive axial loads on the lever pivot bearings when the stabilizer bar assembly is installed on the main rotor hub. Excessive axial loads reduce life of these bearings.

e. Move one lever (14) along the bolt axis until bearing contacts bushing leaving total gap on opposite side. Measure the total gap and determine total number of AN960-616 and/or AN960-616L washers (15) required to fill gap.

NOTE

If difficulty obtaining accurate measurements for the gap between bearing inner race and bushing using above method Is encountered, the following alternate method may be used.

e.1 Move lever along bolt axis to one side until bearing inner race contacts bushing in center frame. Using a feeler gage, measure gap between mixing lever and center frame in the area indicated in figure 5-30.1.

NOTE

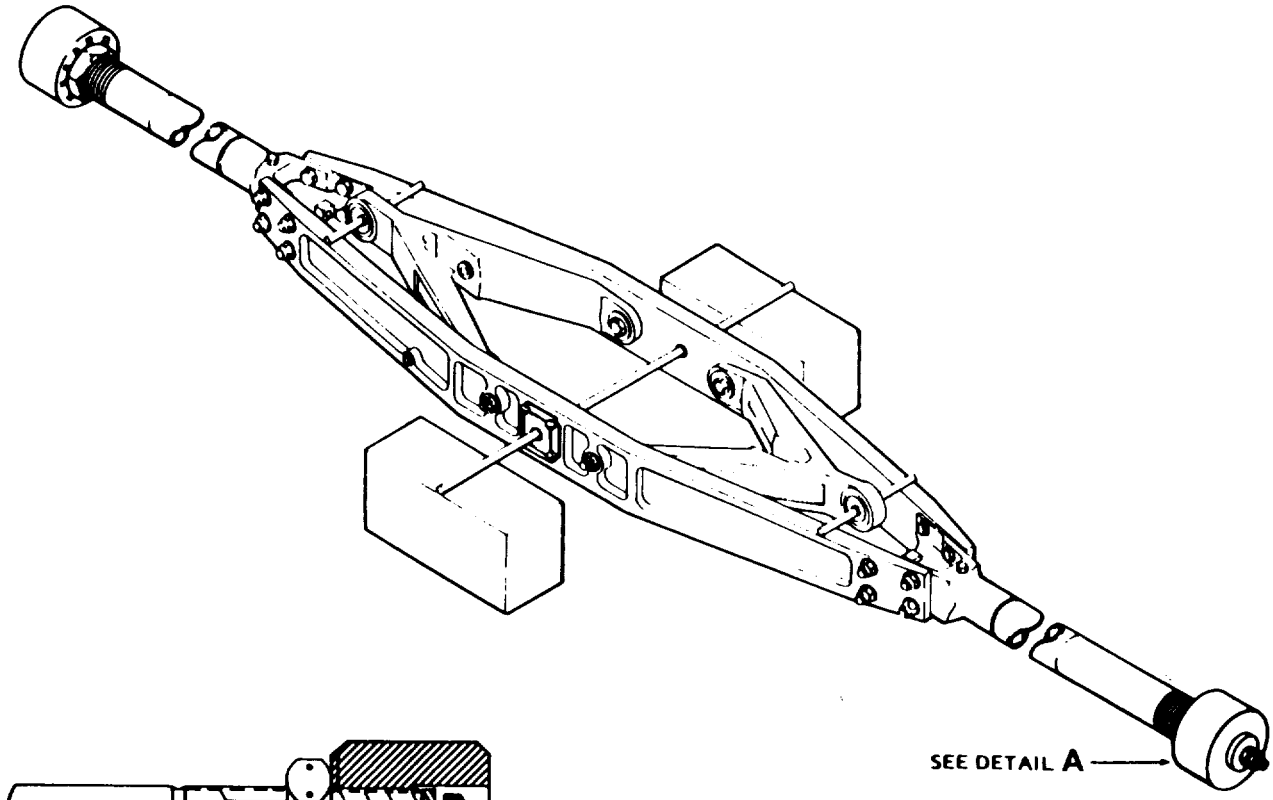
Ensure area where measurement is taken is free of burrs.

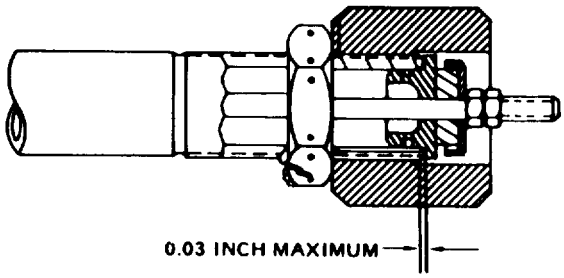
e.2 Record measurement. Move lever along bolt axis in opposite direction until other bearing inner race contacts the bushing in center frame. Again measure gap in exact area as before.

CAUTION

Both measurements must be taken on same side in the area indicated in figure 5-30.1.

e.3 Subtract larger measurement from smaller measurement. Use this figure to determine total number of AN960-616 and/or AN960-616L washers required to fill gap between bearing inner races and bushings.





DETAIL A

NOTE

During balancing of stabilizer bar, if either weight is rotated toward end of tube, minimum tube engagement in weight to be flush with shoulder of counterbore in weight within 0.03 inch.

204010-2000
204-704-065A

Figure 5-31. Stabilizer Bar Balancing PN 212-010-311-101

f. Divide total number of washers required into two groups equal within thickness of one AN960-616L washer. Identify washers to appropriate lever and set aside.

NOTE

If necessary use next longer bolt.

g. Repeat procedure on opposite lever (14).

NOTE

If necessary use next longer bolt.

h. Remove temporarily installed centerframe (1). Install previously identified washer groups on appropriate lever (14) between bearing and flange of centerframe bushing. Insert bolt (13).

CAUTION

Do not install and torque mixing level pivot bolt nuts until both mixing levers have bean shimmed.

i. Install the removed centerframe. Apply zinc chromate (C312) to bolts, centerframe and tube mating surfaces and reassemble while still wet. Install washers (9) and nuts (8) on bolts (10). Torque nuts **100 TO 140** inch-pounds.

NOTE

If necessary use next longer bolt.

j. Install attaching washers (16) and nuts (17). Torque nuts **95 TO 110** inch-pounds. Install cotter pins (18).

k. Install nut (25) and lock (24) on threaded end of tube, with lock in keyway and pierced end inboard. Turn nut in past middle of tube threads.

I. Thread weight (26) on the end of the tube (23) until distance between the centerline of the bearing set (7) and the inboard edge of the flat on O.D. of weight (26) is **51.8** inches prior to static balance. (See detail C, figure 5-28.)

I.1 Deleted.

NOTE

Minimum tube engagement in weight (26) to be flush with shoulder of counter bore in weight within 0.03 inch. See detail B (PN 204-011-326-7).

m. Install packing (27, figure 5-28), bushing (28 and 29), retainer (30), and inboard nut (31) on threaded end of cable assembly (22).

m.1 Deleted.

n. Position cable assembly in center of stabilizer bar outer tube assembly and weight.

CAUTION

Use a screwdriver in slot at threaded end of cable assembly to prevent twisting cable.

o. Torque inboard nut (31, figure 5-28) **1 TO 40** inch-pounds to provide a minimum gap of **0.005** inch between retainer (30) and bushing (28).

o.1. Deleted.

p. Torque outboard nut **60 TO 85** inch-pounds.

NOTE

Minimum gap of 0.005 inch must exist as specified in step o. above.

q. Torque nut (25) **133 TO 158** foot-pounds and align to nearest lock position. Lockwire (155) lock (24) to nut (25).

r. Balance stabilizer bar assembly (paragraph 5-46).

NOTE

Balancing of the stabilizer bar is required any time the weights are disturbed, one or both mixing levers are replaced, one or both stabilizer bar tubes are replaced, the stabilizer bar assembly is disassembled and reassembled, or the balance is questionable.

5-46. Balancing — Stabilizer Bar Assembly (AVIM).

a. Remove bearing support assemblies (11, figure 5-28) from the stabilizer bar center-frame assemblies (1). Insert a rod, smaller than the inside diameter of the pivot bearing sets (7), through the center of the bearing sets. Support both ends of rod on a reasonably level surface in such a manner that the stabilizer bar is suspended by the rod (figure 5-31 or 5-31.1).

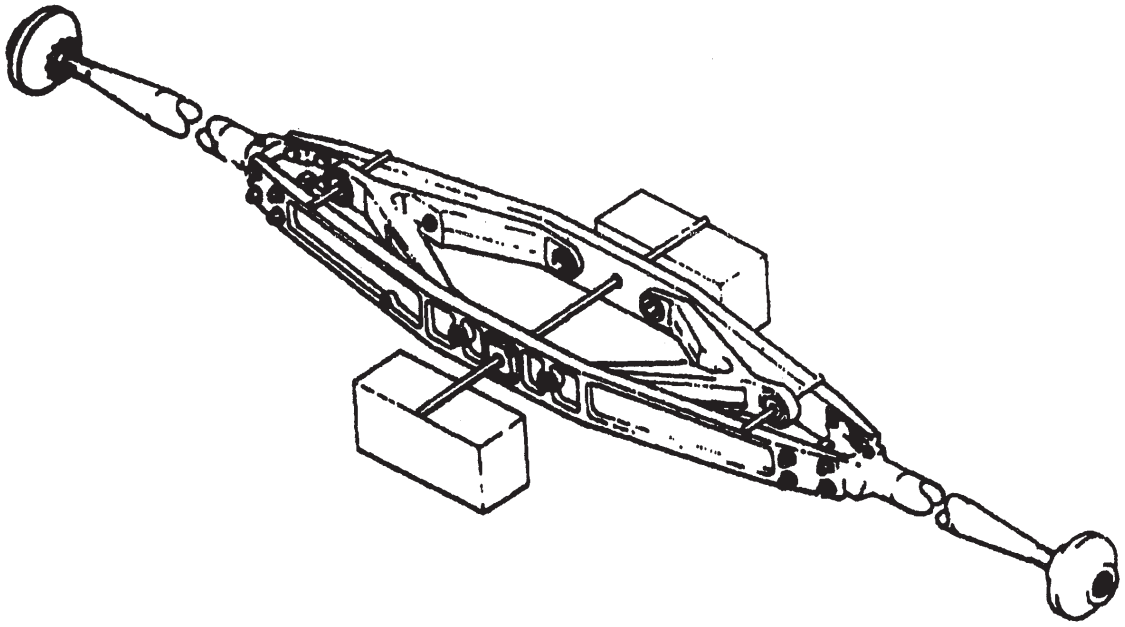


Figure 5-31.1. Stabilizer Bar Balancing

b. Support the lever assemblies (14, figure 5-28) by inserting rods of equal length through the outboard bearings and resting the rods on the center frame assemblies (1)

c. Check balance of the stabilizer bar assemblies and, if necessary, adjust as follows:

(1) On heavy end of stabilizer bar assembly, cut lockwire and disengage key-type lock (24) by backing off nut (25), using locally fabricated workaid figure 5-31.1. Screw tip weight (26) inboard until balance is obtained at nearest lock position.

NOTE

If moving weight (26) inboard does not bring bar into balance, the opposite weight may be moved outboard while maintaining minimum tube engagement shown in detail B, figure 5-28 or detail A, figure 5-31.1.

(2) Leave stabilizer bar assembly at rest for a few minutes to determine if it will remain or return to a level (horizontal) position. When this position is obtained, balance condition is then verified.

(3) Torque nut (25) **133 TO 158** foot-pounds and lockwire (155).

d. Reinstall packing (27), bushings (28) and (29), retainer (30) and nuts (31). Torque inboard nut (31) **1 TO 40** inch-pounds to provide a minimum gap of **0.005** inch between retainer (30) and weight (26). Torque outboard nut (31) **60 TO 85** inch-pounds.

e. Recheck balance of stabilizer bar. If necessary, remove nuts (31) on light side of stabilizer bar and add washers (AN960-516 and/or AN960-516L) as required between inboard nut (31) and retainer (30). Reinstall nuts (31). (Refer to step e..)

f. Deleted.

NOTE

Ensure that nut (4) does not bottom on bolt (12) when torqued. If necessary, add an additional washer (6) to prevent bottoming.

g. Position supports (11) on center frame (1) and install bolts (12), washers (6), and nut (4). Torque nuts (4) **500 TO 700** inch-pounds. Install cotter pins (5).

5-47. Installation — Stabilizer Bar and Control Tubes.

WARNING

Rotor Controls Parts Kit, P/N 204-1629-2, must be replaced as a kit. Replacement of individual bolts within the kit is not authorized (see figure 1-15, Rotor Controls Parts Kit).

a. Observing color code, position stabilizer bar on main rotor hub trunnion. Attach each support, (4, figure 5-27) with long bolts (1) and washers (2) in upper holes and bolts (3) with washers (2) in lower holes. Torque in accordance with figure 5-5. Lockwire (C157) bolts in vertical pairs.

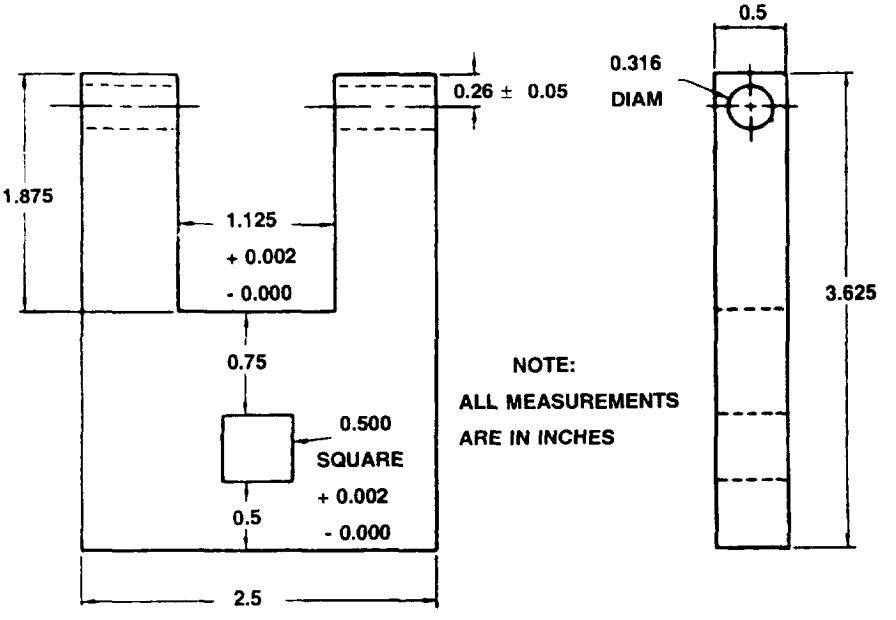
NOTE

To prevent chafing between a control tube and a mixing lever or scissors lever install a rubber washer (40, figure 5-27) between the lever and the control tube clevis, on the side on which heavy contact is noted, but not to cause vertical binding between tube clevis and lever. (This will normally be the trailing edge side of the mixing lever). More than one rubber washer (40) may be used provided control movements are not hindered. The bumper washer may be locally fabricated from MIL-R-7362D approximately 0.031 inch rubber with a 1.50 inch OD and 0.625 inch ID. Environmental conditions may exist (i.e., sand and abrasive dust) that accelerate clevis wear due to their lodging between the rubber washer and inner surface(s) of clevis. Anti-chaffing pad(s) may be fabricated from melamine resin glass cloth, MIL-P-15037, (P/N DK-1, Appendix D) and bonded with EA9313 (or equivalent) to inner surface of the clevis. Surface of clevis will be free of paint and grease prior to application of adhesive. Surface of anti-chaffing pad may be lightly scuffed prior to adhesive application.

b. Connect control tubes (21, figure 5-27, sheet 1) to scissors (25) with bolt (19), and two washers (20), washer (22) and nut (23). (Torque in accordance with figure 5-5). Install cotter pin (24). Connect control tube (21, sheet 2) to mixing lever using bolt (36), washers (37), rubber washer (40), and nut (38). Torque nut (38) in accordance with figure 5-5 and install cotter pin (39, figure 5-27).

NOTE

When installing the control tubes to mixing levers and scissor levers, ensure there are two washers



MAKE FROM 1/2 INCH STEEL

USE BOLT AN5-30A OR AN5H30A

Figure 5-31.2 Stabilizer Bar - Jamnut Work Aid

under head of both the upper and lower attaching bolts. Only one washer will be used under nut. Both bolts will be installed In the direction of rotation.

If this should result in interference between cotter pin and opposite scissors lever, install cotter pin with head horizontal to slot in nut.

c. Adjust pitch change links (8, figure 5-27) length in accordance with figure 5-9. Clevis and rod end bearing shall be installed into pitch change link barrel approximately the same number of turns so that the exposed thread length is equal within 0.030 inch on each end. Witness holes, if any, should be covered.

d. Lubricate all fittings on pitch change link with grease (C129). Purge grease past seals to ensure lubrication.

NOTE

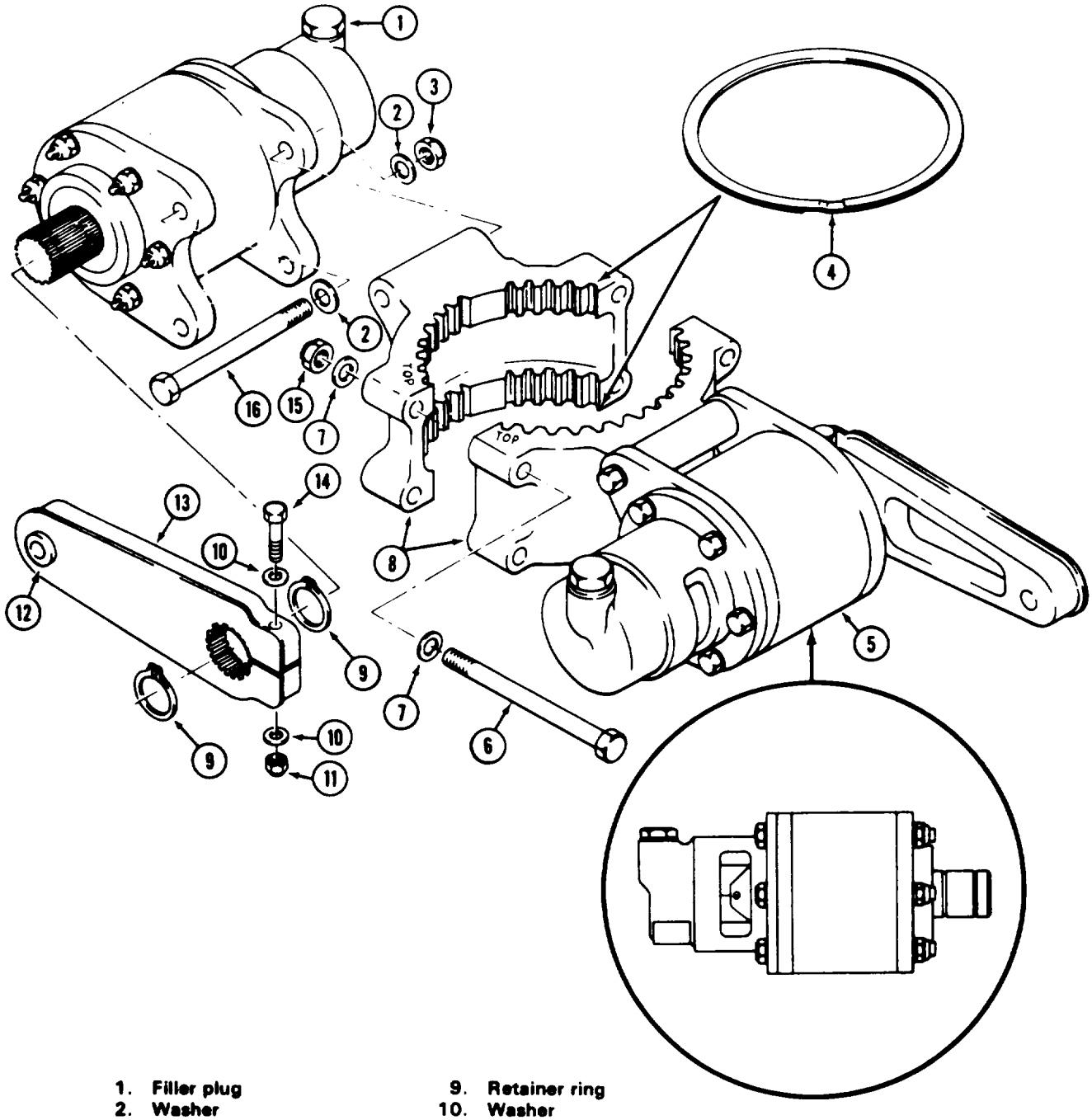
When connecting pitch change links (8, figure 5-27) to pitch horn, install bolt with heads inside of pitch horn. It is permissible to alter washer configuration provided a minimum of one and maximum of two AN960-616 washers are used under nut. A single thin washer should not be installed under nut. If any additional washers are required (for rotter pin alignment), MS20002C6 washer shall be used under bolt head with chamfer next to the bolt head and AN960-616/616L. Washers used as necessary.

d.1. Install pitch link universal on clevis with grease fitting facing inboard on top and aft on lower section of universal. This will not allow rain to be forced into fitting.

e. Remove grip positioning links (T41), install washer and nut on pillow block bolts. Torque 100 to 140 inch-pounds and connect pitch change links (8, figure 5-27) to main rotor pitch horns with bolt (9), washer (7) and nut (5). Torque in accordance with figure 5-5. Install cotter pin (6, figure 5-27). Connect upper end of link to mixing lever using bolt (32), washers (33) and nut (34). Torque nut in accordance with figure 5-5 and install cotter pin (35, figure 5-27).

NOTE

The pitch change link rod end should be centered in the pitch horn when torquing.



1. Filler plug
2. Washer
3. Nut
4. Retainer rings (2)
5. Damper assembly
6. Bolt
7. Washer
8. Adapter set
9. Retainer ring
10. Washer
11. Nut
12. Bushing
13. Lever arm
14. Bolt
15. Nut
16. Bolt

Figure 5-32. Dampers and Adapter

f. Torque jamnuts on pitch change links, **650 TO 800** inch-pounds. Check hole in barrel to insure sufficient thread engagement. Lockwire (C155) upper jamnut to barrel. Lockwire (C155) upper jamnut to clevis. Lockwire (C155) lower jamnut to barrel.

NOTE

When assembling damper link tube ensure safety washer (P/N 206-010-324-1) is inserted between bolt head and bearing.

g. Connect damper link tubes (18, figure 5-27, sheet 2) to stabilizer bar with bolt (26), special washer (27), (cupped side of washer outboard), two washers (28 and 29) and nut (30). Torque **50 TO 70** inch-pounds and install cotter pin (31).

h. If damper links require adjustment-due to parts replacement, proceed as follows:

(1) Pull stabilizer bar down against its stop and swing damper arm down as far as it will go.

(2) Adjust damper link tube (18) to fit, shorten it 2 to 2 1/2 turns, and leave it disconnected; adjust the opposite tube in the same manner. Position link tube so each rod end is centered with respective attachment bolt. With lower end of link tube disconnected and rod ends correctly positioned, torque jamnut **270 TO 300** inch pounds. Repeat procedure for opposite link tube.

NOTE

Use grease pencil to mark the position of link tube and rod ends prior to torquing jamnut. While torquing jamnut use an open end wrench to hold lower rod end just above bearing, use care not to damage uniball bearing. After torquing jamnut check that rod end positioning is still correct.

i. Connect damper link tubes (18, sheet 1) from stabilizer bar to leading sides of damper levers (13). Install bolts (11) from leading side with special washer (12) installed next to bolt head with cup side of washer facing in direction of rotation. Install one steel washer (17) between bushing in damper level (13) and link tube bearing and one aluminum alloy washer (14) under nut. Install nut (16) and torque **50 TO 70** inch-pounds. Install cotter pin (15).

5-48. DAMPERS AND ADAPTER.

5-49. Description - Dampers and Adapter. Two rotary viscous type dampers (see figure 5-32) are mounted on adapters, which are attached on mast splines below main rotor. Levers on damper wingshafts are connected by control tubes to each side of stabilizer bar frame. Dampers are nonadjustable, being present for required stiffness of action. Each has a filler plug for such occasional addition of hydraulic fluid (C130), as may be necessary due to minor leakage.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

5-50. Cleaning - Dampers and Adapter. Clean dampers and adapter using solvent (C261) and clean cloths.

5-51. Lubrication - Dampers and Adapter. Refer to Paragraph 5-54 for servicing of dampers.

5-52. Testing - Dampers and Adapter. Perform limited test flight in accordance with TM 55-1520-242-MTF.

5-53. Removal - Dampers and Adapter.

a. To remove either damper: Disconnect control tube rodend from damper lever (13, figure 5-32) by removing bolt with cotter pin, nut, and washers. (See figure 5-27.) Detach damper from adapter by removing two bolts (16, figure 5-32) with nuts (3) and washers (2).

b. To remove lever (13) from damper wingshaft, remove retainer ring (9) from outer groove of shaft, loosen nut (11) on clamping bolt (14), and pull lever off shaft. Remove inner retainer ring (9) from shaft.

c. To remove adapters, remove spiral retaining ring (4) from groove in mast splines above adapter set, (8), remove four adapter clamp bolts (6), with nuts (15) and washers (7), and slide adapters from mast. Remove lower retaining ring (4) as necessary.

5-54. Inspection - Damper and Adapter.

NOTE

Large washer in front plate of damper may turn with wingshaft. This is not an abnormal condition and does not affect damper serviceability.

a. Inspect dampers for leakage.

(1) If damper shows signs of fluid leakage or if level can be seen slightly below top of window, remove filler plug, fill damper with hydraulic fluid (C130), reinstall plug and lockwire (C155). Therefore, check damper frequently for further leakage.

(2) If fluid level falls more than 1/8 to 3/16 inch below top of window, satisfactory filling without trapped air may not be possible and replacement of damper may be necessary.

(3) Damper must be replaced for the following:

(a) Inability to observe indicator pin because of fluid discoloration.

(b) Failure to meet the following timing check: Move the damper lever ARM against the stop, then quickly move the ARM to neutral. The indicator pin visible in the reservoir window should require four to six second to return to the cam surface.

NOTE

There is no specific oil contamination level established for the damper. Excessive contamination results in slow timing. If damper times properly, do not remove it for contamination.

b. Inspect lever arms (13, figure 5-32) and adapter (8) for obvious damage, cracks, and deformation. Inspect bushing (12) for wear, maximum diameter 0.252. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

(1) See figure 5-33.1 for damage areas and limits.

(2) No cracks are permissible. Deformation that does not cause binding of the control rod bolt is permissible.

(3) Allowable spline damage can be up to 11 splines, provided that not more than 9 splines are adjacent.

c. Inspect damper wingshaft splines to the criteria shown on figure 5-33. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

d. Inspect damper window for leaks, cracks, and cloudiness. If window is leaking, cracked, or cloudy, replace damper.

e. Inspect adapter set for damage. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

5-55. Repair or Replacement - Damper and Adapter.

a. Replace damper or other parts which fail to meet inspection requirements.

b. (AVIM) Replace bushing (12, figure 5-32) as follows:

(1) Support lever arm (13) and press out bushing (12).

(2) Coat new bushing (12) with unreduced primer (C312). Press bushing into lever arm (13) while primer is still wet.

(3) Ream bushings **0.249 TO 0.2505** inch.

5-56. Installation - Dampers and Adapter.

WARNING

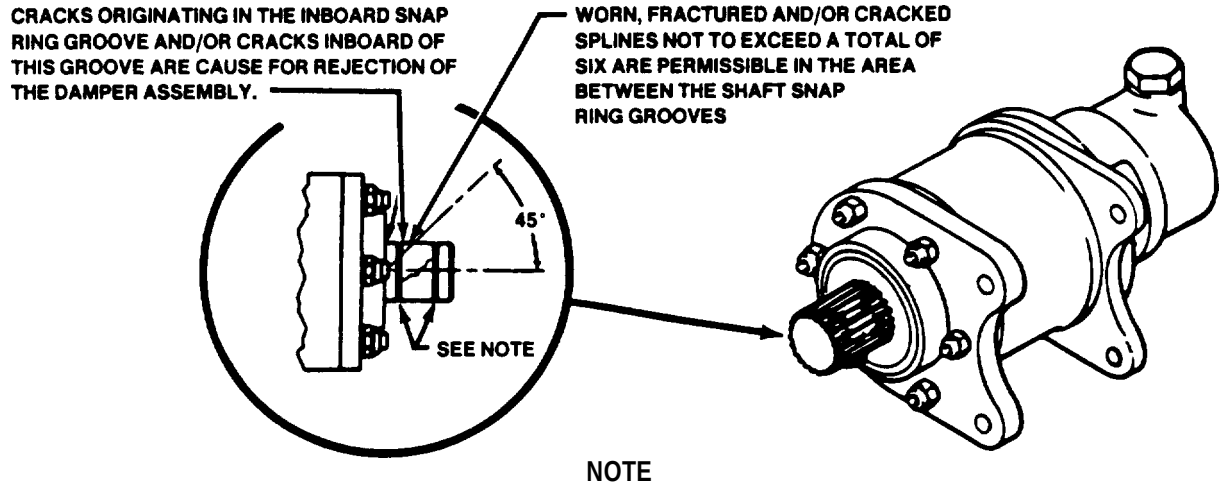
Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

a. Clean mast splines and adapter splines (8, figure 5-32) with solvent (C261). Coat mast splines with corrosion preventive compound (C86).

WARNING

Use alternate tightening procedure to torque four nuts evenly. Torque each nut in increments of 10 inch-pounds, until a torque value of 50 TO 70 inch-pounds is obtained. Do not attempt to pull the supports into the mast splines by means of the attaching bolts. Chipping or fracturing the support splines, bolt lugs, and/or the entire support may result.

b. Install spiral retaining ring (4) in lower groove of mast splines. Align adapter (8) halves with the etched word "top" facing upward. The longer leg of each adapter half installed in the direction of rotation. Position adapters according to markings and master

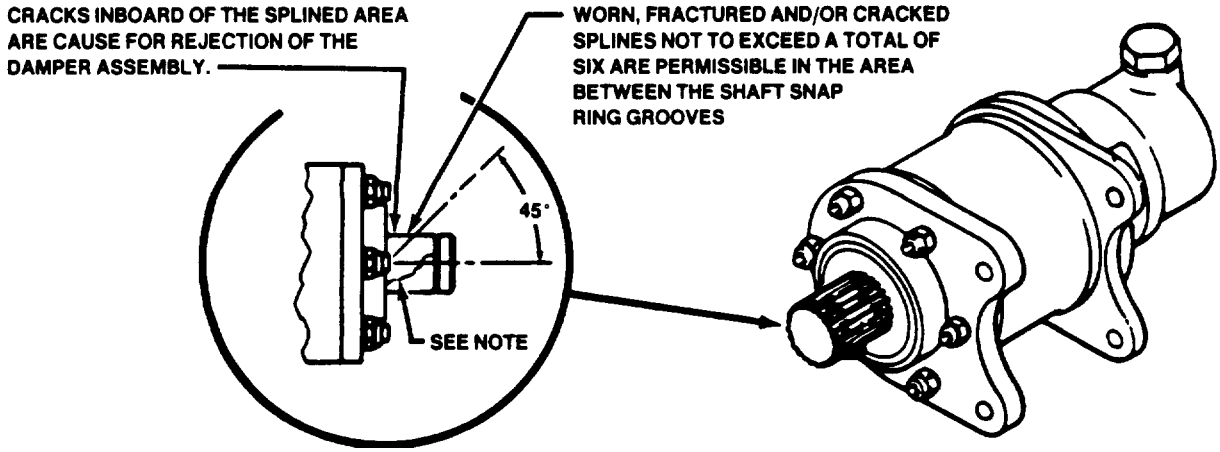


NOTE

Longitudinal cracks in the area between the snap ring grooves which fall within the following limits are permissible.

1. The direction of the cracks is not in excess of 45 degrees to the longitudinal axis of the shaft.
2. The crack(s) does not cross more than a total of nine shaft splines.
3. The crack does not extend through the shaft wall. (A crack through the shaft wall would be indicated by hydraulic fluid leakage.)
4. No more than six splines chipped, missing or broken are allowed. More than three adjacent damaged splines is cause for rejection.

DAMPER PART NO. 204-010-937-5



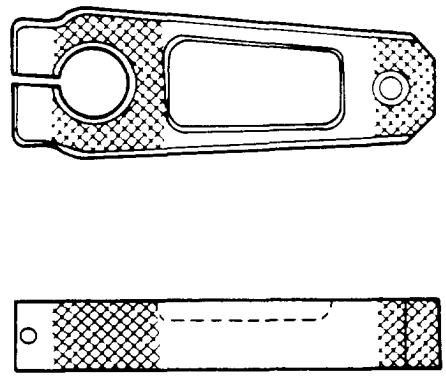
NOTE

Longitudinal cracks in the splinad area of the shaft which fall within the following limits are permissible:

1. The direction of the crack is not in excess of 45 degrees to the longitudinal axis of the shaft.
2. The crack(s) does not cross more than a total of nine shaft splines.
3. The crack does not extend through the shaft wall. (A crack through the shaft wall would be indicated by hydraulic fluid leakage.)
4. No more than six splines missing or broken are allowed. More than three adjacent damaged splines is cause for rejection.

DAMPER PART NO. 204-010-937-7

Figure 5-33. Damper Shaft Inspection



TYPE OF DAMAGE	DAMAGE AREA REPAIR SYMBOLS MAXIMUM DEPTHS AND REPAIR AREAS	
MECHANICAL	0.010 In. before and after repair	0.020 In. before and after repair
CORROSION	0.005 In. before repair 0.010 In. after repair	0.010 In. before repair 0.020 In. after repair
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 Sq. in	0.25 Sq. in.
NUMBER OF REPAIRS	One per segment	Not critical
EDGE CHAMFER TO REMOVE NICKS AND DENTS	0.020 In.	0.040 In

Figure 5-33.1. Lever Arms — Damage Limits

splines, and slide onto mast. Install four bolts (6) (with heads in direction of rotation) with washers (7) and nuts (15) and torque evenly **50 to 70** inch-pounds. Install retainer ring (4) in groove of mast splines above adapter set.

c. To install damper (5) on adapter (8), position damper on adapter, with wingshaft toward rotation, and install two bolts (16) with washer (2) under each head and nut (3).

d. To install lever assembly (13), clean damper shaft splines and lever assembly splines with solvent (C261).

CAUTION

Adhesive (C32) is supplied in 2 parts. Use only part "A". Do not mix part "B" (activator) with part "A". Do not use primer or accelerator. This adhesive is used as a filler and not for bonding the lever assembly to the wingshaft. Do not coat the damper shaft splines or the lever assembly splines with corrosion preventive compound.

(1) Apply adhesive (C32) to the damper shaft.

NOTE

Lever assemblies (13) must be installed with the flange of bushing (12) in direction of rotation.

NOTE

Incorrect positioning of the lever assembly on the wingshaft will result in damper bottoming internally prior to stabilizer bar center frame contacting support stops and the shaft splines being loaded excessively.

NOTE

Some damper assemblies do not have an inboard retaining ring groove. When installing these dampers, disregard the first sentence of step (2) below.

(2) Install retainer ring (9) in the inboard groove on damper wingshaft. Turn shaft to align pin and mark on cam as seen through damper window. Place lever assembly (13) on shaft horizontal to the closest serration.

(3) Torque nut (11). Incorrect torquing of this bolt will result in wear, fretting or shearing of shaft splines.

(4) Install retainer ring (9) in outer groove.

d.1. Prior to incorporation of MWO 55-1520-242-50-1, proceed to next step. After incorporation of MWO 55-1520-242-50-1, (Hub moment springs and support assembly) assure that procedure of para. 5-56.6 is completed before proceeding with next step.

e. Adjust and connect control tubes to lever assembly per instructions in para 5-47 and 5-47i.

(1) Deleted.

(2) Deleted.

(3) Deleted.

(4) After installation of control tubes (fig. 5-27) (18 and 21), pull stabilizer bar down each way and check that the center frames contact the support stops each way prior to bottoming out the damper assembly.

5-56.1. HUB MOMENT SPRINGS AND SUPPORT ASSEMBLY. (After incorporation of MWO 55-1520-242-50-1).

CAUTION

Remove elastomeric springs prior to operating aircraft when OAT is below -5 degrees Fahrenheit (-20 degrees Celsius). Elastomeric springs shall be reinstalled when OAT is expected to stay above -5 degrees Fahrenheit or the threat of sub -5 temperatures no longer exists.

5-56.2. Description - Hub Moment Springs and Support Assembly. Two hub moment springs attached to a support assembly are mounted under main rotor hub on the mast. The leg of each support aligns with upper mounting bolt of the damper. The hub springs provide an additional margin of safety in the event of an inadvertent excursion of the helicopter beyond the approved flight envelope.

5-56.3. Removal - Hub Moment Springs and Support Assembly.

a. Remove support assembly (3, figure 5-33.1) as follows:

(1) Remove nuts (1 and 10), washers (2 and 7), and bolts (5 and 6).

(2) Remove support assembly (3) from mast (9).

NOTE

Hub moment spring (11) may be removed while support assembly (3) is installed on mast (9).

b. Remove hub moment springs (11) from support assembly (3) as follows:

(1) Cut lockwire (4) attached to bolts (12).

(2) Remove bolts (12) and washers (13).

(3) Remove hub moment springs (11) from support assembly (3).

5-56.4. Inspection - Hub Moment Springs and Support Assembly.

a. Inspect support assembly for condition (figure 5-33.2).

b. Inspect hub moment spring for condition (figure 5-33.3). If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

5-56.5. Repair or Replacement - Hub Moment Springs and Support Assembly.

a. Replace support assembly if limits of figure 5-33.2 are exceeded.

b. Replace hub moment springs if limits of figure 5-33.3 are exceeded.

5-56.6. Installation - Hub Moment Springs and Support Assembly.

a. Install support assembly (3) on mast (9) as follows:

(1) Position support assembly (3) on mast (9) so that each support is firmly seated down on the upper radius of damper splines. Also ensure legs of support assembly align with damper upper bolt shanks.

(2) Loosely install bolts (5 and 6), washers (2 and 7), and nuts (1 and 10).

CAUTION

Nuts (1 and 10) shall be torqued evenly to prevent damage to support assembly (3). Support assembly (3) shall be seated so that gap between support assemblies is equal to within 0.020 inch. Failure to comply may result in damage to support assemblies.

(3) Torque nuts (1) **160 to 180** inch-pounds. Torque nuts (10) **100 to 120** inch-pounds.

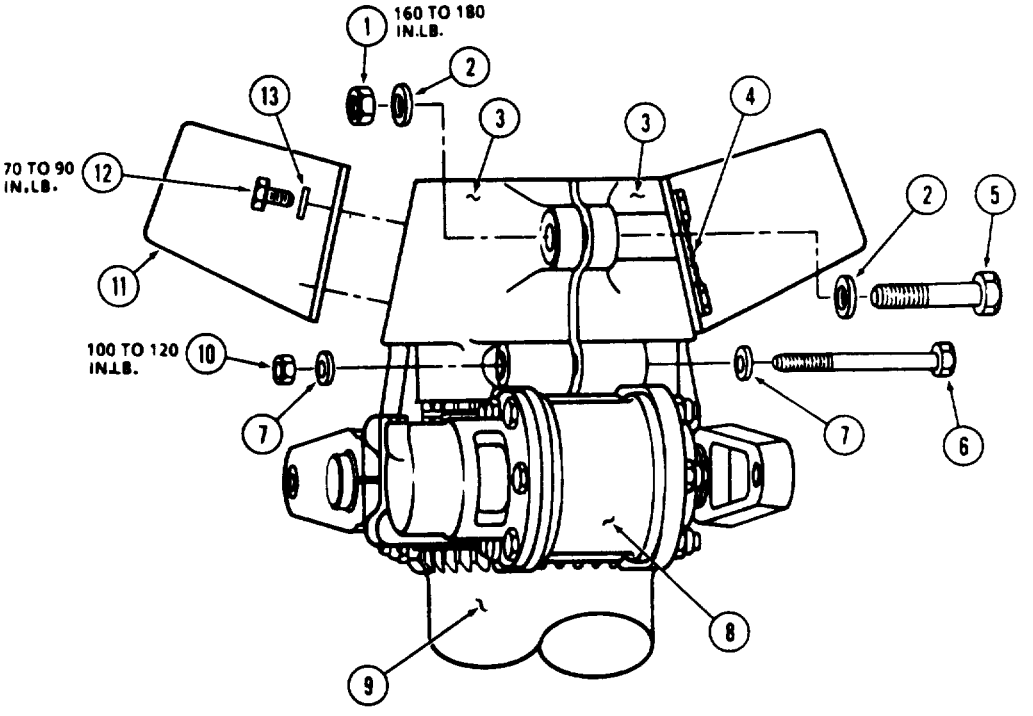
NOTE

Hub moment springs (11, figure 5-33.1) may be installed while support assembly (3) is installed on mast (9).

b. Install hub moment springs (11) on support assembly (3) as follows:

(1) Secure hub moment springs (11) to support assembly (3) with bolts (12) and washers (13).

(2) Torque bolts (12) **70 to 90** inch-pounds and secure in place with lockwire (C155) (4).



1. Nut
2. Washer
3. Support assembly
4. Lockwire
5. Bolt
6. Bolt
7. Washer
8. Damper
9. Mast
10. Nut
11. Hub moment spring
12. Bolt
13. Washer

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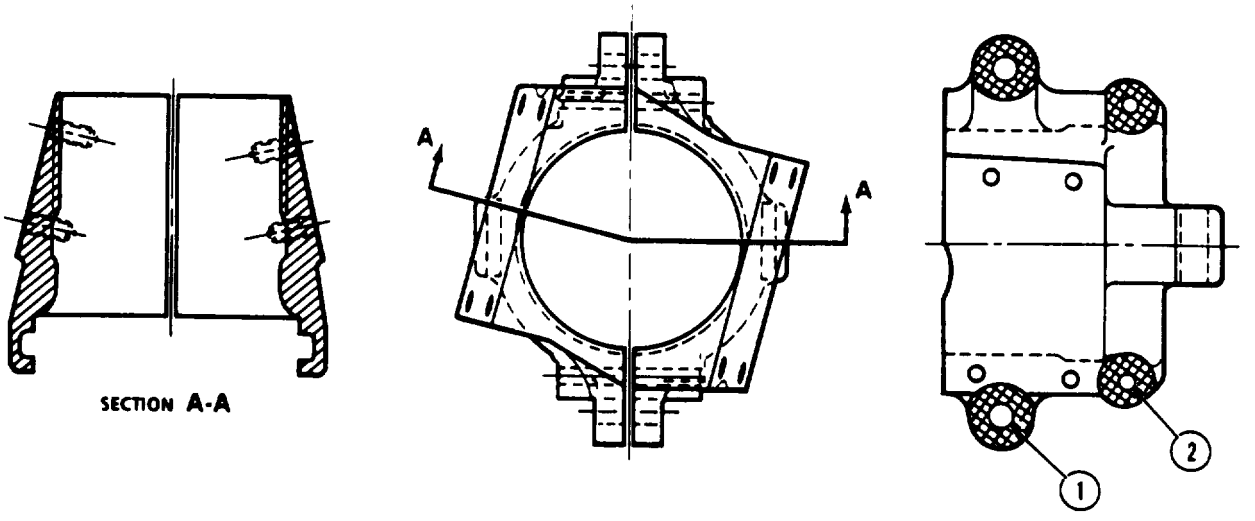
Figure 5-33.1. Hub Moment Springs and Support Assembly (After Incorporation of MWO 55-1520-242-50-1)



TYPE OF DAMAGE	DAMAGE AREA REPAIR SYMBOLS	
	MAXIMUM DEPTHS AND DAMAGE AREAS ALLOWED	
NICKS, SCRATCHES, SHARP DENTS MAXIMUM DAMAGE DEPTH (MECHANICAL)	0.020 IN.	0.030 IN.
MAXIMUM AREA OF FULL-DEPTH REPAIR	0.10 SQ. IN.	2.0 SQ. IN.
MAXIMUM EDGE CHAMFER	0.060 IN.	0.060 IN.
MAXIMUM NUMBER OF REPAIRS	ONE PER AREA	THREE PER AREA
MAXIMUM ACCEPTABLE HOLE DIAMETER	(1) 0.389 IN.	
	(2) 0.271 IN.	
CORROSION DAMAGE	0.020 IN.	0.020 IN.

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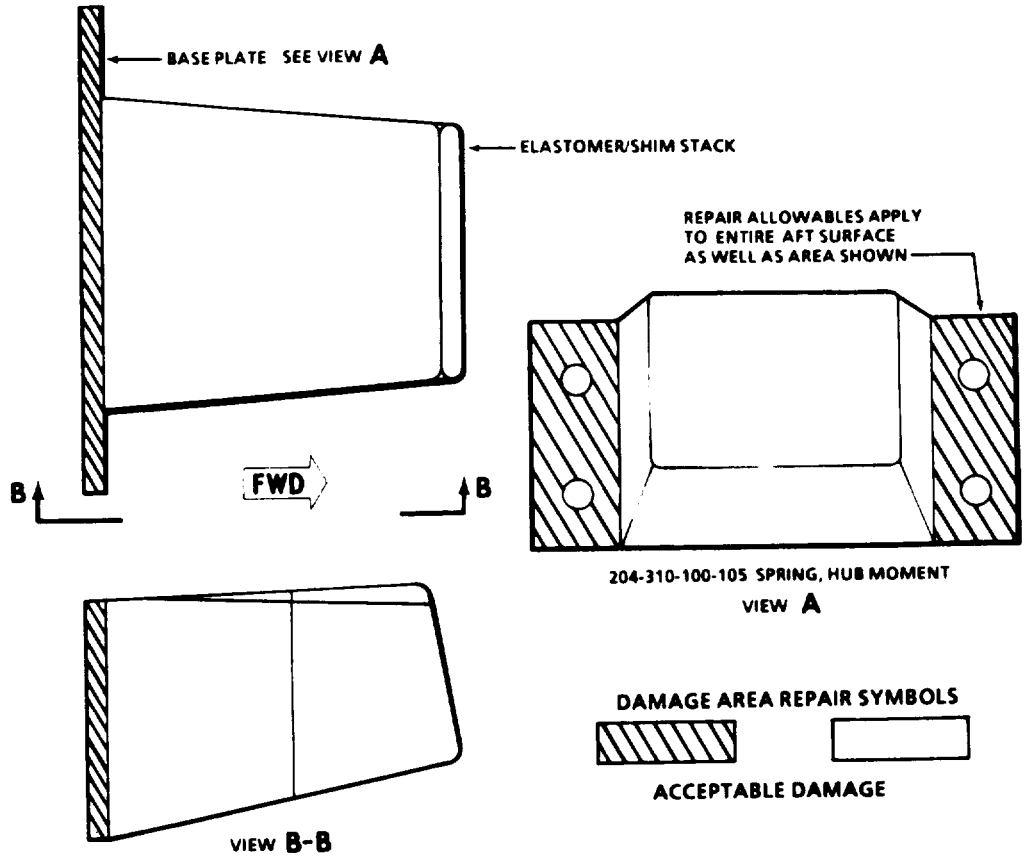
Figure 5-33.2. Support Assembly – Damage Limits (After Incorporation of MWO 55-1520-242-50-11



TYPE OF DAMAGE	
NICKS AND SCRATCHES	
MAXIMUM DAMAGE DEPTH	0.020 IN.
MAXIMUM AREA OF FULL DEPTH REPAIR	0.025 SQ. IN.
MAXIMUM EDGE CHAMFER	0.060 IN.
MAXIMUM NUMBER OF REPAIRS	NOT LIMITED
MAXIMUM ACCEPTABLE HOLE DIAMETER	0.262 IN.
CORROSION DAMAGE	0.020 IN.
RUBBER DELAMINATION	(3) 0.25 IN.

NOTES:

1. Reject shims if cracks are present.
2. Repair is limited to cleaning nicks, scratches, and corrosion within given allowable and to touch up finish.

(3) Delamination of rubber from base or shims is allowable up to 0.25 inch deep measured using a 0.010 inch feeler gage.

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Figure 5-33.3. Hub Moment Spring – Damage Limits (After Incorporation of MWO 55-1520-242-50-1)

5-57. SWASHPLATE AND SUPPORT ASSEMBLY

5-58. Description — Swashplate and Support Assembly. A swashplate and support assembly and a scissors and sleeve assembly are installed together, mounted around mast at top of transmission. The control unit transmits movements from cyclic and collective control systems mounted in cabin and fuselage to linkages which rotate with main rotor. Swashplate is mounted on a universal support, for tilt related to position of cyclic control stick. Collective sleeve moves vertically within swashplate support, as actuated by collective control stick. Combined effect on scissor levers and upper linkage determine main rotor lift and directional control (Figure 5-34)**.**

5-59. Lubrication — Swashplate and Support Assembly. Refer to figure 1-6 for swashplate lubrication.

5-60. Inspection — Swashplate and Support Assembly. (Installed)

a. Deleted.

b. Check trunnion bearings (7, figure 5-37) for wear.

NOTE

Bearings PN 204-011-451 and PN KSP9001 series are used. Both types of trunnion bearings can be installed in the swashplate at the same time and removed in the same manner. The tolerance between the bearings and swashplate are the same for both types of trunnion bearings (Figure 5-35).

(1) Inspect trunnion bearings, PN 204-011-451-1, for freedom, axial chuck (play) and roughness, both cross head and barrel. Play not to exceed **0.020** inch.

NOTE

This bearing is a roller bearing with tapered inner and outer races and may be assembled within 0.0005 inch tight to 0.0005 inch loose fit. The bearings assembled with a tight fit may exhibit a slight roughness. However, if the roughness is not consistent through one revolution or the bearing locks when rotated with an axial force applied, replace the bearing.

(2) Check trunnion bearing, PN KSP 9001-1/-3/-5, for wear, axial play shall not exceed **0.020** inch and radial play shall not exceed **0.020** inch.

(3) Visually inspect trunnion bearings (PN KSP 9001,-1,-3,-5) for cracks in uniball shoulder. Cracks are cause for replacement.

WARNING

If trunnion bearings are replaced due to cracks, a new Rotor Controls Parts Kit, P/N 204-1629-2 (which includes bolt 4, figure 5-34), must be installed.

NOTE

If trunnion bearings are replaced due to cracks, the bolt (4, figure 5-34) should be replaced with a new bolt upon reassembly and installation.

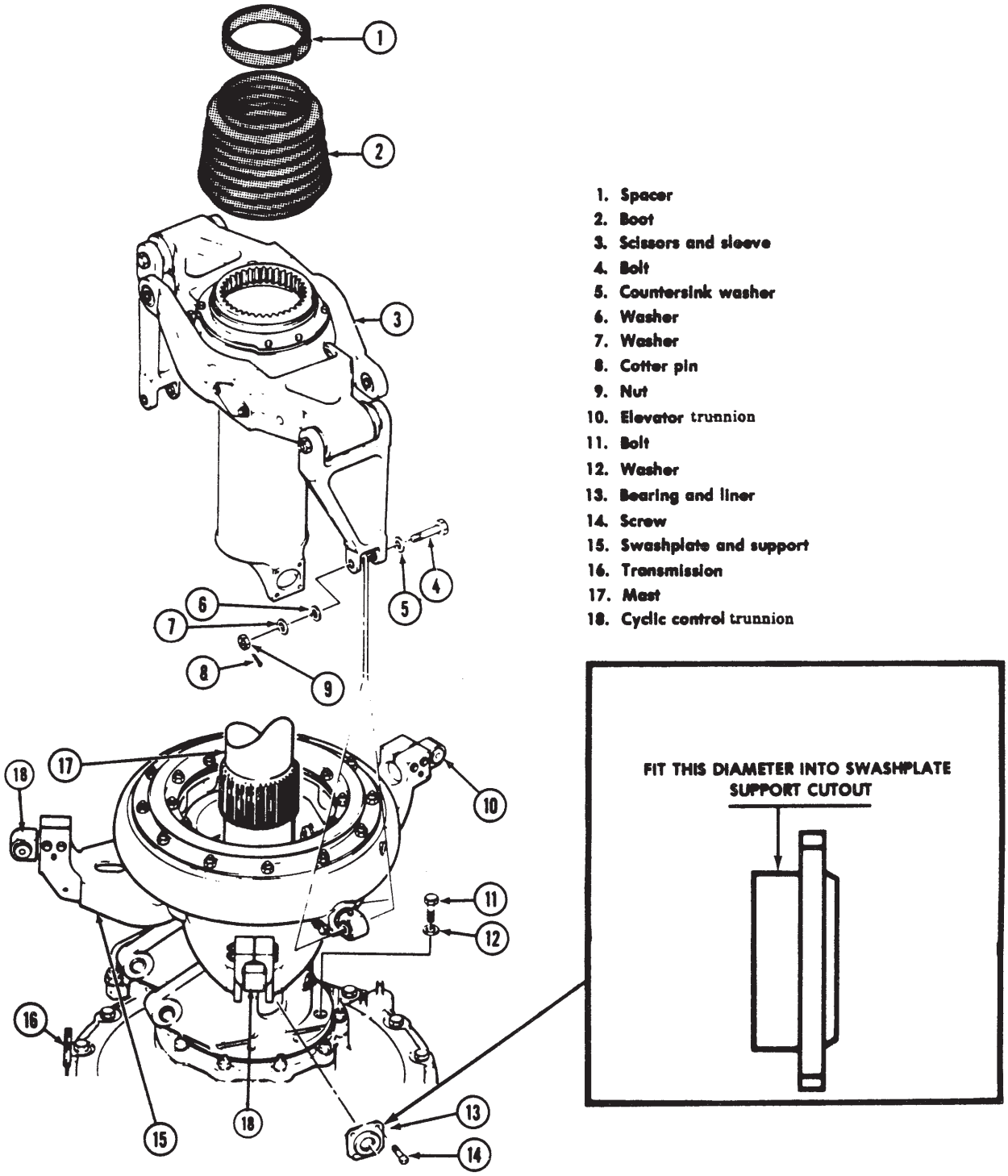


Figure 5-34. Swashplate and Support, and Scissors and Sleeve Installation

NOTE

Trunnion bearings, PN KSP9001 Series, are uniball bearings which should never be greased. Wear should be checked with a dial indicator. Axial or radial play not to exceed 0.020 inch. Trunnion bearings, PN KSP9001 Series, will allow the servo cylinder to be manually rotated. However, no flight loads will be experienced that could cause the servo to rotate when the hoses are correctly routed and properly rigged. The servo cylinders should be cycled and the hoses checked for chafing or interference whenever work is done on the control rigging.

NOTE

PN KSP9001-3 or -5 trunnion bearings differ from PN KSP9001-1 in having two small plastic snubbers to aid in the correct positioning of the cyclic and collective servo cylinders during trunnion or servo cylinder installation or maintenance. PN KSP9001-3 or -5 trunnion bearings with one or both snubbers missing may be treated as a PN KSP 9001-1 trunnion bearing. Missing snubbers do not affect the serviceability of the trunnions.

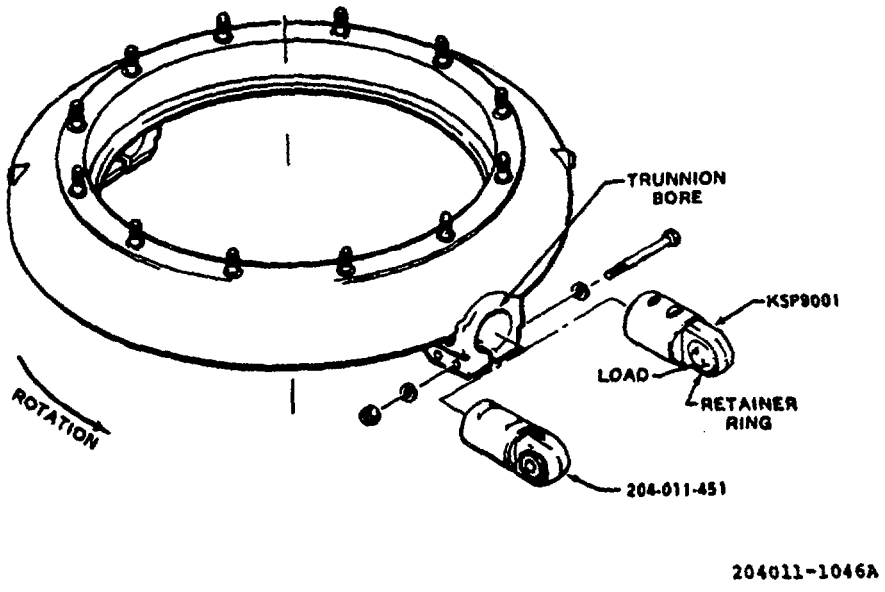


Figure 5-35. Trunnion Bearing Installation

c. Inspect components of swashplate for mechanical and corrosion damage. (See figure 5-36.) If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

NOTE

The following inspection is to be performed at each phase inspection or whenever problems with the swashplate bearing are suspected. The inspection shall be done before lubrication.

d. Inspect for swashplate bearing wear or failure as follows:

(1) Disconnect scissors drive links from trunnions on swashplate outer ring (paragraph 5-78g) and secure to prevent damage.

(2) Rotate the swashplate outer ring and check the bearing for roughness, binding, and unusual noise. Check for vertical play between the inner and outer rings; play is not permitted. Replace the swashplate if any of these conditions are found.

(3) Reconnect the scissors drive links on the trunnions (paragraph 5-84c).

5-61. Removal - Swashplate and Support Assembly.

a. Remove stabilizer bar with attached control tubes (paragraph 5-40).

b. Remove main rotor hub and blades (paragraph 5-12).

c. Remove dampers and adapter (paragraph 5-53).

NOTE

When removing complete unit with collective levers assembled omit step D and disconnect collective cylinder control tube from trunnion of collective levers (paragraph 7-84).

d. Remove collective levers (paragraph 5-70).

e. Remove spacer (1, figure 5-34) and boot (2).

NOTE

Swashplate and support and scissors and sleeve can be removed as an assembly. If removing as an assembly omit step f. and proceed to step g.

f. Remove scissors and sleeve (paragraph 5-78).

g. Disconnect cyclic (paragraph 7-84) and elevator (paragraph 11-175) control tubes from trunnions (10 and 18) of swashplate (15). Insert a piece of folded paper or cardboard into each of the four gimbal support devises to prevent damage during handling.

h. Remove eight bolts (11) and washers (12) which secure swashplate support to cap plate on transmission.

i. Carefully, lift assembly from mast.

5-62. Disassembly - Swashplate and Support Assembly. Item numbers below refer to figure 5-37 unless otherwise indicated. Disassemble swashplate only to extent necessary to accomplish inspection and repair.

a. Remove nuts (5), washers (6), and bolt (8) from outer ring.

b. Remove nuts, washers, and bolts and remove plates (12 and 17) from inner ring (Detail A and B, figure 5-37).

CAUTION

Do not use any device other than the work aid described to spread the housing ears during trunnion removal/installation.

CAUTION

When using work aid to remove trunnions, insert tangs of tool into slot and tighten screw until trunnion can just be pulled out. Immediately release screw tension and remove tool.

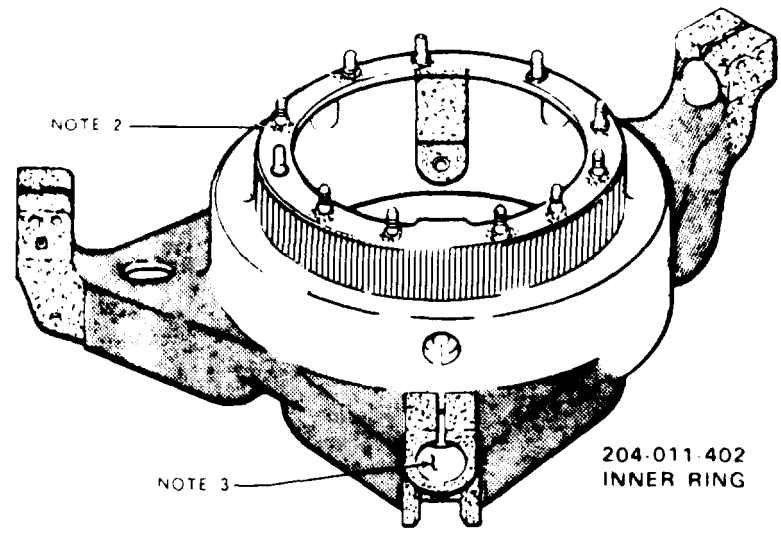
c. If not available, fabricate a work aid (figure 5-38). Remove trunnions using work aid as shown on figure 5-38.

5-63. Cleaning - Swashplate and Support Assembly.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

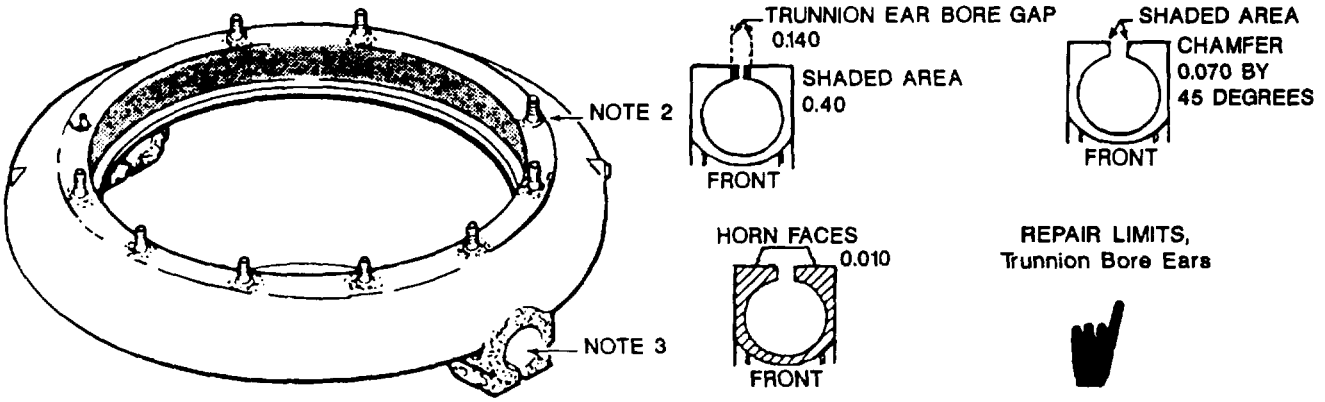
a. Clean all parts with solvent (C261).



		DAMAGE	REPAIR LOCATION	
NICKS, SCRATCHES, SHARP DENTS	0.010 IN.	0.020 IN.	0.020 IN.	0.030 IN.
CORROSION	0.005 IN. BEFORE REPAIR	0.010 IN. BEFORE REPAIR	0.010 IN. BEFORE REPAIR	0.015 IN. BEFORE REPAIR
	0.010 IN. AFTER REPAIR	0.020 IN. AFTER REPAIR	0.020 IN. AFTER REPAIR	0.030 IN. AFTER REPAIR
MAXIMUM AREA PER FULL DEPTH REPAIR	0.25 SQ. IN.	0.50 SQ. IN.	SEE NOTE 1	NOT CRITICAL
NUMBER OF REPAIR AREAS	2 PER LUG	2 PER ARM	-	NOT CRITICAL
EDGE CHAMFER	0.040 IN.	0.100 IN.	-	0.100 IN.
TRUNNION BEARING MOUNT BOLT HOLES		**MAXIMUM DAMAGE 0.002 IN. MAXIMUM DIAMETER 0.2525 IN.**		
THREAD DAMAGE:				
DEPTH	ONE THIRD OF THREAD			
LENGTH	ONE QUARTER OF CIRCUMFERENCE			
NUMBER	ONE			

NOTES
1. Surface corrosion may be cleaned up over the entire surface of the liner. Corrosion requiring full depth repair is limited to one-fourth of the total area. Segments of full depth repair should not exceed 2.0 inches in length and should maintain 0.50 inch minimum separation.
2. Top of ring within 0.5 inch of studs.
3. **Maximum scratch damage of trunnion bore 0.005 inch. Maximum damage of trunnion clamping faces 0.010 inch. Maximum bore diameter 1.2515 inch.**
4. No cracks allowed

Figure 5-36. Swashplate – Damage Limits (Sheet 1 of 3)



DAMAGE AREA REPAIR SYMBOLS

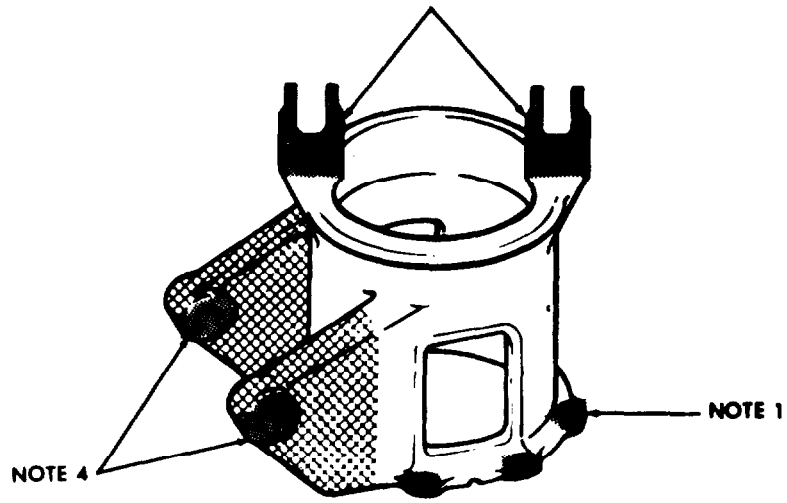
NICKS, SCRATCHES, SHARP DENTS	0.010 IN.	0.020 IN.	0,030 IN,
CORROSION	0.005 IN. BEFORE REPAIR 0.010 IN. AFTER REPAIR	0.010 IN. BEFORE REPAIR 0.020 IN. AFTER REPAIR	0.015 IN. BEFORE REPAIR 0.030 IN. AFTER REPAIR
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 SQ. IN.	SEE NOTE 1.	NOT CRITICAL
NUMBER OF REPAIR AREAS	2 PER SEGMENT		NOT CRITICAL
EDGE CHAMFER	0.030 IN.		0,100 IN.

THREAD DAMAGE:
DEPTH: ONE THIRD OF THREAD
LENGTH: ONE QUARTER OF CIRCUMFERENCE
NUMBER: ONE

TRUNNION BEARING MOUNT BOLT HOLES — **MAXIMUM DAMAGE 0.002 IN.**
MAXIMUM DIAMETER 0.2525 IN.

NOTES: 1. Surface corrosion may be cleaned up over the entire surface of the liner. Corrosion requiring full depth repair is limited to one-fourth of the total area. Segments of full depth repair should not exceed 2.0 inches in length and should maintain 0.50 inch minimum separation.
2. Top of ring within 0.5 inch of studs.
3. Maximum scratch damage of trunnion bore 0.005 inch. Maximum damage of trunnion clamping faces 0.010 inch. Maximum bore diameter 1.2510 inch.
4. No cracks allowed.

Figure 5-36. Swashplate - Damage Limits (Sheet 2 of 3)



DAMAGE AREA REPAIR SYMBOLS

NICKS. SCRATCHES SHARP DENTS	0.010 IN	0.020 IN	0.035 IN.
CORROSION	0.005 IN. BEFORE REPAIR 0.010 IN. AFTER REPAIR	0.010 IN. BEFORE REPAIR 0.020 IN. AFTER REPAIR	0.017 IN. BEFORE REPAIR 0.035 IN. AFTER REPAIR
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 SQ IN.	0.25 SQ. IN	0.50 SQ IN
NuMBER OF REPAIR AREAS	ONE PER LUG	NOT CRITICAL	NOT CRiTIC AL
EDGE CHAMFER	0.040 IN.	0.060 IN.	0.100 IN.

NOTES: 1. Mounting flange within 0.5 inch of holr center.

2. No Cracks allowed.

3. Bushing I. D. MAXIMUM DIAMETER 0.31 50 IN. MAXIMUM DAMAGE 0.002 IN.

4. Bushing L D. MAXIMUM DIAMETER 0.5025 IN. MAXIMUM DAMAGE 0.002 IN.

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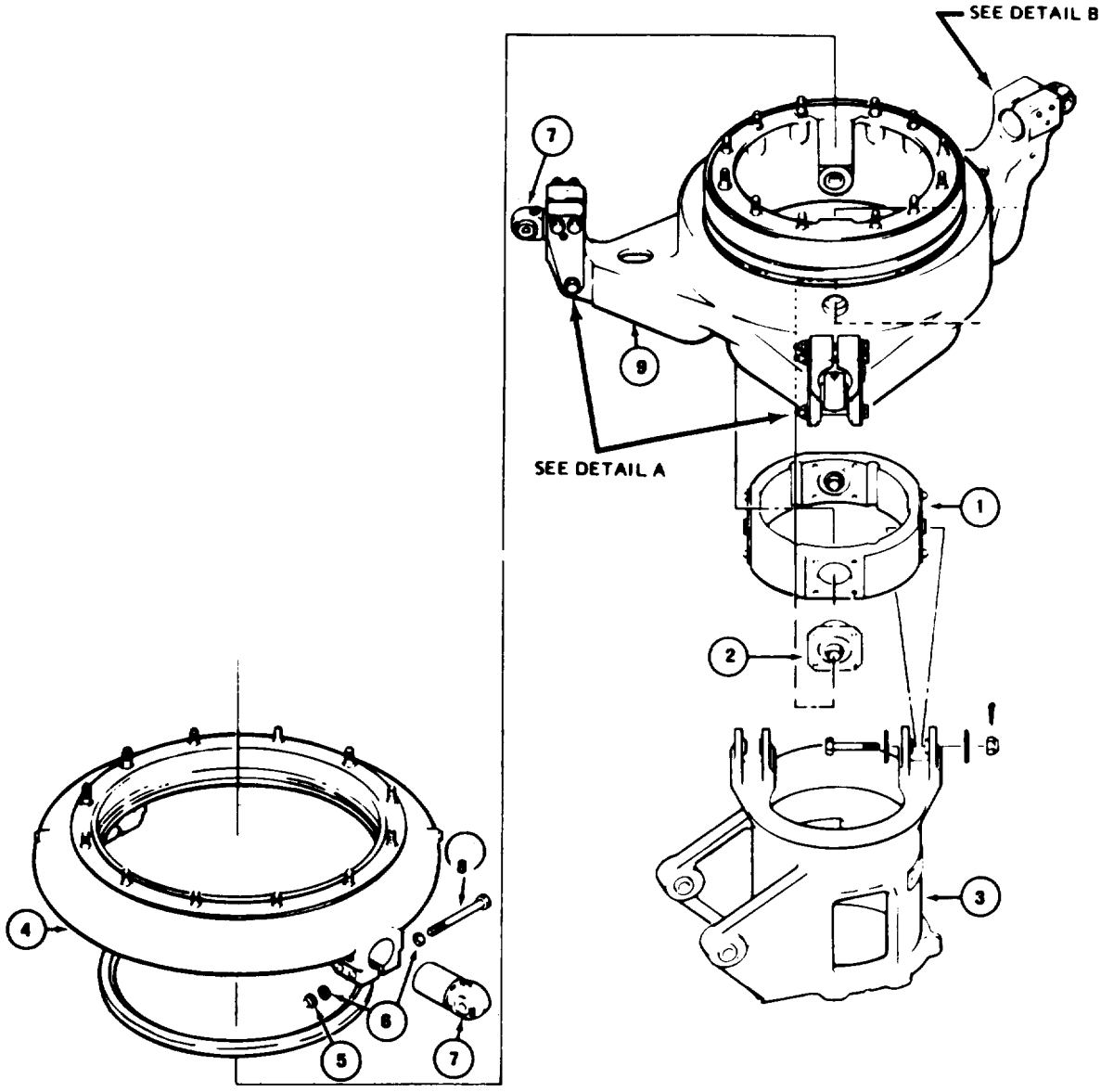
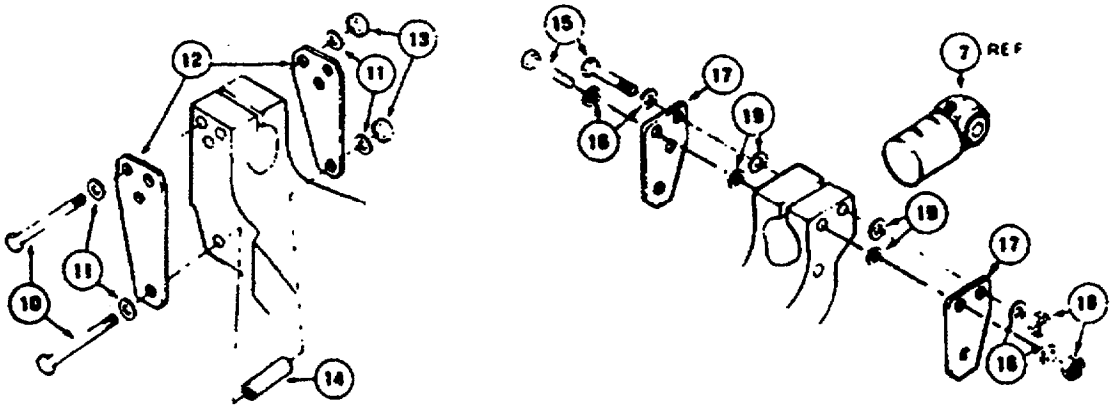
Figure 5-36. Swashplate – Damage Limits (Sheet 3 of 3)



1. Gimbal Ring Assembly
2. Bearing and Liner Assembly
3. Support Assembly
4. Outer Ring Assembly
5. Nut
6. Washer
7. Trunnion Assembly
8. Bolt
9. Inner Ring

Figure 5-37. Swashplate and Support Assembly (Sheet 1 of 2)



DETAIL A
TYPICAL TWO PLACES

DETAIL B

10. Bolts
11. Washers
12. Plates
13. Nuts
14. Spacer

15. Bolts
16. Washers
17. Nuts
18. Plates
19. Washers

Figure 5-37. Swashplate and Support Assembly (Sheet 2 of 2)

b. Dry with filtered compressed air.

5-64. Inspection - Swashplate and Support Assembly.

a. Visually inspect all surfaces for mechanical damage (cracks, dents, nicks, scratches) and corrosion damage: If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

CAUTION

Do not separate inner ring (9) and outer ring (4) figure 5-37. Areas of swashplate and support assembly restricted to depot level maintenance will be inspected during overhaul.

(1) Inspect inner ring (9, figure 5-37), outer ring (4), and support (3) in accordance with figure 5-36. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

(2) Inspect other parts for damage not to exceed **0.035** inch depth after cleanup. Damage and subsequent repairs shall not interfere with the fit and function of any part. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

(3) Inspect holes and bushings for scoring and damage. Maximum I.D. shall not exceed limits specified in figure 5-36.

b. Inspect parts dimensionally if indications of wear are found (figure 5-39).

c. Inspect bearings for wear or damage.

(1) Trunnion bearings (7, figure 5-37) (paragraph 5-60, step b.).

(2) Inspect gimbal bearings (2) for damage and smooth operation.

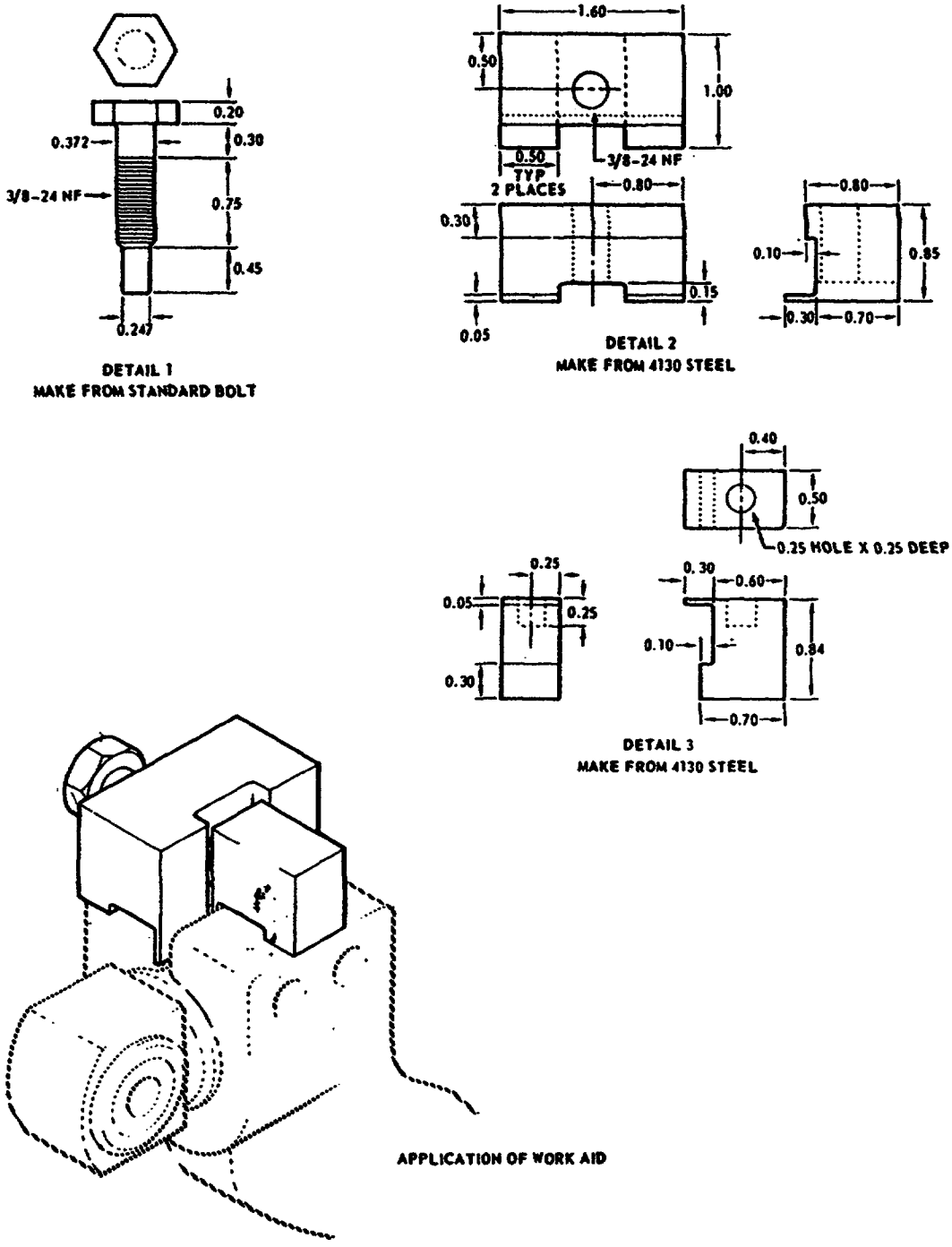
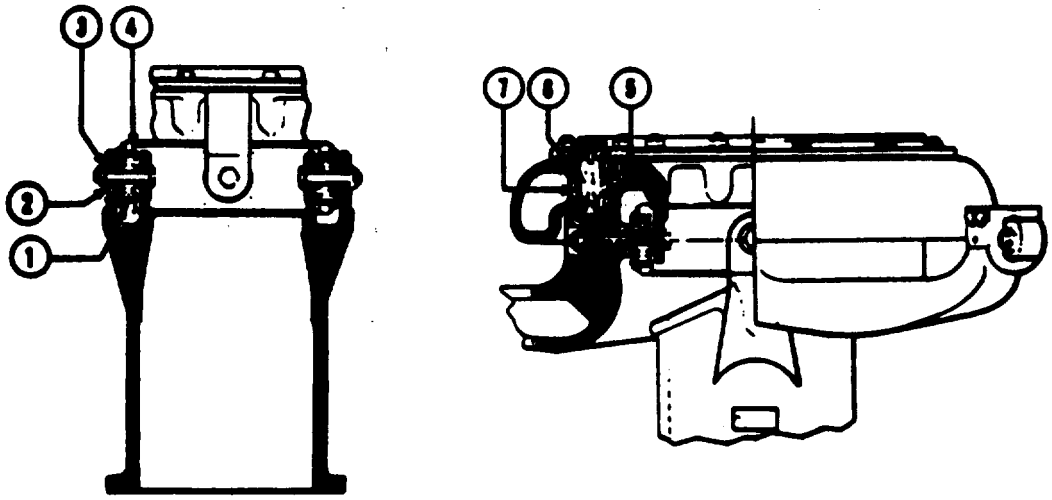


Figure 5-38. Work Aid for Removal and Installation of Swashplate Trunnions



ITEM	NOMENCLATURE		MFG. DIMENSION (INCHES)		REPLACE
1	GIMBAL RING HOLES	ID	1.3750	1.3755	1.3770
2	SUPPORT BUSHING	ID	0.4995	0.5005	0.5025
3	BUSHING	ID	0.3120	0.3130	0.3150
4	BEARING LINER	ID	1.2490	1.2495	1.2505
		OD	1.3743	1.3748	1.3730
5	INNER RING	OD	8.9980	8.9990	8.9970 AVERAGE
6	BEARING	ID	8.9990	9.0000	9.0010 AVERAGE
		OD	10.2490	10.2500	10.2490 AVERAGE
7	OUTER RING	ID	10.2500	10.2520	10.2530 AVERAGE

204011-1064

Figure 5-39. Swashplate and support Assembly - Limits Chart

d. Inspect bolts and nuts for damage and serviceability.

5-65. Repair or Replacement - Swashplate and Support Assembly.

a. Repair surface damage, within limits specified in inspection procedure, by polishing out damage to blend smoothly into surrounding surface. Do not exceed limits of figure 5-36. Observe the following:

(1) Remove no more material than necessary, using fine to medium grades of abrasive cloth (C1) or a fine India stone (C264) and polish to smooth scratch-free surface with crocus cloth (C68). No surface shall be repaired by use of grinding wheel, patching, or plugging.

(2) Corrosion damage should be polished out to twice depth of pit, but mechanical damage should be polished out only deep enough to remove traces of damage.

(3) Where anodized surface is removed by repairs, restore finish with brush alodine (C62).

(4) Where cadmium plating is removed by repairs, apply two coats primer (C206).

b. Replace defective parts which exceed inspection limits of paragraph 5-64.

c. Replace unserviceable attaching bolts, nuts, and washers. Refer to TM 55-1500-204-25/1 to qualify self locking nuts.

d. If parts are damaged which are beyond AVUM responsibility to replace, reassemble swashplate and forward to Depot Maintenance.

e. Apply a coat of dear lacquer (C14) on ail exterior surfaces of three arms of inner ring (9, Figure 5-37), from tips inboard a minimum of four inches. Mask all holes and parts not requiring coating with tape (C276).

5-66. Assembly – Swashplate and Support Assembly. Item numbers below refer to figure 5-37 unless otherwise indicated.

WARNING

Have a qualified technical Inspector check the inside diametric measurements of the trunnion bass In the Inner and outer rings of the swashplate. Replace the swashplate and support assembly if any of the trunnion bores exceed limits specified in fig. 5-38. Install the trunnion In the respective bore. Remove the workaid and perform a spring scale pull cheek (pull check is only required on outer ring trunnions) on the trunnion, along its longitudinal axis (without the bolts installed). Replace the swashplate and support assembly if the trunnion (which has an outside diametric measurement of 1.2495 to 1.2500 Inches) shows any signs of slippage when subject to a pull of 20 pounds

CAUTION

Align grooves of trunnions with bolt holes in plate and Install bolts with finger pressure only. Do not force bolts with a hammer. Use work aid tool (figure 5-38) to Install trunnions. Insert tangs of tool Into slot and tighten screw until trunnion can be inserted. Immediately release screw tension. if tool Is not available, lightly oil (C169) cleaned trunnion. Trunnion lugs of inner ring may be heated with a heat lamp and trunnion chilled to facilitate installation. Both trunnion bolts are to be installed and equally tightened and torqued. if installation cannot be accomplished by these procedures it is recommended parts be replaced.

a. Apply thin coat of corrosion preventive compound (C91) to joining surface of trunnions (7, figure 5-37) and inner ring (9) and outer ring (4).

NOTE

On trunnion bearings KSP90001, ensure that the friction load will be carried by the bearing seat rather than the bearing retainer, as shown in figure 5-35.

b. Install two trunnions (7) in outer ring (4) with grooves aligned to bolt holes.

c. Install bolts (8, figure 5-37) washers (6), nuts (5) in lugs of ring (4). Torque nuts **50 TO 70** inch pounds.

d. Install trunnions (7) on inner ring (9) as outlined in preceding steps b. and c. except install plates (12 and 17) as shown in details A and B, figure 5-37. In detail A at lower hole, fit a spacer (14) not more than 0.005 inch loose (before torquing attaching hardware) between inside surface of horn. In detail B, install thick or thin aluminum washers (19) as required between plates (17) and horn at the two upper bolts so there will not be a bind on the plates.

5-67. Installation - Swashplate and Support Assembly.

NOTE

Swashplate and support assembly and scissors and sleeve assembly can be installed as an assembled unit, or as separate assemblies.

a. Lubricate splines with grease (C129).

b. Carefully lower assembly over mast until swashplate support rests on transmission cap plate (figure 5-34).

c. Align holes and install eight bolts (11) with washers (12) under heads, through flange of support into transmission (16). Use two longest bolts (11) between pivots of collective lever. Torque **100 TO 140** inch-pounds. Lockwire (C155) bolt heads in pairs.

NOTE

In installing a complete unit, with scissors and sleeve (3) and collective lever already assembled, omit step d. and e. and proceed to step f.

d. Install scissors and sleeve assembly (3) (paragraph 5-84).

e. Install collective levers (paragraph 5-73).

f. Connect collective pitch control tube to collective lever (paragraph 7-91). Connect cyclic (paragraph 7-78) and elevator control (paragraph 11-178) tubes to swashplate trunnions. Refer to figure 5-5 for torque values.

5-68. COLLECTIVE LEVERS.

5-69. Description - Collective Levers. The collective levers consist of two lever halves mounted to the swashplate at one end and attached to the hydraulic cylinder of the collective system at the opposite end. The levers also connect to the collective sleeve at an intermediate location.

5-70. Removal - Collective Levers.

a. Disconnect collective cylinder control tube from trunnion of collective levers (paragraph 7-84).

CAUTION

Block up scissors and sleeve assembly prior to disconnecting collective levers. This will prevent scissors and sleeve assembly from settling and pinching bearing and liner assembly.

b. Remove nuts (3, figure 5-40), washers (4), and shims (16), and bolts (15).

c. Remove nuts (5), washers (6), and bolt (11).

d. Remove nuts (7), washers (8), and bolts (10).

e. Remove collective levers (12), trunnion (9), spacer (13), and shims (14).

5-71. Inspection - Collective Levers. (Figure 5-41).

a. Inspect lever halves for cracks, nicks, scratches, dents and corrosive damage. Confirm existence of suspected cracks with a five power magnifying glass or by dye-penetrant inspection. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

b. Inspect bearing (1, figure 5-42) for corrosion, seal damage, cracked or broken races, freedom and smoothness of rotation and excessive wear. Maximum allowable play is **0.010** inch radial and **0.020** inch axial. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

c. Inspect bearing (18, figure 5-40) for corrosion, seal damage, cracked or broken races, freedom and smoothness of rotation and excessive wear. Maximum allowable play is **0.010** radial and **0.020** axial. Refer to Paragraph 5-78f and Paragraph 5-84d. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

d. Inspect for looseness between bearing (1, figure 5-42) and liner (2). Any detectable axial or radial play between bearing and liner requires replacement of bearing. If bearing is replaced because of excessive wear between bearing and liner, the liner will also be replaced.

e. Inspect for looseness between liner (2) and collective lever (3).

NOTE

Inspection for radial play between pin (View A, figure 5-40) and bearing (18) can be done with lever partially installed or by temporarily fitting new bearing (18) on pin.

f. Inspect for radial play between collective lever pin (view A, figure 5-40) and bearing (18). If any play is evident, replace pin.

g. Inspect spacer (13) for corrosion, damage, and wear. Spacer length shall be **4.525 TO 4.530** inches.

5-72. Repair or Replacement - Collective Levers.

CAUTION

In all repairs, no more material should be removed than necessary to effect repair as described. Repair by grinding wheel, patching or plugging is not allowed.

a. Repair corrosion or mechanical damage on levers within limits of figure 5-41. Polish out defects using abrasive cloth (C1). Treat repaired areas with chemical film (C62). Touch up repaired areas with two coats of epoxy primer (C206).

b. Replace lever if damage limits are exceeded or if any cracks are found.

c. (AVIM) -Replace bearing (1, figure 5-42) if wear exceeds limits or if damage described in paragraph 5-71b exists. Refer to TM 1-1500-204-23 series.

d. If bearing (1) is replaced due to excessive wear between bearing and liner, or if liner (2) has been segment staked more than three times (204-011-438-1 lever) replace liner as follows:

(1) Remove old liner (ring stake must be removed prior to removal of liner from lever).

(2) Seat new liner into lever (use C87 on fraying surfaces) and ring stake.

(3) Machine ID of new liner **1.240 TO 1.1245** inch diameter prior to bearing installation.

(4) Minimum thickness of bearing seat flange shall not be less than **0.030** inch after machining.

(5) Segment stake (3 places) bearing into lever (204-011-438 lever only).

e. (AVIM) - Replace bearing (1) and liner (2) if any looseness exists between bearing and liner.

f. Replace collective lever (3) if any looseness exists between liner (2) and lever.

CAUTION

Do not install PN 204 pins on PN 212 collective levers and PN 212 pins on PN 204 collective levers.

g. (AVIM) — If any radial play exists between pin (View A, figure 5-40) and new bearing (18), replace pin by pressing out old pin and pressing in new pin.

5-73. Installation — Collective Levers.

NOTE

When determining shim thickness necessary for final assembly, non-self locking nuts may be used to temporarily connect the levers (12) to their attachments while performing this trial and error procedure.

a. Assemble collective lever (12, figure 5-40) on swashplate support, with pins inserted into bearings (18) on sleeve. Install spacer (13) making sure spacer length is correct (see paragraph 5-71g), bolt (11), washers (6), and nut (5). Install bolts (10) and washers (8) through rear of lever with trunnion (9) in place. Install washers (8) and nuts (7). Tighten nut (5) to **160** inch-pounds. Tighten nut (7) to **50** inch-pounds.

b. Install bolt (15) without nuts, washer, and shims. Hold collective levers to one side and measure gap between face of swashplate support at bushing location, and face of collective lever at inner bearing race location. Be careful not to let feeler gauge ride into bearing liner of collective lever bearing (17). If gap clearance is noted, divide this dimension by two and prepare two shims (16) equal within **0.005** inch to give **0.000 TO 0.005** inch pinch fit per side between bearing (16) and face of swashplate support bushings. Install shims (16), if needed, and reinstall bolts (15). Torque nuts (3) to **300** inch-pounds.

c. Hold collective sleeve to one side. With 45° offset feeler gauge, measure gap between shoulder on pin and bearing (18) inner race. While holding collective sleeve in same position, measure gap on opposite side, if any. Add the two feeler gauge clearances and divide by two to determine thickness of shims (14) required. Prepare two shims to this dimension, equal to each other within 0.005 inch to provide 0.000 TO 0.002 inch pinch fit back side between bearing (18) and face of pin.

d. If more than 0.080 inch shimming is required at the pin per collective lever, remove levers and perform the following check for binding between the pin and collective sleeve bearing:

CAUTION

When collective levers PN 212-010-403-5 are installed, the first shim on the pivot pin should be 0.065 inch thick to prevent it from dropping into the groove around base of pivot pin. Any additional shim thickness required is then added after the 0.065 inch shim is installed.

(1) Assemble collective lever with spacer (13), bolt (11), washer (6) and nut (5). Install bolts (10) and washers (8) through rear of lever with trunnion (9) in place. Install washers (8) and nut (7). Torque nut (7)50 inch-pounds. Torque nut (5) 150 inch-pounds.

(2) Place assembled collective levers on swashplate support at bushing location. Install bolt (15) without nuts, washer and shims. Hold collective levers to one side and measure gap between face of swashplate support bushing and face of collective lever at inner bearing race location Note this measurement and disassemble levers.

(3) Repeat installation instructions as stated in paragraph 5-73. The measurement in paragraph 5-73b should be the same as the measurement performed above. If the measurement in 5-73b is larger, binding exists between the collective lever pin and the collective sleeve bearing. Remove a small amount of cadmium plating from the pins with the abrasive cloth. Reinstall levers. More plating may need to be removed to achieve proper measurement.

e. Remove levers. Coat intend concave surfaces and ends of spacer (13) figure 5-40 with epoxy primer (C206). Install shims (14). coat thru bolt (11) with corrosion prevention compound.

f. Reassemble levers (12) m accordance with steps a, b., c., and d. above.

f.1. Reinstall bolts (15), washers (4) (inboard) shims (16) if required, washers (4) (outboard), nuts (3).

g. Torque Self-Locking Nut (7) MS21042L4 to 70 inch-pounds.

h. Torque Self-Locking Nut (5) MS21042L6 to 190 inch-pounds.

i. Torque Self-Locking Nut (3) MS21042L8 to 410 inch-pounds.

j. Check collective sleeve bearing and liner assembly (18) for axial looseness at the collective lever pin. No axial looseness is permitted.

k. Reconnect collective pitch control tube (paragraph 7-91) and remove blocking material previously used (paragraph 5-70a).

NOTE

To prevent possible damage to the dust boot (2) during operation, a distance of 10.25 TO 10.75-inches must be maintained between the top of the boot and the lower surface of the damper support frame. Position of the collective sticks is not important while setting these dimensions.

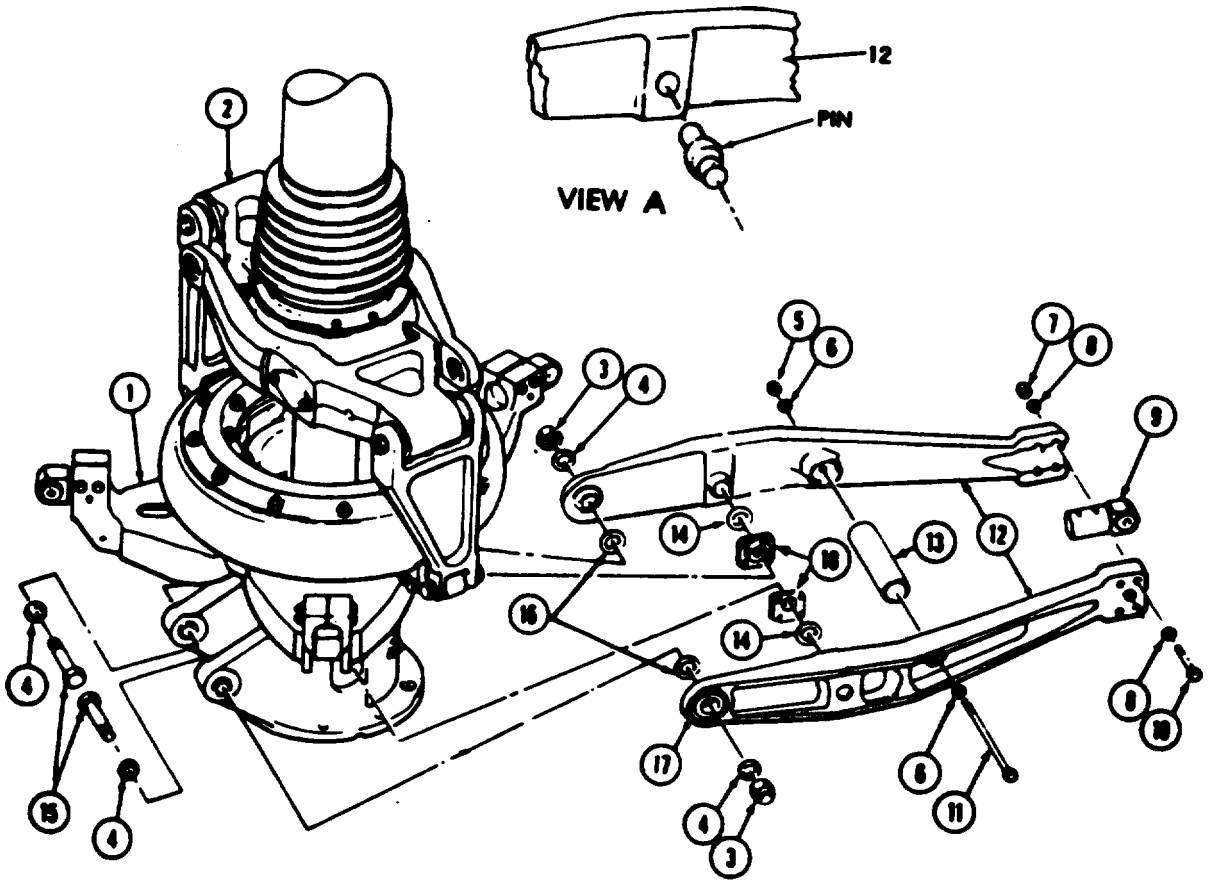
L Position boot (2, figure 5-34) down over flange at top of scissors and sleeve. If boot is split type, apply uniform coat of adhesive (C36) or equivalent on faying surfaces (joint of split) of boot. Form boot around mast while adhesive is wet. Position spacer (1) around mast, under top edge of boot secure top and bottom of boot with lockwire (C155). Apply a bead of sealant (C244) along split of boot (2) and around the top of spacer (l).

m. Install dampers and adapter (paragraph 5-56).

n. Install main rotor hub and blade assembly (paragraph 5-13).

a. Install stabilizer bar (paragraph 5-47).

p. Lubricate swashplate with grease (C129). Purge grease past seals to ensure lubrication. Refer to figure 1+ for lubrication points.



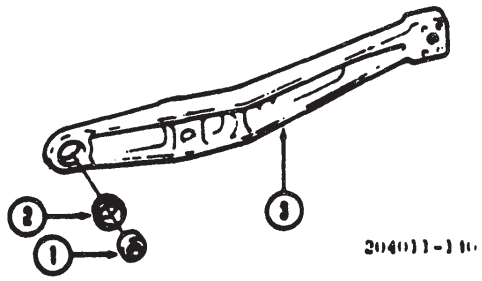
1. Swashplate and support
2. Scissors and sleeve
3. Nut
4. Washer
5. Nut
6. Washer
7. Nut
8. Washer
9. Trunnion
10. Bolt
11. Bolt
12. Collective levers
13. Spacer
14. Shims
15. Bolts
16. Shims
17. Lever bearing and liner
18. Bearing and liner assembly

Figure 5-40. Collective Lever Installation

DAMAGE AREA REPAIR SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
NICKS, SCRATCHES, SHARP DENTS	0.040 INCH BEFORE AND AFTER REPAIR	0.020 INCH BEFORE AND AFTER REPAIR
CORROSION	0.020 INCH BEFORE REPAIR 0.040 INCH AFTER REPAIR	0.010 INCH BEFORE REPAIR 0.020 INCH AFTER REPAIR
AREA OF FULL DEPTH REPAIR	0.50 SQUARE INCH	0.20 SQUARE INCH
NUMBER OF REPAIR AREAS	NOT CRITICAL	ONE PER SEGMENT
EDGE CHAMFER	0.060 INCH	0.030 INCH
NO CRACKS ALLOWED		

Figure 5-41. Collective Lever Damage Limits



1. **Lever bearing**
2. **Liner**
3. **Collective lever**

Figure 5-42. Collective Lever

5-74. SCISSORS AND SLEEVE ASSEMBLY.

5-75. Description — Scissors and Sleeve Assembly. The scissors and sleeve is mounted on the mast and is connected to the swashplate outer ring with two drive links. The drive links are connected to a hub which is mounted through a bearing set on the collective sleeve. Bearings installed on the lower end of the collective sleeve provide for connection of the collective levers.

The Scissors and Sleeve Assembly contains the following Flight Safety Parts:

Scissors Assembly	[item 12, fig 5-44]
Collective Sleeve	[item 31]
Link Assembly	[item 28]
Hub Assembly	[item 44]
Plate Set	[item 42]
Retainer Nut	[item 33]
Collective Sleeve Bearing Retention Nut	[item 38]

5-76. Lubrication — Scissors and Sleeve Assembly. Refer to figure 1-6 for scissors and sleeve lubrication.

5-77. Inspection — Scissors and Sleeve Assembly.

NOTE

Perform step a. prior to removal of scissors and sleeve from mast.

a. Clamp dial indicator to mast with probe of indicator resting on the attaching bolt head (figure 5-43). Rotate sleeve assembly and measure amount of backlash present. Maximum backlash allowed between mast (1) and collective sleeve drive plate (6) is 0.040 inch at point of measurement. Replace plate (6) if wear limit is exceeded.

b. Inspect all bearings for damage, freedom of movement, and maximum allowable looseness.

c. Inspect for axial play between drive link (28, figure 5-44) and scissors (12). Maximum allowable play is 0.090 inch.

5-78. Removal — Scissors and Sleeve Assembly.

a. Remove stabilizer bar with attached control tubes (paragraph 5-40).

b. Remove main rotor hub and blades (paragraph 5-12).

c. Remove dampers and adapter (paragraph 5-53).

d. Remove collective levers (paragraph 5-70).

e. Cut lockwire and remove boot (2, figure 5-34) and spacer (1).

f. Remove screws (14), bearings and liner (13) from each side of collective sleeve.

g. Remove cotter pin (8), nut (9), washers (5, 6, and 7), and bolt (4) to disconnect link from swashplate trunnion at each side.

h. Remove scissors and sleeve assembly (3) upward, carefully, over splines of mast (17).

5-79. Disassembly — Scissors and Sleeve Assembly. Item numbers below refer to figure 5-44 unless otherwise indicated. Disassemble scissors and sleeve only to extent required to accomplish inspection and repair.

WARNING

Rotor Controls Parts Kit, P/N 204-1629-2, must be replaced as a kit. Replacement of individual bolts within the kit is not authorized (see figure 1-15, Rotor Controls Parts Kit).

Premaintenance requirements for disassembly of scissors and sleeve

Condition	Requirements
Model	All
Part No or Serial No	All
Special Tools	(T36) (T37) (T38) (T50) (T58)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	None
Special Environmental Conditions	None

a. Remove nuts (1) and washers (2) securing cover plate (3) and remove cover plate.

b. Remove cotter pin (4), nut (18), and spacer (5). Support scissors and remove bolt (14), safety washer (13), and washer (15). Remove scissors (12) from sleeve and hub assembly (11), remove spacer (17) as it is released. Remove bearing (16) from scissors (12).

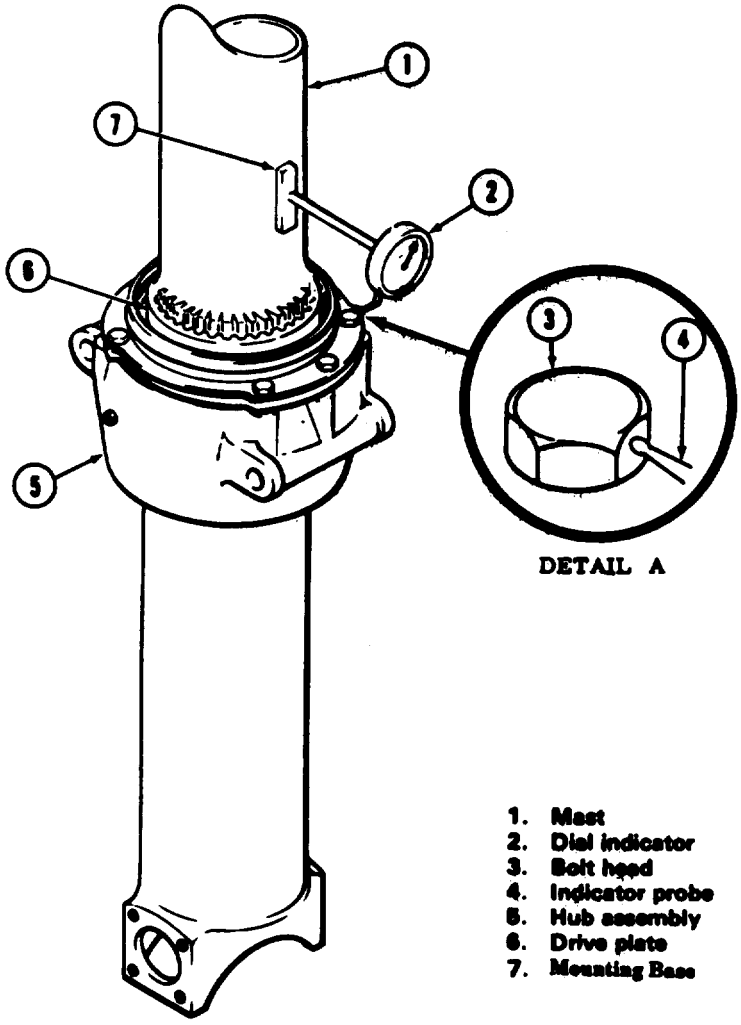


Figure 5-43. Drive Plate Spline Wear Chock

c. Remove liner (10) from scissors (12). Use bar (T50) and press shims (7 and 9), bearing set (8), and spacer (6) from liner (10).

d. Remove cotter pin (30), nut (29), washers (27), and bolt (26) to separate link (28) from scissors (1 2). Remove shim (23), housing (22), and thrust washer (21). Remove inner race (1 9).

e. Use bar (T50) to press bearings (20 and 24) and spacer (25) from scissors (1 2).

f. Repeat steps a. through e. to disassemble opposite scissors assembly.

NOTE

Remove staked bearings only when replacement is necessary.

g. (AVIM) Cut lockwire and remove bolts (40), washer (39), flange (41), and drive plate (42).

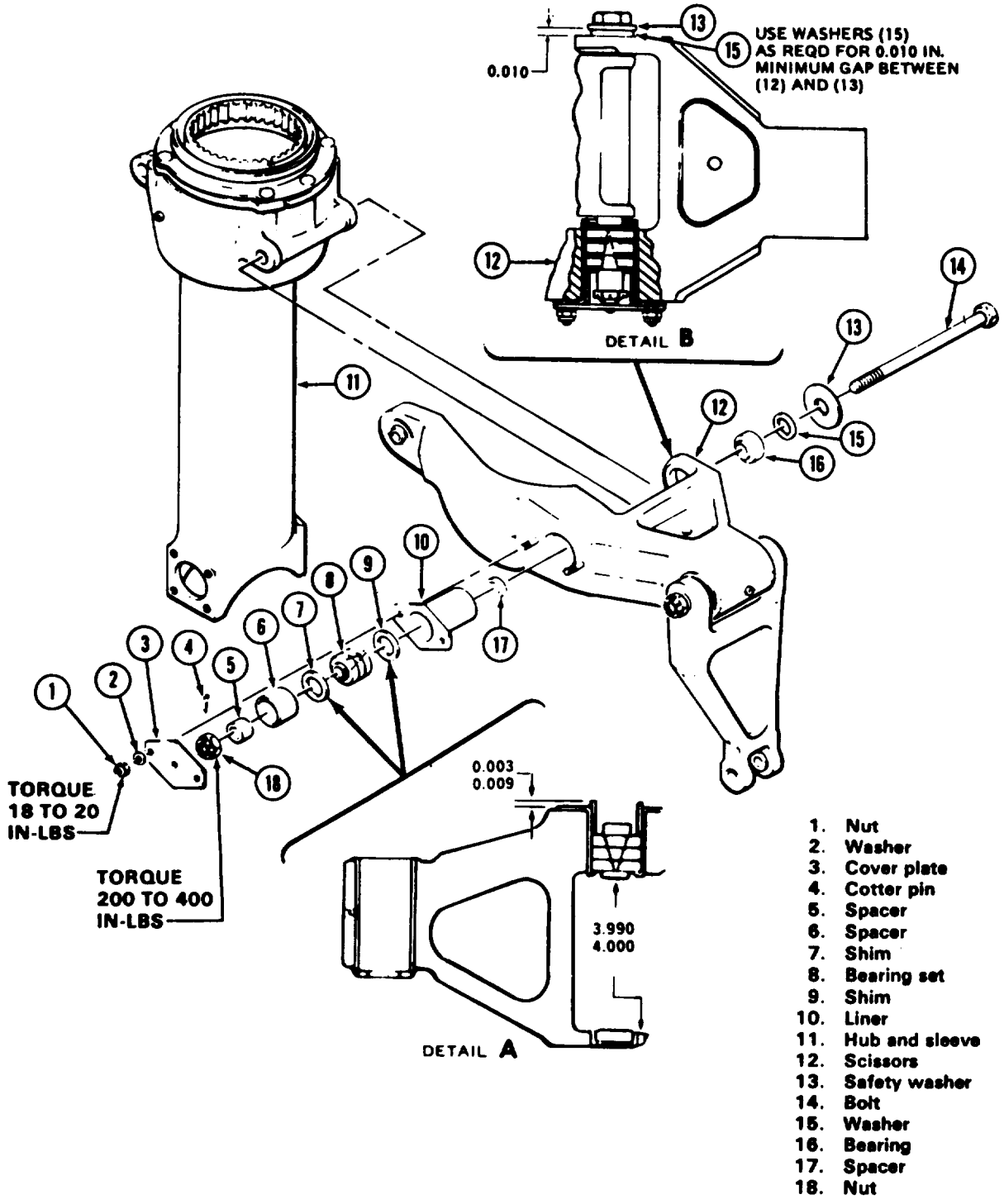


Figure 5-44. Scissors and Sleeve Assembly (Sheet 1 of 3)

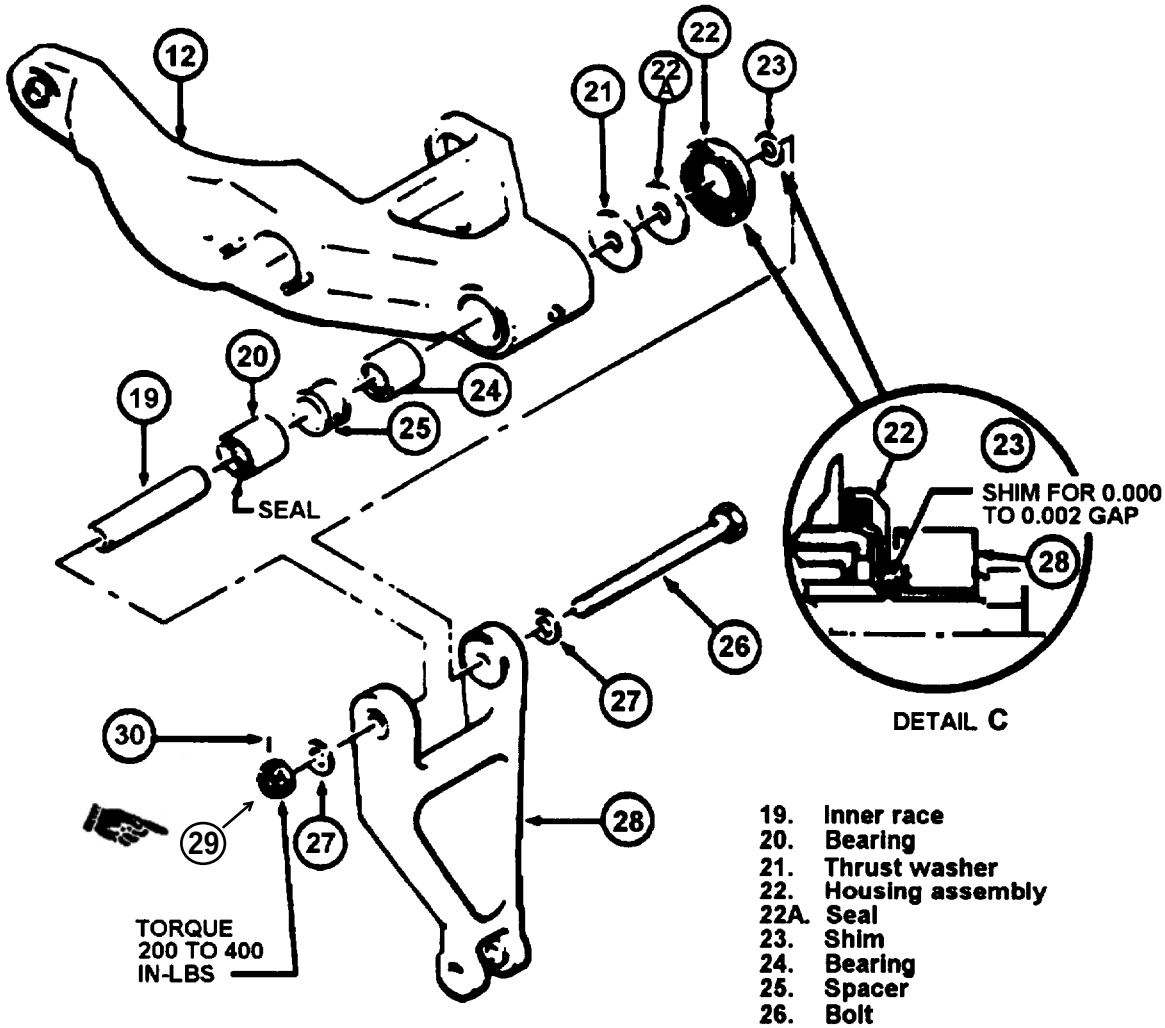


Figure 5-44. Scissors and Sleeve Assembly (Sheet 2 of 3)

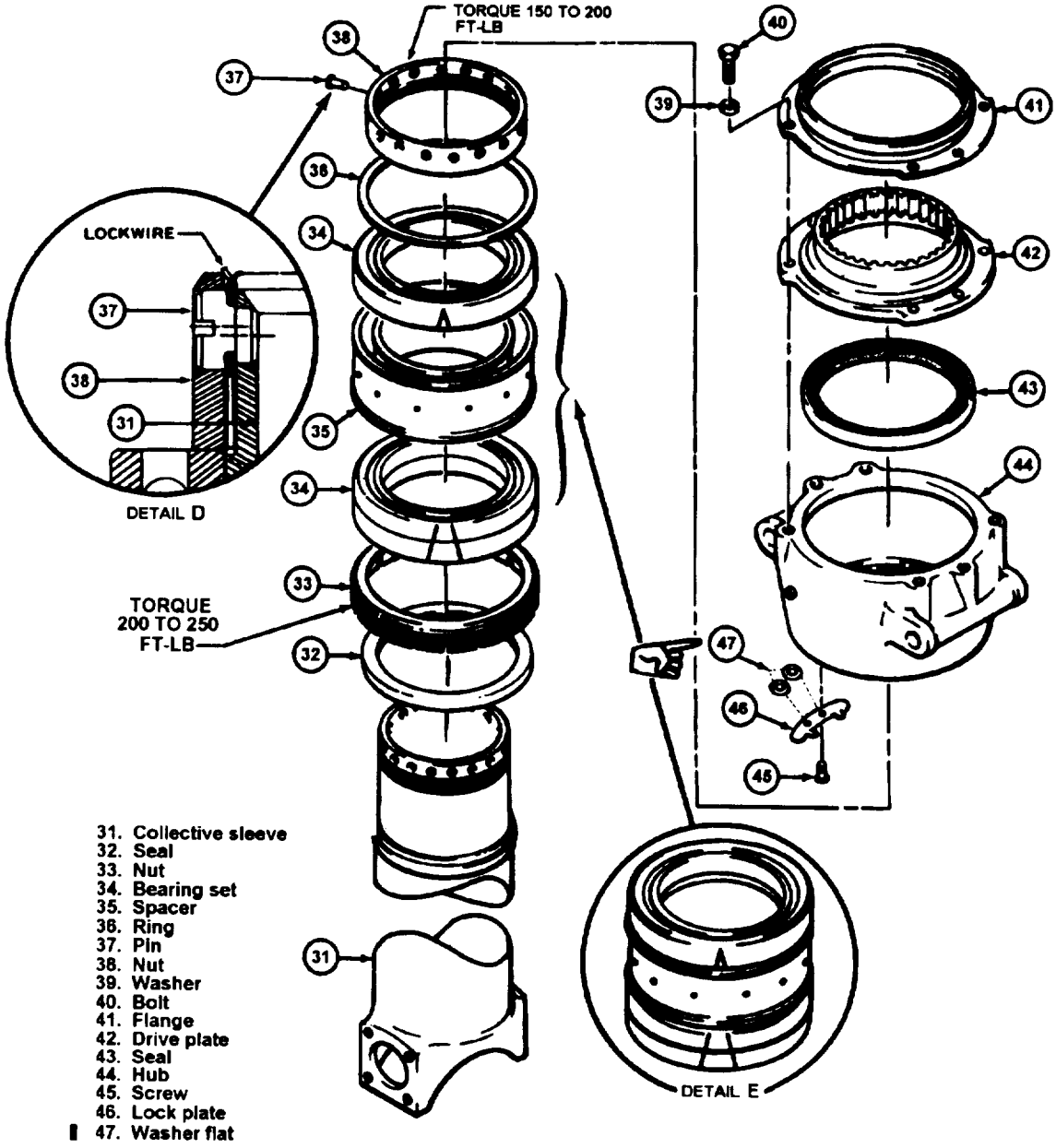


Figure 5-44. Scissors and Sleeve Assembly (Sheet 3 of 3)

h. (AVIM) Cut lockwire and remove screws (45) and lockplate (46). Install wrench (T38) on nut (38). Invert sleeve and hub assembly and secure wrench in vice. Using wrench (T58) remove nut (33) from hub. Remove tools from assembly.

CAUTION

During pressing operation, ensure that bearings will clear halves of support (T36).

i. (AVIM) Place assembly upright on a press with support halves (T36) located under hub (44). Place small end of ram adapter (T37) in top of sleeve (31) and press sleeve from hub. Remove seal (43) and shoulder ring (36).

j. (AVIM) Cut lockwire and remove pin (37), install wrench, (T38) with pins engaged in holes of nut (38). Insert bar (T50) in holes at lower end of sleeve. Hold bar and remove left-hand threaded nut (38).

k. (AVIM) Place sleeve on a press with support halves (T36) under lower bearing set (34). Place small end of ram adapter (T37) in upper end of sleeve and press sleeve from bearing set (34) and spacer set (35). Remove seal (32) from nut (33) with ram adapter (T37).

5-80. Cleaning - Scissors and Sleeve Assembly.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

a. Clean all parts with solvent (C261). Do not immerse bearings (16, figure 5-44) in solvent.

b. Dry with filtered compressed air. Do not spin dry bearings.

c. Protect bearing after cleaning from contamination and corrosion.

5-81. Inspection - Scissors and Sleeve Assembly. (Disassembled) (AVIM)

a. Inspect parts for mechanical or corrosion damage (figure 5-45). If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

b. Inspect bearing set (34, figure 5-44) and spacer set (35) as follows:

(1) Inspect bearing for roughness or brinelling. Any brinelling visible under a 5 power magnification or of sufficient depth to cause roughness when the bearing is rotated, shall be cause for rejection.

(2) Inspect for galled or flaked area on balls and raceways under a strong light. Inspect for broken or fractured retainers.

(3) Inspect spacer set (35) for damage or corrosion.

c. Inspect bearings (8 and 16) for smooth operation and damaged seals or shield. (Bearings tolerance is 0.010 inch axial and 0.012 inch radial.

d. Inspect bearings (20 and 24) for smooth operation. Inspect rollers for looseness due to wear, flaked or flat spots, pitting or scoring. Inspect seals for damage.

e. Inspect inner race (19) and thrust washer (21). If other than a smooth, unscored surface is found, replace parts as required.

f. Inspect liner (10) and spacers (5, 6, 17 and 25) for cracks, corrosion and wear.

g. Inspect drive plate (42) for spline damage and wear (paragraph 5-77, step a.). If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

h. Inspect cover plate (3), housing assembly (22), pin (37), shoulder ring (36), flange (41) and lockplate (46) for damage or deformation.

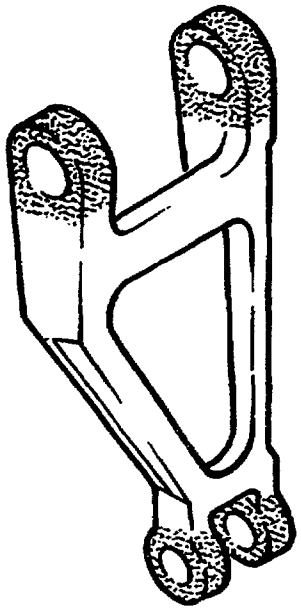
i. Score marks on ID of holes or bushings not to exceed **0.002** inch.

j. Inspect studs in scissors (12) for looseness or damaged threads.

k. Inspect nuts (33 and 38) for thread damage (figure 5-45, sheet 5).

l. Inspect sleeve (31, figure 5-44) and hub (44) for thread damage (figure 5-45, sheet 2 and 3).

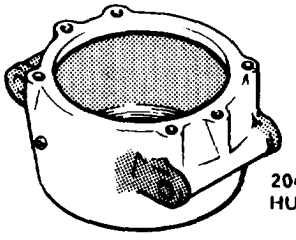
m. Inspect bearing (1, figure 5-46) and liner for looseness. Any looseness will require removal of liner and checking the mating hole. Egging of hole must not exceed **0.001** inch for 30 degrees.



DAMAGE AREA REPAIR SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
MECHANICAL	0.010 INCH BEFORE AND AFTER REPAIR	0.020 INCH BEFORE AND AFTER REPAIR
CORROSION	0.005 INCH BEFORE REPAIR 0.010 INCH AFTER REPAIR	0.010 INCH BEFORE REPAIR 0.020 INCH AFTER REPAIR
MAXIMUM AREA PER FULL DEPTH REPAIR	0.10 SQUARE INCH	0.25 SQUARE INCH
NUMBER OF REPAIR AREAS	ONE PER LUG	NOT CRITICAL
EDGE CHAMFER	0.030 INCH	0.050 INCH
BORE DAMAGE	0.002 INCH FOR ONE-FOURTH CIRCUMFERENCE	
NO CRACKS ALLOWED		

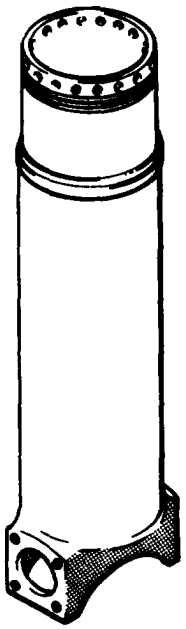
Figure 5-45. Scissors and Sleeve - Damage Limits (Sheet 1 of 5)



204-011-405
HUB

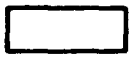
TYPE OF DAMAGE	DAMAGE AREA REPAIR SYMBOLS	
	MAXIMUM DEPTHS AND REPAIR AREA ALLOWED	
MECHANICAL AND CORROSION	0.010 INCH BEFORE AND AFTER REPAIR	0.035 INCH BEFORE AND AFTER REPAIR
MAXIMUM AREA PER FULL DEPTH REPAIR	0.15 SQUARE INCH	0.25 SQUARE INCH
NUMBER OF REPAIRS	ONE PER LUG	NOT CRITICAL
EDGE CHAMFER	0.020 INCH	0.050 INCH
BORE DAMAGE:	0.002 INCH FOR ONE-FOURTH CIRCUMFERENCE	
DEPTH:	ONE-THIRD OF THREAD	
LENGTH:	ONE-HALF OF THREAD	
NUMBER:	TWO	
NO CRACKS ALLOWED		

Figure 5-45. Scissors and Sleeve — Damage Limits (Sheet 2 of 5)



204-011-408
SLEEVE

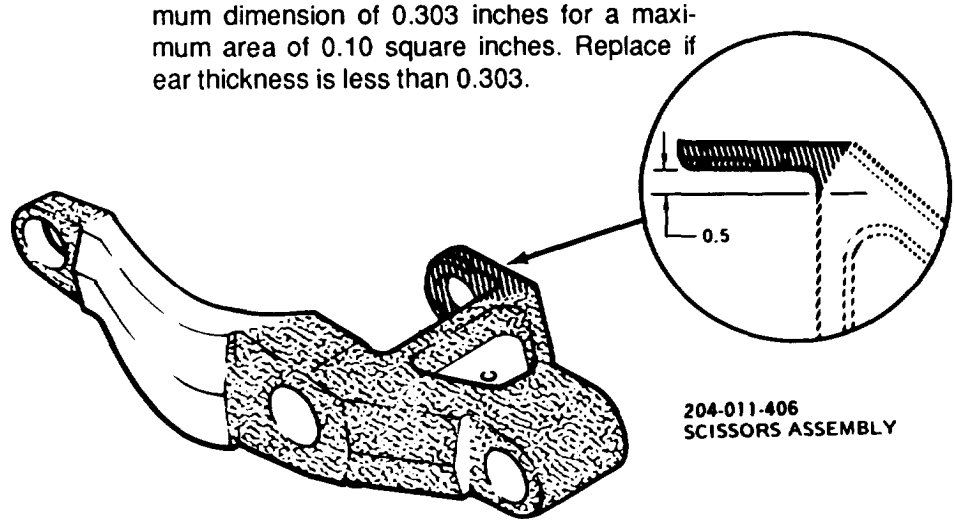
DAMAGE AREA REPAIR SYMBOLS

TYPE OF DAMAGE		
	MAXIMUM DEPTHS AND REPAIR AREA ALLOWED	
MECHANICAL AND CORROSION	0.010 INCH BEFORE AND AFTER REPAIR	0.020 INCH BEFORE AND AFTER REPAIR
AREA OF FULL DEPTH REPAIR	0.50 SQUARE INCH	0.50 SQUARE INCH
NUMBER OF REPAIR AREAS	NOT CRITICAL	NOT CRITICAL
EDGE CHAMFER	0.020 INCH	0.040 INCH
BORE DAMAGE:	0.002 INCH FOR ONE-FOURTH CIRCUMFERENCE	
DEPTH:	ONE-THIRD OF THREAD	
LENGTH:	ONE QUARTER INCH	
NUMBER:	TWO PER SEGMENT	

NO CRACKS ALLOWED

Figure 5-45. Scissors and Sleeve — Damage Limits (Sheet 3 of 5)

NOTE 1. One scratch, dent, or tool mark (one per lug) may be blended out to a minimum dimension of 0.303 inches for a maximum area of 0.10 square inches. Replace if ear thickness is less than 0.303.

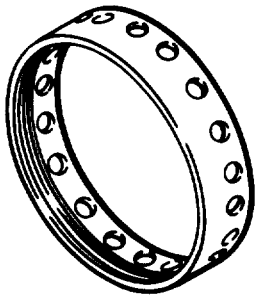


DAMAGE AREA REPAIR SYMBOLS

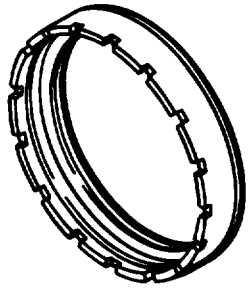
TYPE OF DAMAGE			
	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED		
MECHANICAL	0.005 INCH BEFORE AND AFTER REPAIR	0.020 INCH BEFORE AND AFTER REPAIR	0.035 INCH BEFORE AND AFTER REPAIR
CORROSION	0.0025 INCH BEFORE REPAIR 0.005 INCH AFTER REPAIR	0.010 INCH BEFORE REPAIR 0.020 INCH AFTER REPAIR	0.0175 INCH BEFORE REPAIR 0.035 INCH AFTER REPAIR
AREA OF FULL DEPTH OF REPAIR	0.10 SQ. IN.	0.25 SQ. IN.	0.040 SQ. IN.
NUMBER OF REPAIR AREAS	ONE	NOT CRITICAL	NOT CRITICAL
EDGE CHAMFER	0.020 INCH	0.040 INCH	0.060 INCH
BORE DAMAGE:	0.001 INCH FOR ONE-FOURTH CIRCUMFERENCE		

NO CRACKS ALLOWED

Figure 5-45. Scissors and Sleeve — Damage Limits (Sheet 4 of 5)



204-010-420
NUT



204-010-437
NUT

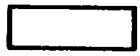
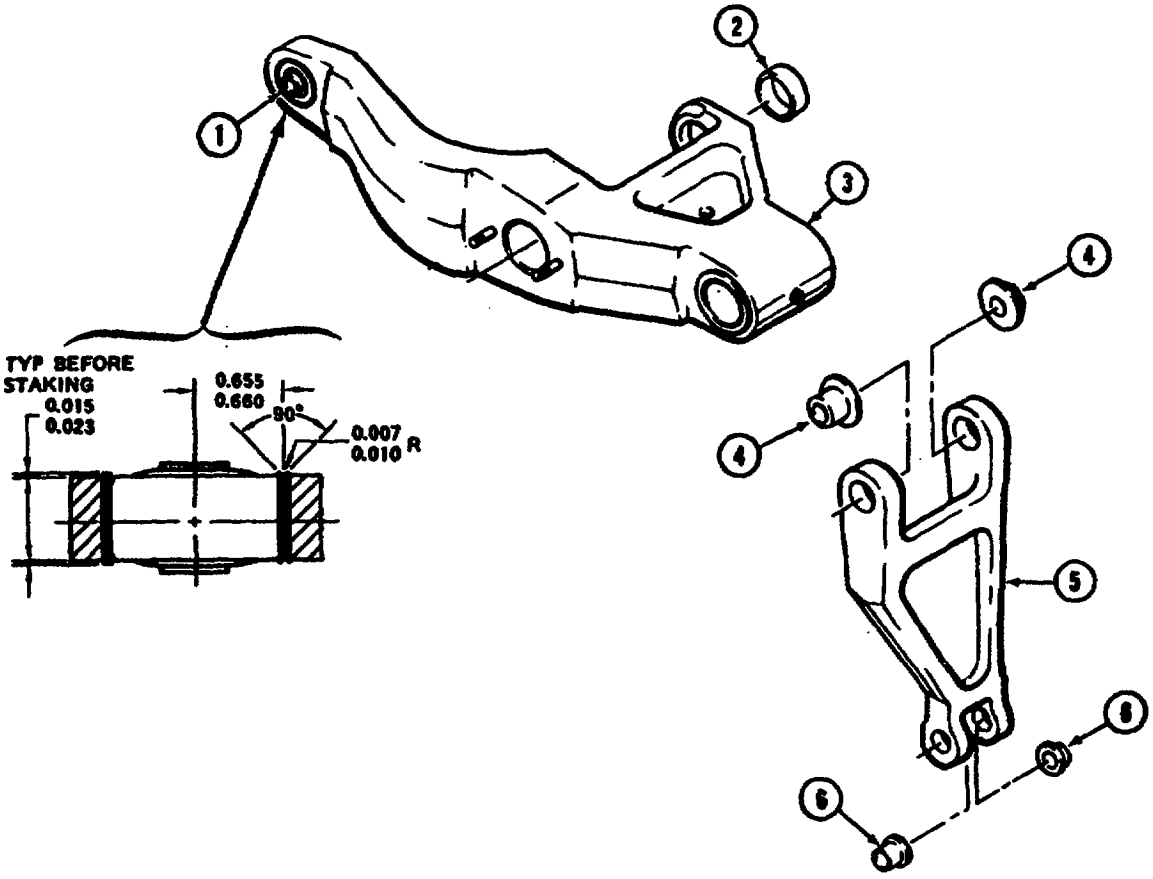
TYPE OF DAMAGE	DAMAGE AREA REPAIR SYMBOLS
	
	MAXIMUM DEPTH AND REPAIR AREA ALLOWED
MECHANICAL AND CORROSION	0.005 INCH BEFORE AND AFTER REPAIR
AREA OF FULL DEPTH REPAIR	0.25 SQUARE INCH
NUMBER OF REPAIR AREAS	TWO
EDGE CHAMFER	0.020 INCH
THREAD DAMAGE	
DEPTH:	ONE-THIRD OF THREAD
LENGTH:	ONE QUARTER INCH
NUMBER:	TWO
NO CRACKS ALLOWED	

Figure 5-45. Scissors and Sleeve — Damage Limits (Sheet 5 of 5)



1. Bearing
2. Sleeve
3. Scissors
4. Bushing
5. Link
6. Bushing

Figure 5-46. Scissors and Link - Repair

n. Inspect the following parts by magnetic particle method, (Code M) or fluorescent penetrant method (Code F), if cracks are suspected. (TM 43-0103) Parts with cracks must be replaced. Item numbers are keyed to figure 5-44. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

ITEM	NOMENCLATURE	CODE
12	Scissors	F
28	Link	F
31	Sleeve	M
33	Nut	M
38	Nut	M
44	Hub	M

o. Inspect parts dimensionally if any evidence of wear is present. (See figure 5-47.)

p. Inspect bushing in lower end of drive link for wear. Dimension between worn surface of bushing flanges not to exceed 0.878 inch. ID of bushing not to exceed 0.314 inch.

q. Inspect shims (7 and 9) for damage or deterioration.

5-82. Repair - Scissors and Sleeve Assembly.

a. If necessary dress spline in drive plate (42, figure 5-44) with a fine India stone (C264).

b. (AVIM) Replace all seals at reassembly. Replace lubrication fittings and studs in scissors assembly if unsuitable for continued use.

c. (AVIM) Replace parts with damage exceeding limits of figure 5-45.

d. (AVIM) Repair corrosion and mechanical damage that is within limits of figure 5-45. Repair steel parts only to a depth sufficient to remove traces of corrosion. Repair aluminum parts to twice the depth of deepest pit, not to exceed limits of figure 5-45. Use fine to medium grade of abrasive cloth (C1) or fine India stone and final polish to a scratch free finish with crocus cloth (C68). Apply primer (C79) to repairs on cadmium plated surfaces. Apply alodine (C62) to repairs on aluminum surfaces.

e. (AVIM) Replace parts with wear exceeding limits of figure 5-47.

f. (AVIM) Replace parts which fail magnetic particle or fluorescent penetrant inspection.

g. (AVIM) Replace bearing (1, Fig 5-46) if looseness exceeds 0.010 inch axial or 0.007 inch radial or if bearing and sleeve are loose in scissors. Inspect bearing (16, Fig 5-44) and liner (2, Fig 5-46) for looseness, bearing play 0.010 inch axial and 0.012 inch radial and egging of mating hole. Egging shall not exceed 0.0005 inch for 30 degrees. Maximum allowable wear to liner is 0.0025 inch, if ID is greater than 1.1285 inch replace liner.

(1) Position scissors over a suitable support having clearance for bearing and sleeve. Press bearing and sleeve out of scissors lever.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(2) Clean lever using methyl-ethyl-ketone (C177). Inspect bore for scoring. Depth of score shall not exceed **0.002** inch after cleanup.

(3) Apply primer (C79) to mating surfaces of replacement sleeve and scissors bore. Support scissors and press sleeve into bore (figure 5-46).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(4) Remove lube fitting from lever and using hole as a guide, drill **0.092 TO 0.098** inch hole in sleeve. Exercise care not to increase lube fitting hole size. Press new lube fitting in lever. Ream sleeve **1.2488 TO 1.2493** inch diameter. Clean sleeve bore with methyl-ethyl-ketone (C177).

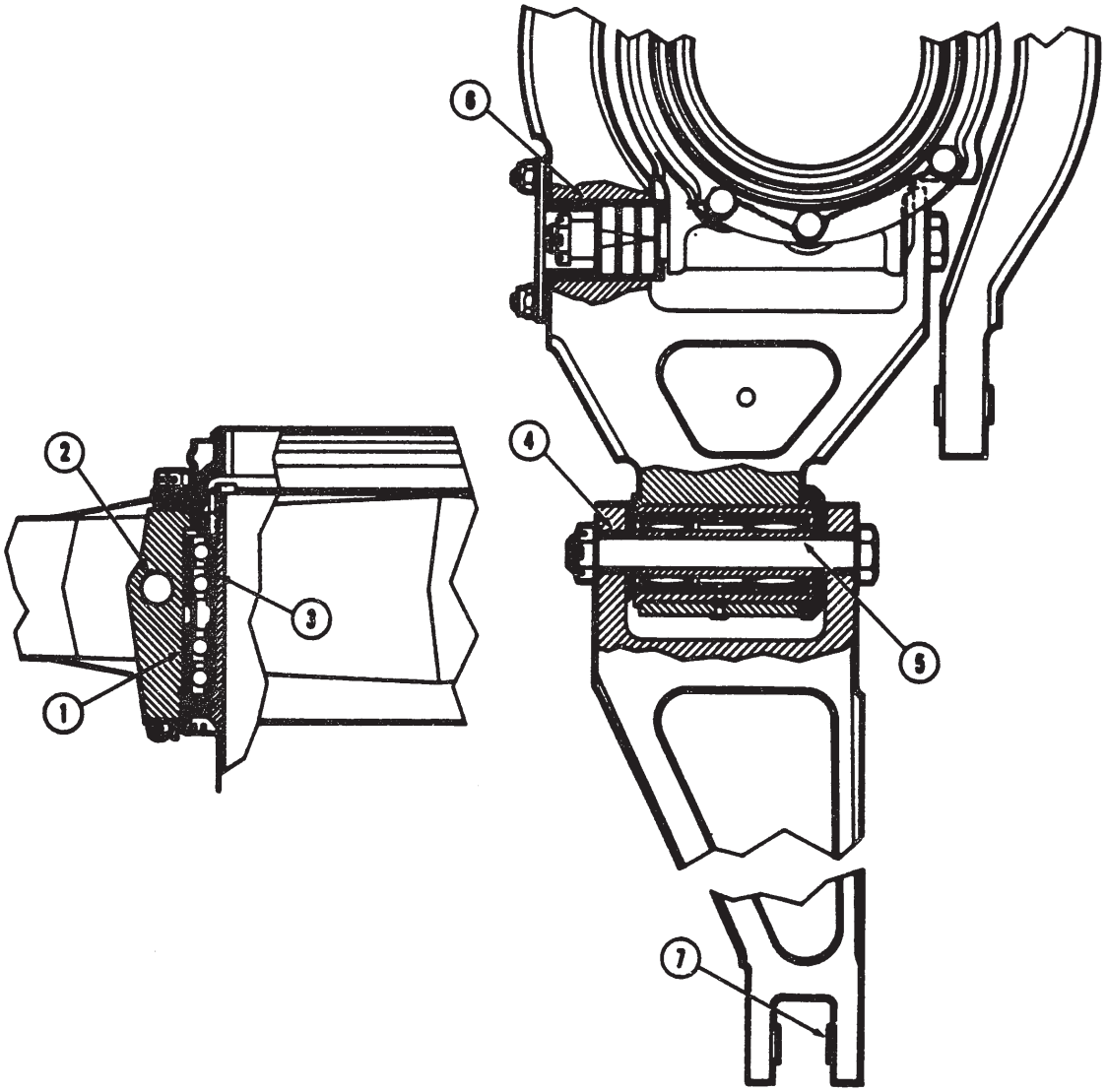
(5) Apply primer (C79) to mating surfaces of bearing and sleeve. Press bearing into sleeve.

(6) Ring stake sleeve over bearing and housing on both sides with staking tool (T99.1). (Figure 5-46). Proof load ring staking of bearing to 500 pounds in each direction. Apply load to outer race only. This is a sign-off inspection point. Check bearing for freedom of movement.

(7) Check scissors for cracks. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

h. (AVIM) Replace sleeve (2, figure 5-46) if inside diameter exceeds 1.1285 inch.

(1) Support scissors and press sleeve out.



ITEM	NOMENCLATURE		MFG. DIMENSIONS (NEW PART)		REPLACE
			MIN	MAX	
1	HUB	ID	5.2496	5.2500	5.2520
2	HUB BOLT HOLE		0.4995	0.5000	0.5015
3	SLEEVE BEARING SEAT	OD	4.2500	4.2507	4.2480
4	LINK BUSHING	ID	0.4995	0.5000	0.5010
5	INNER RACE	ID	0.4995	0.5000	0.5010
6	BEARING LINER	ID	1.1249	1.1254	1.1270
7	LINK BUSHING	ID	0.3120	0.3125	0.3140

Figure 5-47. Scissors and Sleeve — Limit Chart

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(2) Remove all traces of adhesive from scissors bore with a plastic scraper. Clean bore with methyl-ethyl-ketone (C177) and wipe dry with clean cheesecloth.

(3) Abrade the sleeve OD with 180 grit abrasive cloth (C2) and wipe with a dry, clean cloth to remove sanding residue.

(4) Apply retaining compound (C79) to mating surfaces of sleeve and bore. Cure at **180F** for one hour or at room temperature for **24** hours.

i. (AVIM) Replace bearing set (8, figure 5-44) if allowable play of 0.010 inch axial or 0.012 inch radial is exceeded. Bearing must be replaced by serialized set. Replace bearing (16, figure 5-44) if allowable play of 0.010 inch axial or 0.012 inch radial is exceeded.

j. (AVIM) Replace bushings (4 and 6, figure 5-46) if wear limits are exceeded.

(1) Support tangs of link and press out bushings (4 and 6) as required.

(2) Apply primer (C79) to mating surfaces of bushing and link. Support tang of link and press in new bushing.

(3) Line ream new bushings (6) **0.3120 TO 0.3125** inch after installation.

(4) Line ream new bushings (4) **0.4995 TO 0.5000** inch after installation.

k. Replace shims (7 and 9) if damaged or deteriorated.

5-83. Assembly - Scissors and Sleeve Assembly. Item numbers below refer to figure 5-44 unless otherwise indicated.

WARNING

Rotor Controls Parts Kit, P/N 204-1629-2, must be replaced as a kit. Replacement of individual bolts within the kit is not authorized (see figure 1-15, Rotor Controls Parts Kit).

Premaintenance requirements for assembly of scissors and sleeve

Condition	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T36) (T37) (T38) (T50) and (T58)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C91) (C129) (C155) (C261)
Special Environmental Conditions	None

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

a. Clean bearings (8, 20, and 24) with clean solvent (C261), and hand pack with grease (C129).

b. Using bar (T50) press bearing (24), spacer (25) and bearing (20) (seal side outboard) into scissors (12).

c. Install shim (9) and bearing set (8) (V-mark on outer races aligned and pointing inboard) into liner (10). Install liner in scissors with compound (C79) on mating surfaces (cure at 180 degrees for one hour or room temperature for **24** hours and check for a dimension of **3.990 TO 4.000** inches between inner race of bearing set (8) and inside face of short leg of scissors. (See detail A.) (Add or remove shim (9) as required to obtain dimension.

d. Install shim (7) and spacer (6) in liner (10) and temporarily install cover plate (3). Check that spacer (6) extends **0.003 TO 0.009** inch beyond outer face of liner (10). (See detail A.) Adjust shim (7) as required to obtain dimension.

e. Accomplish steps a. through d. on opposite scissors.

f. (AVIM) Install new seal (32) in nut (33) using ram adapter (T37). Apply coat of corrosion preventive compound (C91) to threads of nut. Place nut (slotted side down) on collective sleeve (31).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

g. (AVIM) Clean bearing set (34) with solvent (C261), air dry and hand pack bearings with grease (C129).

h. (AVIM) Assemble bearing set (34) and spacer set (35) with V-mark on bearing races aligned and pointing up. (See detail E.) Using ram adapter (T37) press two lower bearings (34) on collective sleeve (31). Press spacer set (35) and upper bearing on collective sleeve. Ensure that V-mark is aligned and pointing up.

i. (AVIM) Apply coat of corrosion preventive compound (91) to threads of nut (38). Start nut (left-hand threads) on collective sleeve (31). Install wrench (T38) with pins engaged in holes of nut. Hold collective sleeve (31) with bar (T50) and torque nut (38) **150 to 200** foot-pounds, until one hole in both nut and collective sleeve is aligned. Remove wrench from nut.

j. (AVIM) Install pin (37) in aligned holes of nut (38) and collective sleeve. Install lockwire (C155)through hole in pin in space between nut and sleeve. (See detail D.) A sign-off inspection is required to insure the installation of the pins and lockwire.

k. (AVIM) Press new seal (43), lip of seal up, into top of hub (44) using ram adapter (T37). Press seal flush with or slightly, below top surface of hub seal bore.

l. (AVIM) Place collective sleeve (31) on suitable press with support halves (T36) under lower bearing set (34). Place shoulder ring (36) on upper bearing (34) and press hub down over bearings.

m. (AVIM) Install wrench (T38) on nut (38). Invert hub and sleeve assembly and secure wrench in a vise.

n. (AVIM) Start nut (33) into hub and using wrench (T58), torque nut **200 to 250** foot-pounds until tabs of lockplate (46) will align with slots in nut and holes in lockplate align with screw mounting holes in hub. If lockplate will not align within torque limits, obtain a new lockplate and drill two holes, **0.198 to 0.204** inch diameter to match screw mounting holes in hub (44).

o. (AVIM) Install lockplate (46) with tabs engaged in slots of nut (33). Install two screws (45) thru lockplate (46) and washer, flat (47) and lockwire (C155). This is a sign-off Inspection point. Turn assembly upright and remove tools.

p. (AVIM) Apply corrosion preventive compound (C91) to bolts (40). Install drive plate (42) and flange (41) on top of hub (44). Secure with bolts (40) and washers (39). Lockwire (C155) bolt heads in sets of three.

q. Install scissors assembly (12) as follows:

(1) Position spacer (17) in inboard end of liner (10).

(2) Position bearing (16) in short arm of scissors assembly (12).

NOTE

Bearing (16) is intended to have a loose fit in steel liner.

(3) Coat bolt (14) with corrosion preventive compound (C291).

(4) Position scissors assembly (12) on sleeve and hub assembly (11) and insert bolt (14) with special washer (13) under bolt head. Use standard or thin steel washer (15) as required to provide a **0.010** inch minimum gap between scissors assembly (12) and special washer (13). (See detail B). Install spacer (5) and nut (18). Torque nut (18) **200 to 400** inch-pounds and install cotter pin (4). Check for freedom of movement and no end play of scissors (12) on hub assembly (11). This is a sign-off inspection point to insure installation of cotter pins.

(5) Install cover plate (3) and secure with washers (2) and nuts (1).

(6) Accomplish steps (1) through (5) install opposite scissors.

r. Install link (28) on scissors (12) as follows:

(1) Install inner race (19) thrust washer (21), seal (22A) and housing assembly (22) between tangs of link (28). Retain parts in place with bolt (26). Hold assembled parts against opposite side of link and measure gap between housing assembly (22) and tang of link (28).

(2) Prepare and install shim (23) between housing assembly (22) and link assembly (28) as required to obtain **0.000 to 0.002** inch gap. (See detail C.) Remove bolt (26) and assembly parts from links.

(3) Coat new bolt (26) with corrosion preventive compound (C91).

(4) Insert inner race (19) in outboard end of scissors (12). Position link (28) on scissors with thrust washer (21), seal (22A), housing assembly (22), and shim (23), of previously determined thickness, between forward tang of link (28) and scissors. Install bolt (26) with washer (27) under head. Install washer (27) and nut (29). Torque nut (29) **200 to 400** inch-pounds and install cotter pin (30). This is a sign-off inspection point to insure installation of cotter pins.

NOTE

There should be no axial looseness at inner race. Ensure that the drive link does not bind on the scissors and that 0.090 inch chuck is not exceeded.

(5) Accomplish steps (1) through (4) to install link on opposite scissors.

s. Lubricate scissors and hub through lube fittings with grease (C129) (figure 1-6).

t. Check scissors and sleeve assembly for smooth operation.

5-84. Installation — Scissors and Sleeve.

WARNING

If trunnion bearings are replaced due to cracks per paragraph 5-60.b.(3), a new Rotor Controls Parts Kit, P/N 204-1629-2 (which includes bolt 4, figure 5-34), must be installed.

a. Lubricate splines and collective sleeve with grease (C129).

b. Lower scissors and sleeve assembly (3, figure 5-34) carefully over mast and into swashplate support.

NOTE

If trunnion bearing has been replaced due to cracks per paragraph 5-60.b.(3), a new bolt (4) shall be used and old bolt discarded.

c. Attach drive links to trunnions (10) on swashplate outer ring. Install bolt (4) (head in direction of rotation). Washer (5) will be installed with the countersunk portion against the bolt head. This is the only washer used under the bolt head. Install bolt through drive link and trunnion. Install washer (6) next to drive link, followed by as many washers (7) as required for proper placement of nut. Install nut (9) and torque **120** inch pounds. Install cotter pin (8). If slots do not align, tighten until castellations on nut align with bolt hole but do not exceed **145** inch-pounds of torque.

CAUTION

Ensure that bearing and liner (13) is installed with raised side toward mast.

d. Position bearing and liner assemblies (13) in cut-out in swashplate support with raised side toward mast. Install screws (14). Lockwire (C155) in vertical pairs.

e. Position boot (2, figure 5-34) down over flange at top of scissors and sleeve. If boot is split type, apply uniform coat of adhesive (C39) or equivalent on faying surfaces (joint of split) of boot. Form boot around mast while adhesive is wet. Position spacer (1) around mast, under top edge of boot. Secure top and bottom of boot with lockwire (C155). Apply a bead of sealant (C244) along split of boot (2) and around top of spacer (1).

CAUTION

To prevent possible damage to the dust boot (2) during operation, a distance of 10.25 TO 10.75 inches must be maintained between the top of the boot and the lower surface of the damper support frame. Position of the collective stick is not important while setting these dimensions.

f. Install collective lever (paragraph 5-73).

g. Install damper and support assembly (paragraph 5-56).

h. Install main rotor hub and blade assembly (paragraph 5-13).

i. Install stabilizer bar (paragraph 5-47).

SECTION V. TAIL ROTOR SYSTEM

5-85. TAIL ROTOR SYSTEM.

5-86. Description - Tail Rotor System. The tail rotor system consists of the tail rotor hub and blade assembly and the pitch change mechanism. The hub and blade assembly is mounted on the left side of the tail rotor gearbox and is driven through the gearbox. The pitch change mechanism controls pitch angle of the tail rotor blades by a pitch change rod mounted through the gearbox, a crosshead, and pitch change links. The pitch change mechanism is actuated by control pedals through a series of control tubes, a hydraulic cylinder, a quadrant, and cables extending through the tailboom from the quadrant to the pitch change mechanism.

5-87. Troubleshooting - Tall Rotor System. A chart of possible tail rotor troubles, causes, and corrective action is shown on Table 5-6.

NOTE

Before you use this table be sure you have performed all normal operational checks. Throughout this table the tall rotor hub and blade assembly is referred to as tall rotor.

Table 5-6. Troubleshooting Tail Rotor System

CONDITION TEST OR INSPECTION CORRECTIVE ACTION
1. High Frequency Vibration.
STEP 1. Tail rotor out of track.
Track tall rotor (paragraph 5-124 or 5-135).
STEP 2. Tail rotor out of balance.
Remove tail rotor (paragraph 5-92).
Balance fixture (paragraph 5-96).
Dynamically balance tall rotor (paragraph 5-124 or 5-135).
STEP 3. Worn or loose hinge flapping.
Repair tail rotor hub (paragraph 5-101 thru 5-106).
STEP 4. Worn grip bearing.
Repair tail rotor hub (paragraphs 5-101 thru 5-106).
STEP 5. Loose retaining nut.
Torque nut (paragraph 5-97).

Table 5-6. Troubleshooting Tail Rotor System (Cont)

CONDITION	TEST OR INSPECTION	CORRECTIVE ACTION
	STEP 6. Bent pitch change links.	Replace pitch change links (paragraphs 5-92 and 5-97).
	STEP 7. Worn or loose pitch change rod duplex bearings.	Torque nuts/replace bearings (paragraphs 5-92 and 5-97).
	STEP 8. Worn or loose pitch change slider.	Replace slider (paragraphs 5-92 and 5-97).
	STEP 9. Elongated holes 90 degree gearbox mount.	Repair gearbox mount (paragraph 2-296).
	STEP 10. Loose rivets from spar to casting under 90 degree gearbox.	Replace rivets (paragraph 2-296.1).
	STEP 11. Loose tail rotor gearbox bolts.	Torque gearbox mounting bolts (paragraph 6-189).
	STEP 12. Loose elevator linkage at the elevator horn.	Replace worn bushings (paragraph 5-57).
	STEP 13. Loose elevator.	Adjust bearing shims (paragraph 2-293).
	STEP 14. Loose rivets in elevator mounting plates.	Replace rivets (paragraph 2-292).
	STEP 15. FM antenna mount loose or cracked.	Tighten mount or replace (figure 2-59).
2. Inability to make normal right and left turns in flight		
	Blade angles not set properly.	Check pitch settings and rigging (paragraph 11-110).

*U.S. Government Printing Office: 1990-754-046/1049

SECTION VI. TAIL ROTOR HUB AND BLADE ASSEMBLY

5-88. TAIL ROTOR HUB AND BLADE ASSEMBLY.

5-89. Description - Tail Hub and Blade Assembly. A single two blade controllable pitch tail rotor is located on the left side of the tail rotor gearbox. It is composed of the blades and the hub, and is driven through the tail rotor gearbox. Blades are all metal construction and attached by bolts in blade grips which are mounted through bearings to spindles of the hub yoke. The tail rotor hub is hinge mounted to provide automatic equalization of thrust on advancing and retreating blades. Control links provide equal and simultaneous pitch change to both blades. The tail rotor counteracts torque of the main rotor and provides directional control.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

5-90. Cleaning - Tail Rotor Hub and Blade Assembly.

a. Clean tail rotor hub by wiping with a clean cloth moistened with solvent (C261).

b. Wash tail rotor blades with a solution of mild soap (C101) and water.

5-91. Inspection - Tail Rotor Hub and Blade Assembly (Installed).

a. Inspect inside of gearbox shaft (30, figure 5-48) for evidence of grease, caused by excessive lubrication of crosshead bearing.

(1) Remove tail rotor crosshead and slider, move pitch change rod (29) to fully extended position.

(2) Inspect inside of gearbox shaft (30) for grease.

(3) If any grease if found, drain oil from gearbox, then remove chip detector from sump and inspect internally for evidence of grease.

(4) If there is no evidence of contamination from grease, service gearbox, reinstall tail rotor slider and crosshead, and return to service.

(5) If contamination is found remove gearbox for inspection (paragraph 6-194).

b. Inspect tail rotor grip bearings.

(1) Disconnect pitch links from tail rotor blade pitch horns.

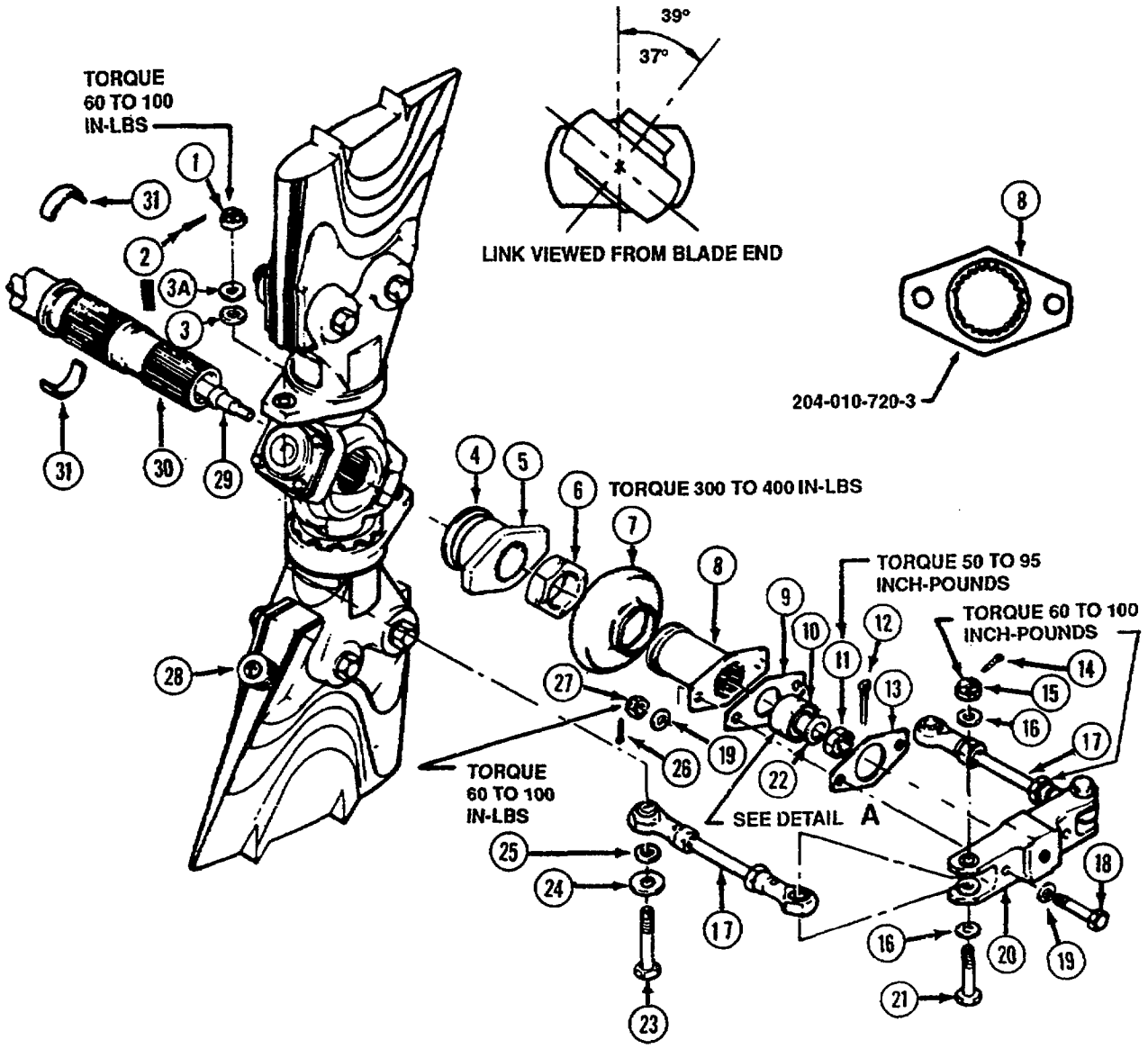
(2) Rotate blades individually about pitch change axis and check that bearings move smoothly with no evidence of roughness (roughness in the form of a light washboard effect on the grip bearings is acceptable). If bearings are questionable, remove and disassemble tail rotor for bearing inspection.

c. Inspect all tail rotor parts for evidence of damage. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

d. Inspect moving parts and pivot bolts in the pitch change mechanism for looseness and wear. Use a dial indicator to measure axial and radial looseness of pitch change rod bearing (10, figure 5-48) (paragraph 11-145).

e. Deleted.

f. Inspect crosshead for visible damage, surface nicks and scratching. (Refer to paragraph 5-111 for detailed inspection.) If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.



1. Nut
2. Cotter pin
3. Washer
3A Washer
4. Shim
5. Static stop
6. Nut, hub retaining
7. Boot
8. Slider
9. Retainer plate
10. Bearing set
11. Nut
12. Cotter pin
13. Shim
14. Cotter pin
15. Nut
16. Washer
17. Pitch link
18. Bolt
19. Washer
20. Crosshead
21. Bolt
22. Washer
23. Bolt
24. Washer, safety
25. Spacer
26. Cotter pin
27. Nut
28. Hub and blade assembly
29. Pitch change rod
30. Gearbox shaft
31. Split cone set

Figure 5-48. Tail Rotor Installation

g. Use a dial indicator to inspect for maximum allowable radial or axial looseness of **0.020** inch at each end of the pitch change link (17, figure 5-48).

h. Inspect boot (7) for wear and deterioration.

5-92. Removal - Tail Rotor Hub and Blade Assembly. Item numbers below refer to figure 5-48 unless otherwise indicated.

a. Disconnect pitch change link (17) from tail rotor hub by removing attaching hardware.

b. Remove crosshead (20) and shim (13) by removing two attaching bolts (18) with nuts (27) and washers (19).

c. Cut lockwire wrapped on each end of boot (7).

CAUTION

Remove bearing set (10) with care. Inner races are not fixed and will separate from bearing if not held together.

d. Remove cotter pin (12), nut (11), and washer (22) from end of pitch change rod (29). Remove bearing set (10), retainer plate (9), and pitch change slider (8). Remove boot (7).

e. Cut lockwire and remove hub retainer nut (6). Remove static stop (5). Remove shim (4), if installed.

f. Move tail rotor hub and blade assembly (28) outboard on splines of shaft and remove split cone set (31) as it is released. Remove tail rotor over end of gearbox shaft (30) and pitch change rod (29).

Figure 5-49. Deleted.

NOTE

Fasten split cones together and retain as a matched set.

5-93. Disassembly - Tail Rotor Hub and Blade Assembly.

NOTE

Observe and note color coding on blades and grips.

a. Remove nuts, washers, and bolts attaching tail rotor blades to blade grips, and remove blades.

b. Loosely install bolts, washers and nuts in grips as removed if same blades and hub are to be reassembled. If blades or hub are to be replaced, bolts, washers and nuts need not be identified.

5-94. Inspection - Tail Rotor Hub and Blade Assembly.

a. Inspect tail rotor hub for damage, wear and rough grip bearings. Refer to paragraph 5-103. for detail inspection of hub parts. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

b. Inspect blades for paint condition and damage. Refer to paragraph 5-117. for detail inspection of blades.

5-95. Assembly - Tail Rotor Hub and Blade Assembly.

CAUTION

When installing a new or replacement blade, inspect for corrosion in accordance with paragraph 5-117.h.(4).

a. Clean paint or foreign material out of bolt holes in grips and blades. Coat bolts with corrosion inhibitor (C135).

CAUTION

Do not attempt to align bolt holes by striking the blade with any tool. Back up the grip at the bolt hole with a wooden block while carefully tapping bolts into place.

CAUTION

Steel grip assemblies must be installed on both spindles. Do not intermix steel and aluminum grips.

NOTE

Observe color coding on blades and grips.

b. Insert blade into grip with leading edge of blade on same side of grip as pitch horn. Align one bolt hole and install bolt, with one washer under bolt head, two washers under nut, and nut.

c. Align second bolt hole and install bolt, washers and nut in the same manner. Torque bolts **270 TO 300** inch-pounds.

NOTE

Blade bolts may be installed with heads either inboard or outboard, but all four bolts must be installed in the same direction.

d. Repeat steps a. through c. to install opposite tail rotor blade.

e. Balance tail rotor hub and blade assembly (Refer to paragraph 5-96.).

5-96. Balancing - Tail Rotor Hub and Blade Assembly.

NOTE

Tail rotor balancing is required whenever the blades and/or hub are replaced and whenever the hub is disassembled for grip, bearing or trunnion replacement.

Premaintenance requirements for balancing tail rotor hub and blade assembly

Condition	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T1) (T73) (T78) (T85)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	None
Special Environmental Conditions	Draft Free

Assemble work stand and hoist kit (T73) (figure 5-50). Place fixture, (2) recessed side downward on table of stand as shown in view A.

NOTE

If workstand is not available, auxiliary support blocks may be used to act as a support stand.

b. Before installing post assemblies (4), adjust index pin (16) to a dimension of 1-11/16 inches from the end of the past (1, view B). Using a 3/32 inch hex wrench, tighten the set screw in index pin (16) to maintain the proper setting.

c. After adjusting post assemblies properly, install post assemblies (4) into holes of fixture (2), shown as holes A in fixture (view C).

d. Locate pilot bushing (11) large end down, centrally on top of fixture bolt.

e. Remove or loosen nuts (14) from tail rotor blade attaching bolts (1 3). Drive bolts partially out of yoke assembly to obtain an approximate 9/32 inch gap under bolt heads as shown in view A.

NOTE

Insure tail rotor assembly has been purged and lubricated prior to balancing.

f. Set tail rotor on fixture (2) so that blade shanks clear posts (4); flat surface of hub is upward and inside diameter of rotor splined trunnion fits over diameter of pilot bushing (11).

NOTE

Figure 5-51 illustrates the differences in yoke designs and it will be noted that the "beefed-up'" yoke with the half-moon cutout portion oft he bottom as shown in Detail A requires the 7-3/8 inch setting. when using the (T78) kit. Detail B. illustrates the yoke configuration requiring the 7-1 /4 inch setting, when using the (T78) kit. When using the Tail Rotor Balance Positioning Kit, (T1) follow the instructions of paragraph a. through o. except use an arbor setting of 7-1 /8 inch or 7-1 /4 inch position on the arbor scale as follows: Detail A of figure 5-51 requires a 7-1/4 inch setting and Detail B of figure 5-51 requires a 7-1 /8 inch setting.

g. Install bushing (7, figure 5-50) flange end downward, on balancing arbor (8) so that top surface of bushing aligns with 7-1/4 inch or 7-3/8 inch position on arbor scale (9) depending on the yoke configuration. When using the (T1) kit, use arbor setting of 7-1/8 or 7-1/4 depending on the yoke configuration. lock bushing in this position by moderate and uniform tightening of bushing set screws (10) using 3/32 inch hex wrench.

h. Place plate (6) centrally on top surface of rotor hub as shown in top view of assembly and insert lower end of balancing arbor (8) downward through plate (6), bushing (11) and hub of fixture (2). Seat assembly firmly together by pressing downward on bushing (7) and lock in this position by moderate and uniform tightening of two lower fixture set screws (12).

i. Rotate the rotor hub on fixture, positioning the index pins (16) of the two post assemblies (4) until the indexing pins enter pitch linkage holes in grip arms to their full depth.

j. From the matched sets of positioning bars (3) (P/N 2940 thru 2950, kit T78 or T1). select the pair (set) Identified as having the lowest part number (2940). Make sure each bar bears the same matched pair serial number and the same part number. Trial-install the matched set of bars, blocks upward, between opposite blade attachment bolts, contacting shanks underneath the bolt heads. If bars are short, continue the trial installation using Increasingly longer bar sets as necessary until the longest matched pair that can be installed between the bolts without force has been established. Once this set and length have been established, select the next higher part number bar pair. This is the matched pair bar set that shall be used during the balance operations. Be certain that the pair is identified correctly.

jl. Install balancing spacer, Figure 5-50A, between bolts with cut out facing outboard.

k. Carefully lift upward on both rotor blades at the tips simultaneously to increase span distance between the blade bolts, install the properly matched pair of bars described in paragraph j above, over balancing spacers installed in previous steps (jl.). Then release blade tips, allowing bolts to rest firm-ly on bar ends. Move bars into final position by pressing upward to seat block sections against rotor grip bushing face surface and inward to set tang of bars against bolts (view D).

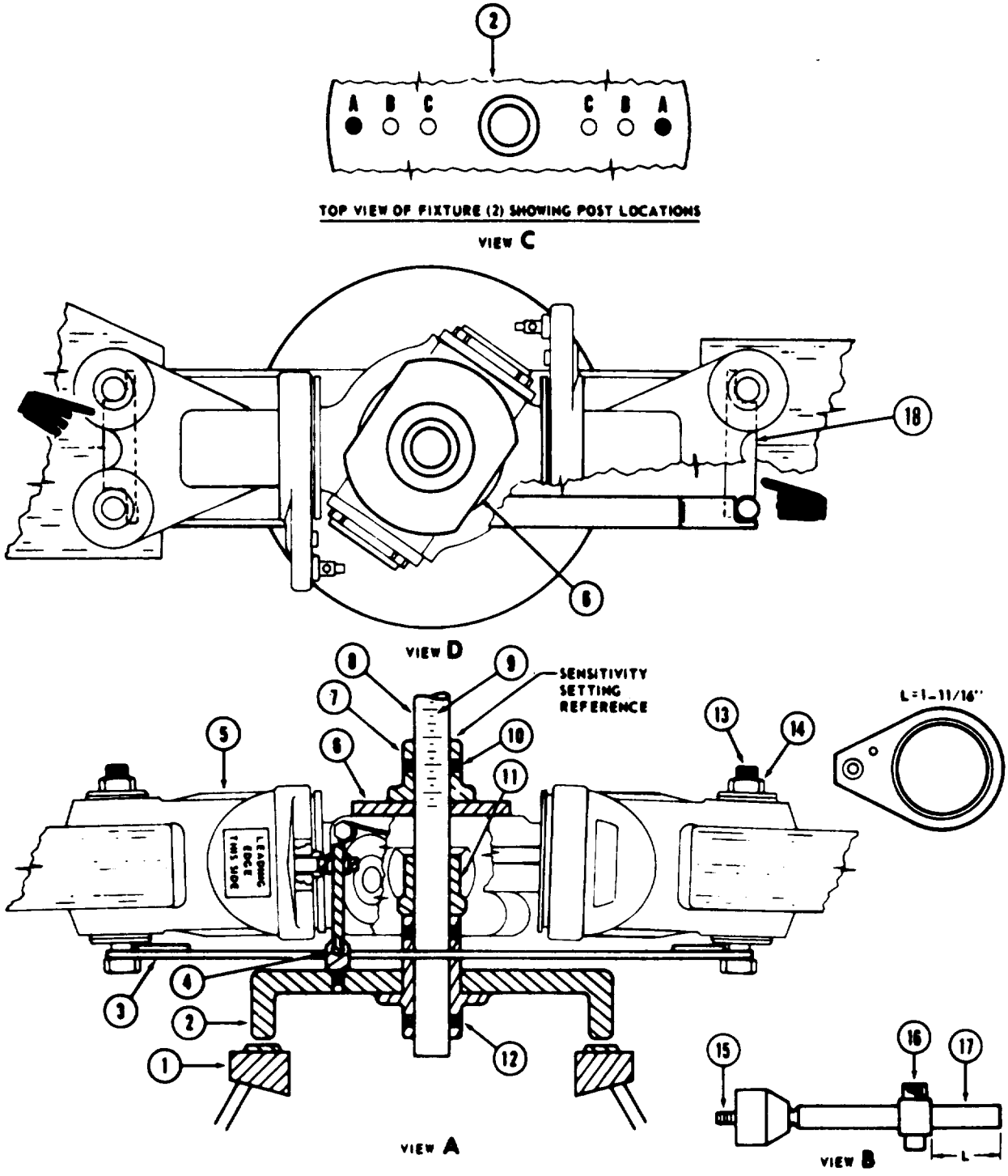


Figure 5-50. Tail Rotor Hub and Blade Balancing (Sheet 1 of 2)

1. Stand table (T73)
2. Fixure assembly
3. Bar pair (11 sets) (2940 thru 2960,178 or T1)
4. Post Assembly (2) (2939, T78 or T1)
5. Tail rotor hub and blade assembly
6. Plate, special tool (T86)
7. Bushing
8. Balancing arbor
9. Arbor scale
10. Bushing setscrew
11. Pilot bushing
12. Lower fixture setscrew
13. Tail rotor attach bolts
14. Tail rotor attach nuts
15. Post thread
16. Index pin — setscrew
17. Moveable index section
18. Balancing spacers

Figure 5-50. Tail Rotor Hub and Blade Balancing (Sheet 2 of 2)

l. Check to make sure that the positioning post index sections are engaged in grip pitch arm holes and that the arbor (8) with bushing (7) 15 tight against the rotor hub.

m. Sight beneath the rotor hub across the positioning bars (3) to make sure they are in the same plane. Correct, if required, by readjusting the index section of each positioning post on its mounting rod and equal mount.

n. Install quick-disconnect coupling (T73) kit on arbor suspension coupler and suspend entire assembly free of interference.

NOTE

Balancing must be done in an absolutely draftless area. A maximum of six washers of any combination is allowed on each bolt in addition to the balance arms. Do not remove or rework blade assembly weights. Use a combination of washers with heaviest washers next to grip. Use one thin washer under bolt head and nut if balance washers are not required.

o. Balance chordwise and spanwise by adding washers to one or more of the blade grip bolts until the indicator bushing is as near center as possible. See figure 5-23 for interpretation of balancer conditions.

p. Torque nuts on blade bolts 270 TO 300 inch-pounds.

5-97. Installation — Tail Rotor Hub and Blade Assembly. Item numbers below refer to figure 5-48 unless otherwise indicated.

WARNING

Ensure slider, part number 204-010-720-3, is installed (figure 5-48).

NOTE

Prior to installation ensure tail rotor hub crosshead, and pitch links are compatible for installation on UH-1 H/V helicopters (figure 5-52).

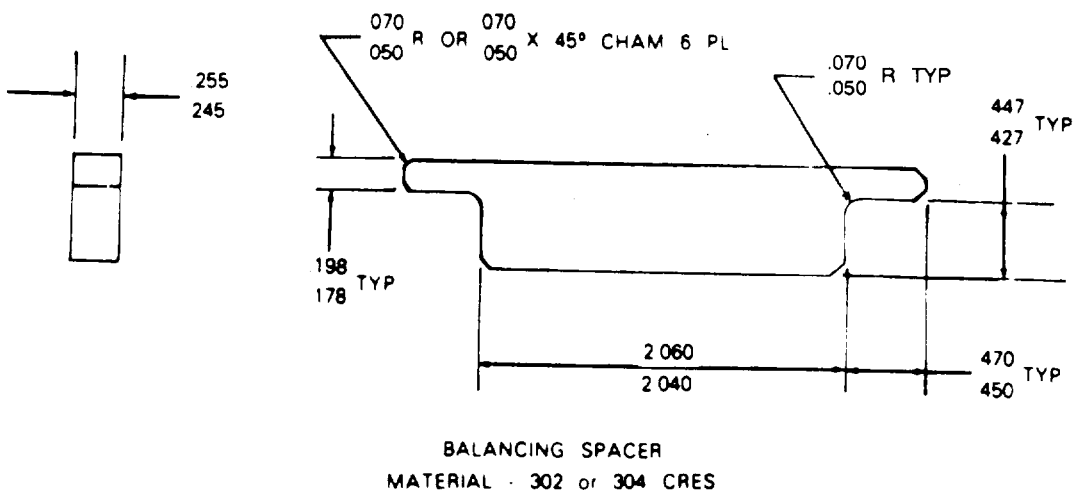
NOTE

Tail rotor blades PIN 204-011-702-15 are the preferred blades for U H-1 H/V series helicopter. Tall rotor blades PIN 204-011-702-17 may be utilized as a substitute, however, intermixing of these blades is prohibited.

a. Observe color coding of parts during installation.

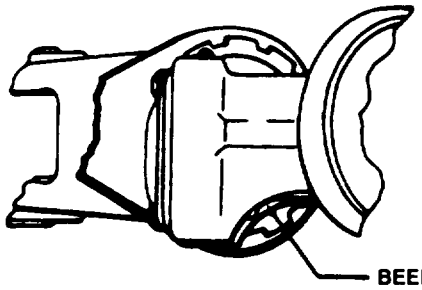
b. Touch up dry film coating (C163) on shaft splines and splines of slider.

c. Position tail rotor hub and blade assembly (28) near end of shaft (30) with bearing bosses of the yoke inboard and flat side of yoke outboard. Align master splines and slide hub of shaft until trunnion is just started on second set of splines.



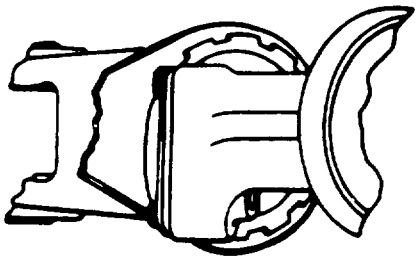
BALANCING SPACER
MATERIAL - 302 or 304 CRES

Figure 5-50A. Balancing Spacer Fabrication



DETAIL A

KIT NO.	ARBOR SCALE SETTING
7HEL065	7 - 3/8 INCH
AA4920-8503	7 - 1/4 INCH



DETAIL B

KIT NO.	ARBOR SCALE SETTING
7HEL065	7 - 1/4 INCH
AA4920-8503	7 - 1/8 INCH

Figure 5-51 Tail Rotor Yoke Configuration - for Proper Arbor Scale Setting Identification

NOTE

Identify crosshead part No. 204-011-711-1 by five inch dimension. The crosshead may have an embossed forging part number. This does not reflect the crosshead part number.

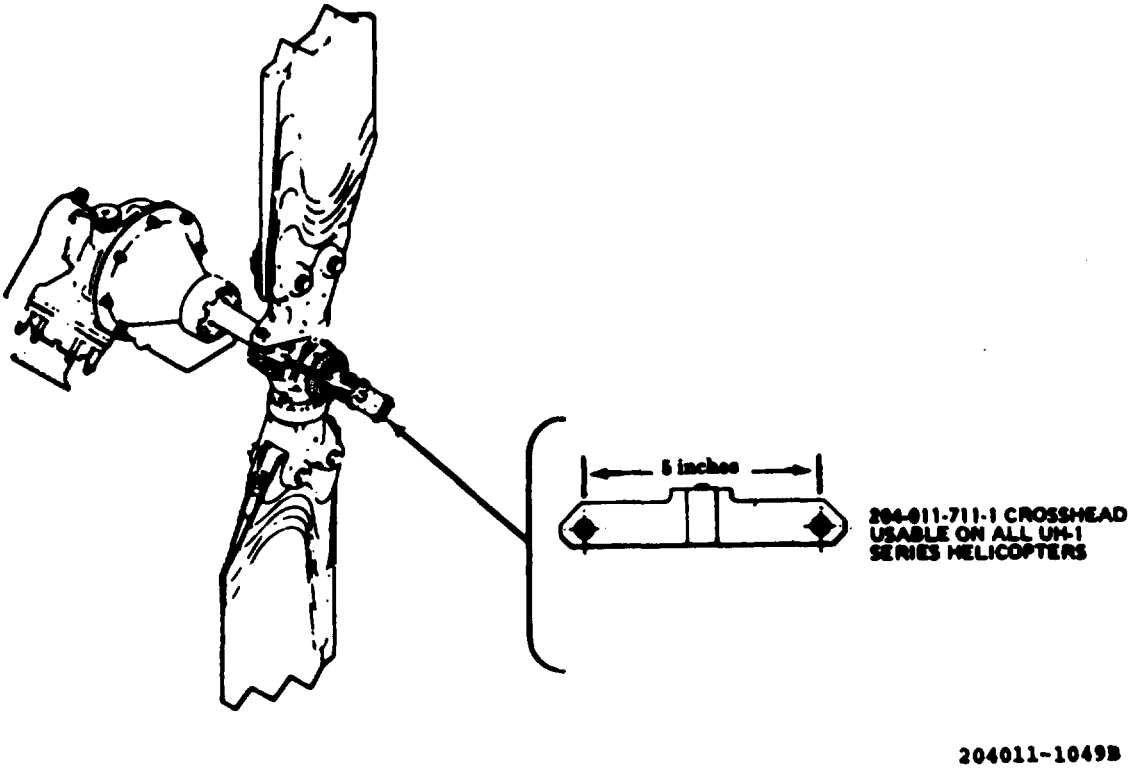


Figure 5-52. Tall Rotor Hub, Crosshead and Pitch Link Compatibility

d. Prior to installation, inspect split cones for any nicks, scratches, indentations or any type deformities in the cones. If damaged, replace.

NOTE

Install split cones as matched set only.

e. Place split cone set (31), with bevel outboard, in groove between splines and shoulder on shaft with end gaps equally spaced. Slide hub inboard to seat trunnion on cones Check cone set for equal spacing.

NOTE

Spilt cones are Installed with equal end gap spacing. If the split cones touch at anytime thereafter, they need not be respaced.

CAUTION

Nut (6) is a Flight Safety Part. The critical area of the nut is the threads. Assure, prior to installation, that threads are inspected for nicks, gouges, missing threads, double cut threads, burrs, and general quality. Any evidence of these defects is cause for rejection.

f. Install shim (4) on shaft against trunnion. Install static stop (5) and hub retaining nut (6). Hold rotor by hub. Torque nut 300 TO 400 inch-pounds. A maximum of one exposed unengaged thread inside nut (6) is permissible after shimming. Lockwire (C156) nut (6) to static stop (5) and install boot (7) on shaft.

CAUTION

Before applying torque to bearing (10), turn pitch change rod to fully extended position to ensure that the bearing bottoms out on the pitch change rod bearing seat and not on retainer plate (9).

NOTE

The 204-011-769-1 bearin is a one-piece design, has no "V" etch, and may be installed in either direction.

g. Install slider (8) on shaft (30) and into boot (7). Lockwire (C155) each end of boot. Place retainer plate (9) and bearings (10) on end of pitch change rod (29), and secure by washer (22) and nut (11). Torque nut 50 TO 95 inch-pounds and secure with cotter pin (12).

h. Determine thickness of shim (13) required for 0.002 TO 0.004 inch pinch fit on crosshead bearings as follows:

(1) With shim omitted temporarily assemble crosshead (20) and secure with two bolts (18), washers (19) and nuts (27).

CAUTION

Ensure correct P/N crosshead is installed (figure 5-52).

(2) Tighten nuts enough to secure assembly without any distortion (seat bearings, but do not preload).

(3) With a feeler gage measure gap between retainer plate and crosshead. Add or subtract sufficient shims to obtain 0.002 TO 0.004 inch gap between retainer plate and crosshead. Use bonded laminated shim only.

(4) Remove bolts and crosshead.

i. Fill crosshead to the ring inside cavity with grease (Cl 29). With pitch change rod and bearing extended away from output shaft, place shim (13, figure 5-48) and crosshead (20) over bearings. Align parts and install bolts (18) with washers (19) under heads, through crosshead (20), shim (13), retainer plate (9), and flange of slider (8). Install washer (19) and nut (27). Torque 60 TO 100 inch-pounds. Additional thin steel washers can be installed under nuts (27) if needed for cotter pin alignment. Install cotter pin (26).

NOTE

With torque applied to nuts (27) the 0.002 to 0.004 inch gap obtained in step h. (3) above will not be evident; however proper pinch fit on crosshead bearings will be present.

j. Either full or partially threaded links can be used to assemble pitch change link (17). Intermixing KSP connecting links with PIN 204-011-762-1 or P/N 204-011-762-11 connecting links is permissible if both link assemblies on any given tail rotor hub are built up the same. Crosshead and blade grip attaching bolts shall be installed with bolt heads toward direction of rotation. Pitch change links must both be of the same configuration.

(1) Maximum allowable wear tolerance for rod end bearings is 0.020 inch axial or radial looseness. No corrosion pitting is allowed on bearing or rod surface.

NOTE

If the same hub and blade assembly and pitch links are being installed and adjustment of the pitch links is known to be satisfactory, omit setting the links to their initial length.

(2) Set pitch links to initial length of 5.4 inches measured between bolt hole centers.

k. Connect each pitch change link (17) to blade pitch horn as follows:

(1) Inspect pitch change links, and determine part number of links being installed. Loosen jamnut on pitch change link at riveted rod end. Check security of rivet and rod end to link. Tighten jamnut and torque 60 TO 100 inch-pounds.

(2) Install links on tail rotor grips with attaching parts. Torque nuts 60 TO 100 inch-pounds. Install cotter pins.

NOTE

The extended rod end bearing of the pitch change link will be attached to the tail rotor grip. The pitch change link with the extended rod end bearing must contact the tail rotor grip.

l. Install pitch change links in crosshead as follows:

(1) Install bolts with washers. Install synthane washers between pitch change links and crosshead. Distance between crosshead ears shall be 0.750 minimum. Install heads of bolts in direction of rotation.

(2) Torque nuts 60 TO 100 inch-pounds and install cotter pins. Use one additional thin steel washer under nuts, if necessary for cotter pin alignment.

(3) Insure extended rod end bearings are centered on tail rotor grips. Loosen jam nut on extended rod end, rotate to center, hold bearing with wrench, tighten jam nut and torque 60 TO 100 inch-pounds.

CAUTION

Do not rotate tall rotor by hand.

CAUTION

At no time will the trailing edge of the tall rotor blade be adjusted to less than 2.5 inches from the tailboom vertical fin.

CAUTION

If adjustment of shim (4) is required, ensure that all procedures for removal and installation of tall rotor attaching parts are followed.

m. Check for 3.0 (±0.5) inch clearance between the thickest portion of the tailboom vertical fin and nearest trailing edge of tail rotor at full right pedal position in rigged condition. If necessary, add shims (4, figure 5-48) to move blade closer to vertical fin or remove shims if blade is too close to vertical fin. Use bonded laminated shims only.

Page 5-118.1 /(5-1 18.2 blank) deleted.

NOTE

Inspect nut (6, figure 5-46) for proper thread engagement to shaft. A maximum of one exposed unengaged thread inside nut is permissible, after shimming is accomplished.

n. Check the tail rotor, and controls for free movement, with not interference, through full flapping angle with full right and left anti-torque pedal applied. if installation is not correct, interference between the pitch change links (17, figure 5-48) and the safety washer (24) may occur before the rotor hub contacts the static stop (5).

0. Lubricate the tail rotor (figure 1-6).

p. Track tail rotor (paragraph 5-124).

NOTE

Between five and ten hours of flight, after installation of tail rotor, retorque tail rotor retaining nut (6, figure 5-48). Retorque can be accomplished with slider and crosshead Installed using care that wrench does not contact adjacent parts.

NOTE

Do not back off nut. Retorque by turning in the tightening direction only. Install new lockwire (C156).

SECTION VII. TAIL ROTOR HUB AND CONTROLS

5-98. TAIL ROTOR HUB.

5-99. Description — Tail Rotor Hub. The tail rotor hub is delta-hinge mounted on a trunnion which is splined for mounting on the gearbox output shaft. The hub utilizes a grooved yoke and split cone arrangement inboard of the retaining nuts; to hold the pitch change bearings in place, and route the centrifugal and oscillatory loads into the yoke at the groove rather than at the retaining nut threads.

5-100. Lubrication -Tail Rotor Hub. Refer to figure 1-6 for lubrication.

5-101. Disassembly – Tail Rotor Hub. (AVIM)

Permaintenance requirements for disassembly of tail rotor hub

Condition	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T43) (T44 or T56)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	None
Special Environmental Conditions	None

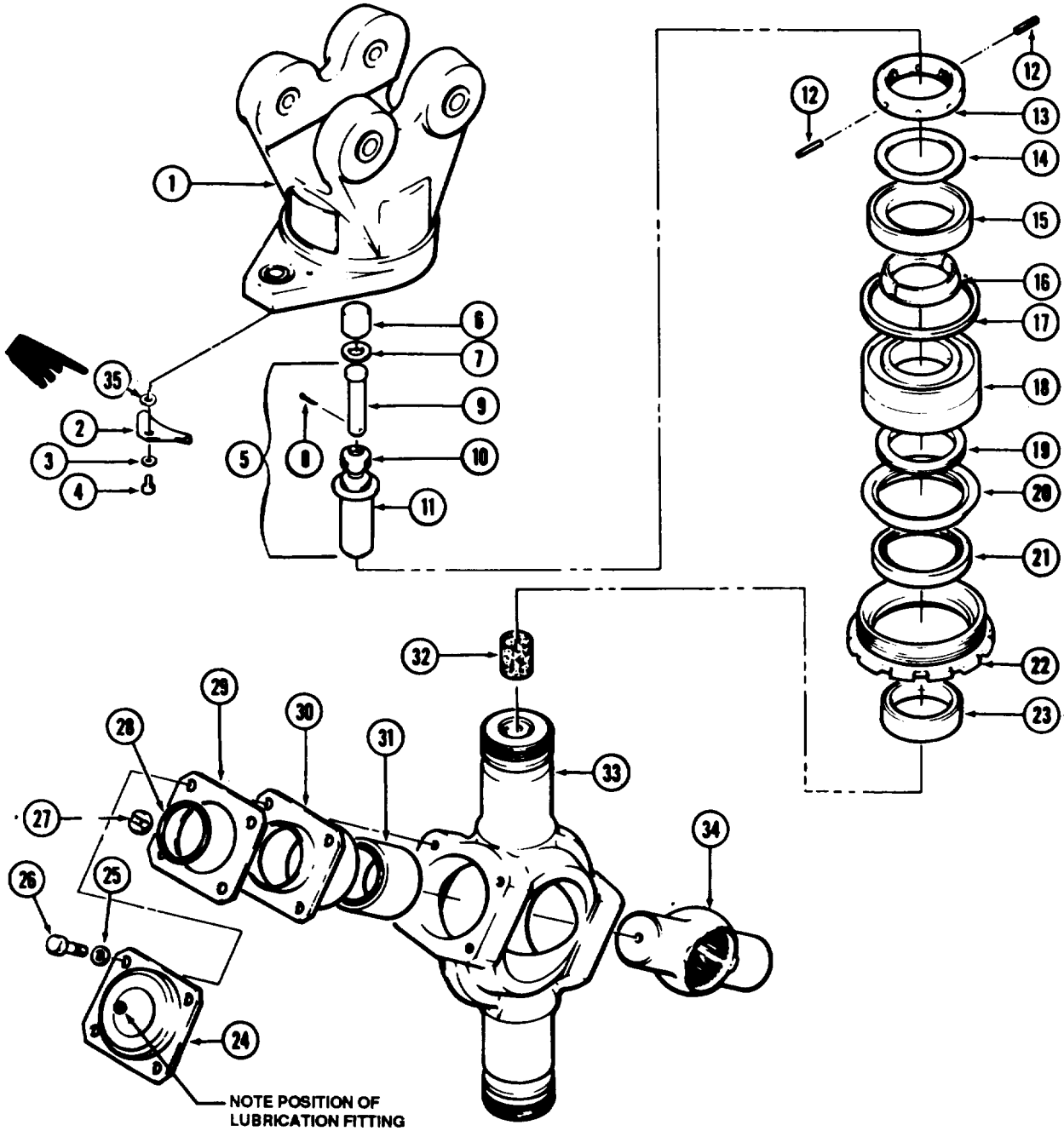
NOTE

Complete disassembly and inspection of the tall rotor hub is not required to replace the grip assembly. When replaclng grip assembly due to expiration of retirement life, Inspect bearings far serviceability and perform visual inspection of accessible parts. Detail dimensional and magnetic particle/ penetrant impactions are required only to evaluate discrepancies.

a. Secure holding fixture of tool (T44) in a vise. Place hub assembly onto fixture with fiat side down. Install and tighten locking nut of tool.

b. Cut lockwire and remove screws (4, figure 5-55), washers (3) and lockplate (2) from grip assembly (1).

c. Back off adapter nut (22) and remove grip assembly (1).



1. Grip assembly
2. Lockplate
3. Washer
4. Screw
5. Spring assembly
6. Plug
7. Shim
8. Cotter pin
9. Pin
10. Washers
11. Housing
12. Spring pin
13. Nut
14. Shim
15. Ring
16. Cone set
17. Shim
18. Bearing set
19. Shim
20. Spacer
21. Seal
22. Nut
23. Radius ring
24. Thrust cap
25. Washer
26. Screw
27. Thrust washer
28. Packing
29. Shim
30. Housing
31. Bearing
32. Cork
33. Yoke
34. Trunnion
35. Washer (Steel grips only)

Figure 5-55. Tail Rotor Hub Disassembled

d. Remove shim (17).

e. Remove plug (6) and shims (7) from spring assembly (5).

f. Remove spring assembly (5) from yoke (33).

g. Disassemble spring assembly (5) by removing cotter pin (8), pin (9), and washers (10) from case (11).

NOTE

Tag Belleville washers (10) as removed for reassembly in the same position. A total of 42 washers consisting of 14 stacks of three washers per stack, is required.

h. Cut lockwire from around nut (13). Remove two spring pins (12) and remove nut from yoke (33).

i. Remove shim (14), ring (15), cone set (16), bearing set (18), shim (19), and spacer (20).

NOTE

Keep bearing set (18) and shims (19) together as a set for reassembly on same spindle of yoke.

j. Remove seal (21) from spacer (20).

k. Remove adapter nut (22) and radius ring (23) from spindle of yoke (33).

l. Repeat steps b. through k. for disassembly of parts from opposite yoke spindle.

m. Cut lockwire and remove four bolts (26), washers (25), and thrust cap (24).

n. Remove thrust washers (27), packing (28), and shim (29).

o. Remove housing (30). Use seal bearing tool (T43) to press bearing (31) from housing.

p. Repeat steps m. through o. to remove parts from opposite side of yoke.

q. Remove hub assembly from holding fixture and remove trunnion (34) from yoke (33).

5-102. Cleaning - Tail Rotor Hub.

CAUTION

Do not use any metallic brush, scraper or other tool to remove sealant from grip thread area.

a. Do not clean sealing compound from grip thread area. Carefully peal sealant from boss area of the grip and from yoke spindle and radius ring before cleaning with solvent.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing solvent vapors.

b. Clean all parts except bearings with solvent (C261).

WARNING

Do not allow air pressure to spin bearing.

c. Dry with filtered compressed air.

5-103. Inspection - Tail Rotor Hub (Disassembled). (AVIM).

a. Visually inspect all components for damage, excessive wear, or corrosion (figures 5-56 through 5-58). If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

NOTE

Any nicks, scratches, and sharp dents not exceeding the maximum damage limits, will be dressed and blended into the surrounding areas.

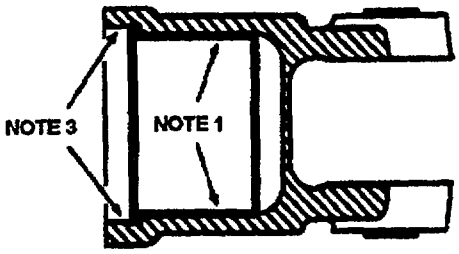
b. Visually inspect bearings (18 and 31, figure 5-53), replace if corroded or cracked. Replace grip bearing (18) if there is evidence of radial play with bearings in thrust loaded position. Roughness in the form of light washboard effect on grip bearings is acceptable. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

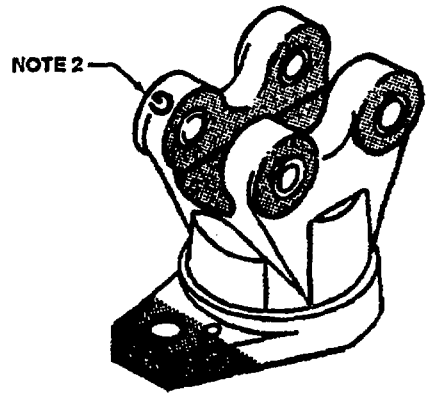
c. Inspect splines in trunnion for chipped or worn teeth (figure 5-58).

c.1. Inspect trunnion bearing liner for nicks, scratches and corrosion, figure 5-58. Replace liners as required.

(1) Adequately secure trunnion assembly. Using an abrasive cutting wheel (or equivalent) make two in line horizontal cut **180** degrees apart on bearing liners approximately **0.5** inch from the top. Depth of cuts shall not exceed **0.093** inch, and their length should adequately accommodate a small bearing cup puller (NSN 5120-00-497-8798, snap-on (J950).

(2) After accomplishment of cuts, place bearing cup puller into grooves and tighten.





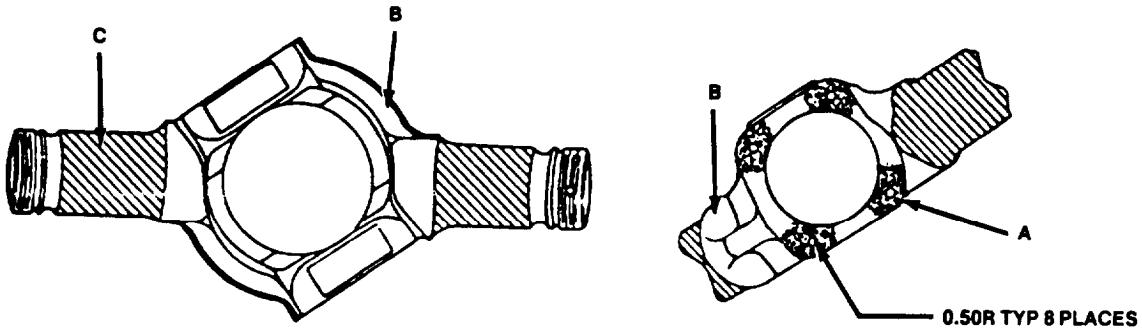
204-011-728/205-011-711
Grip

TYPE OF DAMAGE	DAMAGE AREA REPAIR SYMBOLS ■	 □
	MAXIMUM DEPTHS AND REPAIR AREA ALLOWED	
NICKS, SCRATCHES AND DENTS	0.010 in. Before and After Repair	0.020 in. Before and After Repair
CORROSION	0.005 in. Before Repair 0.010 in. After Repair	0.010 in. Before Repair 0.020 in. After Repair
MAXIMUM AREA OF FULL DEPTH REPAIR	0.010 sq. in.	0.030 sq. in.
MAXIMUM NUMBER OF FULL DEPTH REPAIRS	Note 6	Not Critical

NOTES:

1. **Bearing Liner or Inner Cavity Damage -** Maximum Depth: 0.005 inch.
   Maximum area of full depth repair: 0.010 square inch.
   Maximum number of full depth repairs: 2
2. Letter "G" is vibro etched on grip tang at time of manufacture to indicate thread and hardness specification conformance and should not be removed unless necessary. (Aluminum grip only).
3. Thread Damage - Maximum depth: one-third of thread.
   Maximum length: one-half inch.
4. Edge chamfer - 0.030 inch.
5. Treat all repair areas on aluminum surfaces with brush alodine.
6. The area of repair on inner surface of lugs shall not exceed one-half of any quadrant.
7. Treat all repair areas on steel surfaces by prime/touching up with Epoxy Primer per MIL-P-23377, Item C-206, Table 1-1 repaired areas not holding grease (leave greased areas bare).

Figure 5-56. Tail Rotor Hub Grip - Damage Limits

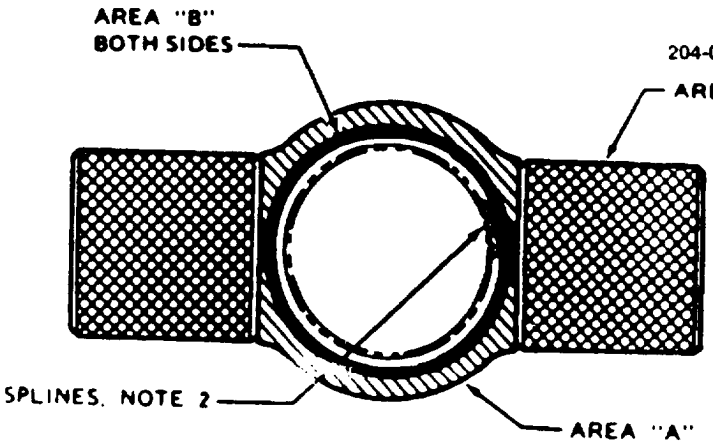


TYPE OF DAMAGE	DAMAGE LOCATION SYMBOLS		
	AREA A	AREA B	AREA C
	MAXIMUM DAMAGE AND REPAIR DEPTH		
NICKS, SCRATCHES SHARP DENTS	0.005 INCH MAX. DEPTH	0.010 INCH MAX. DEPTH	NONE ALLOWED SEE NOTES 8 AND 9
CORROSION	0.005 INCH MAX. DEPTH	0.010 INCH MAX. DEPTH	NONE ALLOWED

NOTES

1. Inspect damage inside roll pin holes with a five (5) to ten (10) power magnifying glass.
2. Local gouges 0.005 inch or less in depth at thread root inside roll pin hole may be cleaned up using a round jewelers file. Clean up area length is 20 percent of hole depth. Minor damage to the peak of the thread surrounding the pin holes requires no clean up unless during installation interference is encountered. Should interference occur, the thread may be dressed using an India stone, providing peak thread damage is less than 30 percent of the thread depth. Damage to thread in excess of above limits is cause for scrapping yoke.
3. Gouges inside roll pin holes beyond thread root, do not affect usability of part.
4. Inside diameter of spindles in area of thrust unit is not a critical area. However, roll pin holes at this location and surrounding surfaces shall be cleaned up. Damage limit is maximum depth of 0.020 inch. Repair will be blended into surrounding area.
5. Scratches in trunnion housing bore may be polished out if less than 0.002 inch in depth.
6. Repair areas on cadmium plates surfaces should be recoated with brush cadmium plate. Zinc chromate primer is acceptable for field repairs.
7. All edges may be radiused or chamfered locally to a depth of 0.030 inch to remove nicks or dents on the yoke center section.
8. Longitudinal scratches on yoke spindle which are not in excess of 0.002 inch in depth need not be completely removed. Surface burrs, however, should be removed using crocus cloth (C68).
9. Refer to wear limits chart (Figure 5-59).
10. Corrosion may be eliminated from trunnion housing by removal of bore material by honing or lapping to a maximum diameter of 1.8765 inch with a final surface finish of 63 RMS.

Figure 5-57. Tail Rotor Hub Yoke — Damage Limits



	AREA A	AREA B	AREA C
TYPE OF DAMAGE	NOTE 1	NOTE 1	NOTE 3
NICKS, SCRATCHES, SHARP DENTS — MAXIMUM DEPTH AFTER BLENDING	0.020 In.	0.010 In.	NONE ALLOWED
CORROSION — MAXIMUM DEPTH AFTER BLENDING	0.020 In.	0.010 In.	NONE ALLOWED
NO CRACKS ALLOWED			

NOTES:

(1) Area A and Area B — Maximum area of rework not to exceed 30 percent of the surface.

(2) Spline Surfaces — Nicks, scratches not exceeding 0.005 inch depth and/or 10 percent of the surface area may be polished locally to blend. No corrosion pitting allowed on splines.

(3) Refer to wear limits chart (figure 5-59).

Figure 5-58. Tail Rotor Hub Trunnion — Damage Limits

(3) Using a press or puller, remove bearing liners from trunnion (use bearing cup puller as a gripping tool).

(4) Place trunnion bearing liners (204-011-736-1) in an oven at 450 degrees F for 15 minutes. Cool trunnion (204-011-737-3) using liquid nitrogen, a freezer, or a mixture of dry ice and denatured ethyl alcohol for 60 minutes after application of a thin film of oil (MIL-L-6085).

(5) Assembly of trunnion and liners shall proceed immediately after parts are removed from their respective media.

(6) Ensure bearing liners are properly seated on trunnion.

d. Inspect all components dimensionally for excessive wear (figure 5-59).

e. Inspect the following parts by magnetic particle method, or fluorescent penetrant method. If cracks are suspected, refer to TM 55-1500-335-23. Parts with cracks must be replaced. Refer to Figure 5-55. Alternate inspection if crack is suspected in the mast nut, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

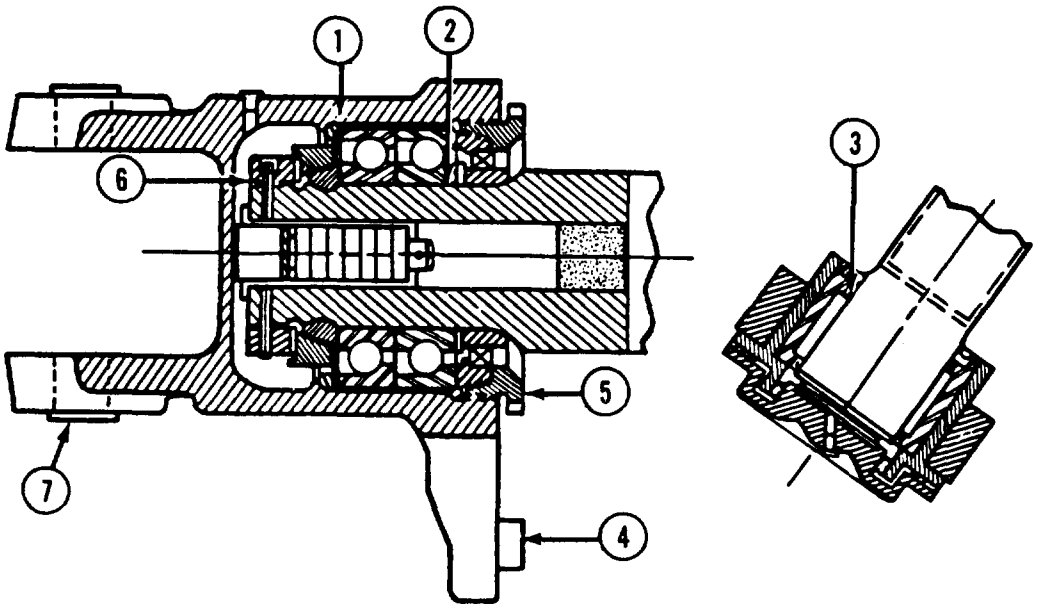
ITEM	NOMENCLATURE	CODE
1	Grip Assembly P/N 204-011-728	F
1	Grip Assembly P/N 205-011-711	M
13	Nut	M
15	Ring	M
22	Adapter Nut	M
33	Yoke	M
34	Trunnion	M

f. Special magnetic particle inspection criteria have been established for the yoke (33, figure 5-55) as follows:

(1) Each yoke shall be inspected by all of the following steps, using the wet continuous method. The true length of any indication shall be determined by the residual method of magnetization (figure 5-60).

(2) Magnetize the part by positioning it so that the yoke arms contact the gauze contact heads of the machine and pass 1400 amperes maximum through the part. Inspect the complete part for indications.

(3) Magnetize the part by placing it inside a coil so that the long axis of the part (yoke arms) is approximately 90 degrees to the direction of the current flow in the coil and pass 1400 amperes through the coil. Inspect the complete part for indications.



ITEM	NOMENCLATURE		MIN.	MAX.	REPLACE
			(MANUFACTURING TOLERANCES)		
1	GRIP LINER	ID	2.4410	2.4415	2.4425
2	YOKE, BEARING SEAT	OD	1.3771	1.3780	1.3750
3	TRUNNION SPINDLE	OD	1.1246	1.1250	1.1230*
4	BUSHING, PITCH LINK	ID	0.2495	0.2505	0.2525
			TORQUE		
5	NUT	IN./LB	500	600	
6	NUT	IN./LB	100	125	
7	BUSHING, BLADE RETENTION	ID	0.4370	0.4380	0.4384

* Replace Trunnion Assembly.

Figure 5-59. Tail Rotor Hub Limits Chart

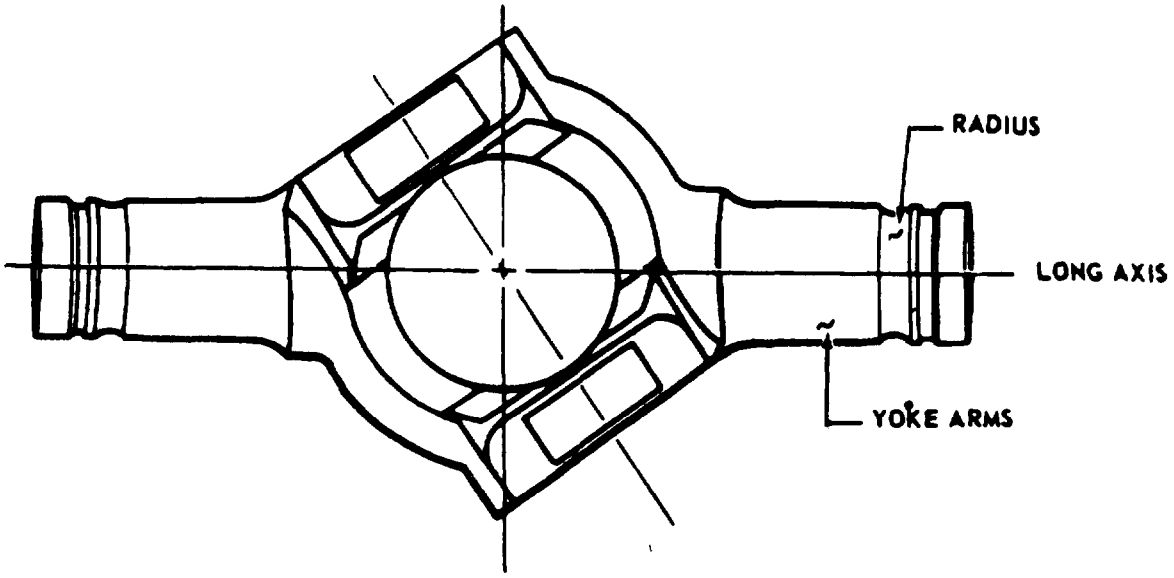


Figure 5-60. Tail Rotor Yoke — Special Inspection Standards

current through the coil. Inspect the complete part for indications

(4) Indications interpreted as cracks, seams, laps or shuts are cause for rejection.

(5) Demagnetize parts after completion of inspection.

5-104. Repair — Tall Rotor Hub. (AVIM).

a. Repair criteria.

(1) Dimensional replacement limits apply to the physical item, “bare metal" prior to the application of any corrosion protection treatment, such as cadmium plating dry film lube, etc.

(2) Evidence of corrosion on yoke spindles is cause for rejection. Inspect yoke spindles as specified in figure 5-57. Longitudinal scratches on the yoke spindle which are not in excess of O 002 inch in depth need not be completely removed. Surface burrs, however, should be removed using crocus cloth (C68).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of advent vapors

(3) Should the dry film lube and/or cadmium plating require removal for any reason, it may be accomplished using abrasive pad (C11) saturated with methyl-ethyl-ketone (C177).

(4) Whenever the cadmium plating or dry film lube (C163) has been removed, it should be reapplied at the authorized maintenance level in accordance with existing directives.

b. Repair or replace, as applicable, any parts which are not within tolerances, or show evidence of failure, when inspected to the criteria outlined in paragraph 5-103.

b.1. If grease fitting is unserviceable, use suitable tool to remove fitting. Apply primer (C219) to new fitting and press into place while still wet.

c. Replace all packing and seals on reassembly. Replace bearing (31) if seal is damaged.

d. Dress splines and threads with a fine India stone (C264) if burrs or scratches are visible.

a. Repair tail rotor grip assembly (1, figure 5-55) to the limits shown in figures 5-56 and 5-59. If replacement of the blade retention bushings (7, figure 5-59) is required, proceed as follows:

(1) Press damaged bushing(s) from grip.

(2) Inspect grip bore for damage, maximum I.D. is 0.6250.

(3) Chill bushing(s) in dry ice for 30 minutes.

(4) Press bushing(s) into grip.

(5) Line ream bushings to figure 5-59 dimensions.

f. Repair tail rotor yoke (33, figure 5-55) to the limits shown in figure 5-57.

g. Refinish tail rotor grip assemblies (1, figure 5-55). Apply one coat epoxy primer (C206) and two coats acrylic lacquer (C14) on all external surfaces. Do not paint holes or bores.

5-105. Lubrication — Tail Rotor Hub. (AVIM)

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

CAUTION

Do not spin bearing with air pressure.

a. Install grip bearings (18, figure 5-55) in bearing lubricator NSN 4930-00-704-1852. Purge and relubricate with grease (C129).

b. Hand pack bearings (31, figure 5-55 with grease (C129).

c. Line grip assembly cavity with grease (C1 29) prior to reassembly.

d. At reassembly lubricate all mating surfaces with lubricating oil (C169).

e. Use corrosion preventive compound (C86) on mating threads of dissimilar metals, except where sealant is used.

5-106. Assembly - Tail Rotor Hub. (AVIM).

Premaintenance requirements for assembly of tail rotor hub

Condition	Requirements
Model	All
Part No. or Special No	All
Special Tools	(T43) (T56)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(Cl 29) (C155) (C244) (C246)
Special Environmental Conditions	None

a. If corks (32, figure 5-55) were removed from yoke, apply shellac (C246) to new cork seals and install into yoke while wet. Apply sealing compound (C244) to the inboard side of the cork.

NOTE

Completely cover the exposed end of the corks which are located in the yoke spindle in board cavities with sealing compound.

b. Use seal bearing tool (T43) to press bearing (31) into housing (30). Position trunnion (34) in place in yoke (33). Push housing, with bearing, into yoke and on trunnion.

NOTE

Position bearing (31) with seal toward yoke.

c. Repeat steps a. and b. to assemble parts on opposite end of trunnion.

d. Center trunnion (34) in yoke (33) as follows:

(1) Secure shaft of grip spacing tool (T44) in a vise. Position yoke and trunnion onto tool with flat side of yoke down.

NOTE

Ensure that I.D. of yoke and trunnion are properly aligned and seated on tool.

(2) Install and tighten locking nut of tool onto assembly.

(3) install thrust washer (27) and thrust cap (24) in place on each side of trunnion (34).

NOTE

Do not install shims (29) and packing (28) at this point of assembly.

(4) Temporarily install washers (25) and bolts (26). Tighten evenly and lightly.

(5) Use a feeler gage to measure gap between thrust cap (24) and housing (30).

(6) Prepare a shim (29) to thickness determined in step (5)

(7) Remove 0.002 inch from shim to provide a total of 0.001 TO 0.004 inch pinch fit on trunnion (34).

(8) Remove thrust cap (24), bolts (26), and washers (25) from measured side of trunnion (34).

(9) Install thrust washer (27) with groove facing outboard, packing (28), and previously prepared shim (29). Position thrust cap (24) with lubrication fitting aligned with groove in thrust washer (27) and lubrication fitting pointing toward the data plate side of tail rotor yoke. Install bolts (26) with washers (25). Do not tighten bolts.

(10) Prepare and install shim (29) for opposite side of trunnion (24) by same procedures outlined in steps (3) through (9).

(11) Torque bolts (26) 20 TO 25 inch-pounds. Lockwire (Cl 55) bolt heads in pairs.

e. Determine thickness of shim (19) required for split cone clamp-up as follows (figure 5-61.)

(1) Identify spindle side, which is being evaluated for shim installation.

(2) Apply a 1/8 inch bead of sealing compound (C244) to radius ring I.D. Position radius ring onto the yoke spindle.

CAUTION

To ensure proper stackup of bearings, "V" markings on O.D. of bearings must line up. As a further check on proper alignment prior to assembly on yoke, each outer race Is marked "THRUST HERE" on Inboard side of bearing outer race. Assemble on yoke spindle with "V' pointing outboard, The word "OUT BD" should then appear on outboard face of outboard Inner race.

(3) Install thrust bearings, (with thrust sides inboard), apex identification facing outboard, onto the yoke spindle. Use a third thrust bearing as a tool to set radius ring properly. Put third bearing on spindle. Torque nut (13, figure 5-55) to 200 inch-pounds. Back nut off, remove third bearing.

(4) Place the split cone set (figure 5-61) into the groove provided on the yoke spindle and retain in position with a small piece of tape.

NOTE

Hold split cones together when applying finger pressure to the bearing set.

(5) Apply finger pressure to the bearing set, in an outboard direction. Insert two feeler gages between the radius ring and the inboard bearing inner race 180 degrees apart. Record gap dimension obtained.

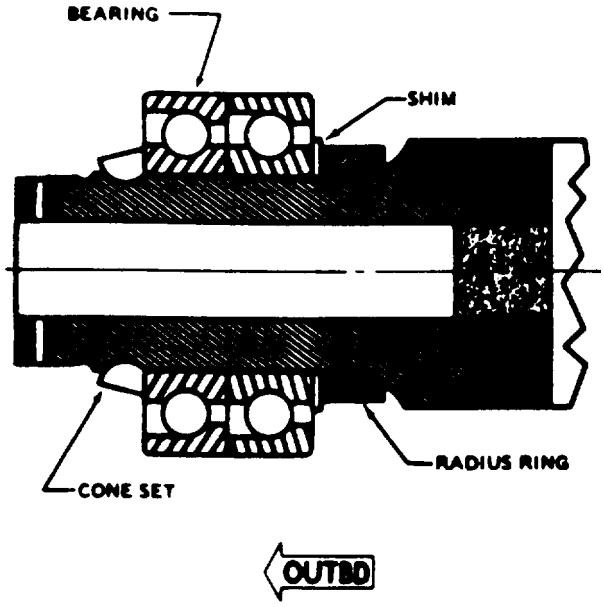


Figure 5-61. Tail Rotor Yoke Bearing Shimming

NOTE

in obtaining the above dimensional gap. tight feeler gage reaedings (heavy drag) are preferred .

(6) Use two readings obtained in step (S). Add 0.002 TO 0.004 inch to the dimension recorded. This figure will represent the shim thckness required. Prepare shim to this dimension.

(7) Remove the split cone set and bearing set, and identify for reinstallation on that spindle side.

(8) Repeat steps (1) through (7) on opposite yoke spindle,

f. Complete assembly of yoke spindles as follows: (figure 5-55),

CAUTION

Shims, bearings, and radius rings must be installed on seine spindle as determined in step e.

CAUTION

Steel grip assemblies must be installed on both spindles. Do not Intermix steel and aluminum grip.

(1) Position adapter nuts (22) on yoke spindles.

(2) Install seal (21) into spacer (20) metal side first, so that rubber lip will face the center of the yoke after installation. Slide spacer (20) and shim (19) into place on each spindle, being careful not to let seal and compound touch seal (21).

CAUTION

To ensure proper stackup of bearing.. "V" markings on O.D. of bearings must line up. As a further chock on proper alignment prior to assembly on yoke, each outer race is marked “THRUST HERE" on inboard aide of bearings outer race. Assemble on yoke spindle with "V" pointing outboard. The word "OUT'BD should then appear on outboard face of outboard inner race.

(3) Install bearings (18) with face marked OUT'BD" positioned toward outboard side of yoke spindle,

NOTE

During installation of the split cones, a noticeable snap fit should be present, which will reflect correct shim installation has been achieved.

(4) Install split cones (16), ring (1 5), and shims (14) each side is required to permit installation of spring pins for locking nut.

(6) Should either of the two following conditions be noted, incorrect shimming has been accomplished and steps (1) through (7), under step e, must be repeated:

(a) Split con. set (16) will not properly seat.

(b) Radius ring (23) will rotate during grip rotation.

(6) install nut (13) Torque 100 TO 125 inch-pounds. Adjust shims (14) as necessary installation of spring pins (12).

NOTE

Prior to attempting to Install spring pins, it is necessary that positive alignment be established to ensure damage-free assembly.

(7) Install spring pins (12). Lockwire (C155) spring pins in place on each spindle.

g. Assemble spring assembly (5) as follows:

(1) Stack washers (10) (42 required consisting of 14 stacks of three washers per stack) and insert pin (9) with washers into case (11).

(2) Lock in place with cotter pin (8).

(3) Install shim (7), into open end of spring assembly, maximum of 12 shims may be used for complete hub assembly. Install thrust plug (6), on top of shim (7), adjust thickness of shims as necessary to maintain 0.275 + 0.010 inch protrusion of thrust plug (6), from bottom of shoulder of spring assembly (5) (figure 5-62).

h. Install spring assembly and plug (figure 5-62) into each end of yoke (33, figure 5-55).

h.1 .Should binding of the steel grip occur when attempting installation, clean grip cavity thoroughly to remove any lubricant. Inspect grip cavity to determine if a high spot(s) is present where cadmium plate is causing binding. Using an abrasive cloth remove a minimal amount of cadmium plating from the grip cavity and remove residue. Relubricate cavity and reattempt grip installation. If binding still occurs repeat the above procedure until the grip seats fully on the bearings.

CAUTION

Do not attempt to use thermal expansion of the grip to achieve grip installation. The grip should be installed at ambient temperatures using hand pressure only.

NOTE

Remove only the minimum cadmium plate required to achieve fit. Excessive removal would create an undesirable loose fit between the grip and the bearings. Do not remove cadmium plate down to bare metal.

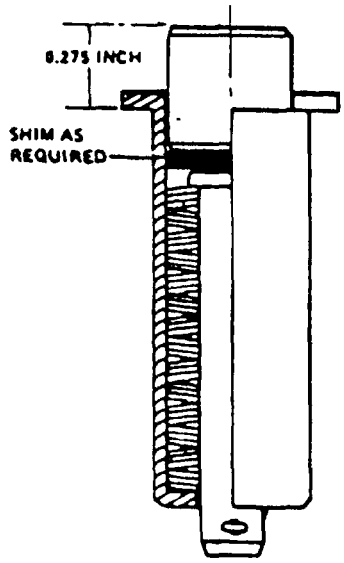


Figure 5-62. Tall Rotor Hub Spring Shimming

i. Install shim (17) on shoulder of sleeve in grip (1) which will rest against outer race of bearing set (18). Temporarily install grip assemblies (1) on hub assembly. Torque adapter nut (22) 500 TO 600 inch-pounds. Position hub assembly on arbor portion of (T56) tool with flat side of hub down over flange of tool. Secure with nut. Install shim setting tool, gage assembly of (T56), in blade mounting holes. Check distance between pointer and shaft of tool on each side (figure 5-63). Distance should be within 0.002 inch of each other. Remove grip and adjust shim (17, figure 5-55) as required. Recheck grip spacing.

CAUTION

Use only a very sparing amount of sealant (C244) when filling thread relief notch. Sealant shall not be allowed to enter bearing area.

Apply a bead of sealant (C244) into the thread relief notch, located below the last thread of grip (1). A very sparing amount on the last two threads is also beneficial. (Refer to Caution above). Sparingly coat the threads of the grip adapter nuts (22) with sealing compound. Install grip assembly (1) in place, align and screw adapter nut (22) into grip assembly. Wipe off excessive sealing compound, leaving only enough to provide an external fillet or bead around the adapter nut grip interface. Allow 48 hours for sealant to air dry before using hub and blade assembly.

CAUTION

Do not attempt to install grip using thermal expansion of the grip. The grip must be installed using hand pressure at ambient temperatures.

NOTE

Fill grip cavity with grease (C129) prior to assembly. Be careful to avoid getting grease in sealant and on grip threads.

k. Torque adapter nut 500 TO 600 inch-pounds. To overcome resistance of the assembly to seating properly, the adapter nut (22) must be torqued, backed off and torqued again.

l. Install washer (35) Iockplates (2), washers (3), and screw (4) on grip (1), shear flange into notch of nut (22). Lockwire (C155) in position.

NOTE

The new steel tail rotor grip is physically different from aluminum grip in the lock-plate mounting area. A larger screw (4) and an additional washer (35) are required to build up Iockplate (2) to the level that will allow locking with nut. The following parts will be utilized.

NOMENCLATURE	P/N
SCREW	AN 502-10-8 (ALTERNATE AN 502-10-10)
WASHER	AN 960-10 (ALTERNATE AN960C10

NOTE

If Iockplate (2) makes contact with yoke assembly, metal may be ground from the tab side of Iockplate to allow a minimum clearance of 0.0625 inches between itself and yoke assembly.

NOTE

If thrust cap will not take grease check for alignment of lubrication fitting in thrust cap (24) with groove in thrust washer (27).

m. Lubricate hub assembly at lubricant fittings on thrust caps (24) and grip assemblies (1) with grease (C129). Purge grips until grease is noted bypassing the inboard grip seal.

NOTE

Allow 48 hours for sealant applied in step j to air dry before using hub and blade assembly.

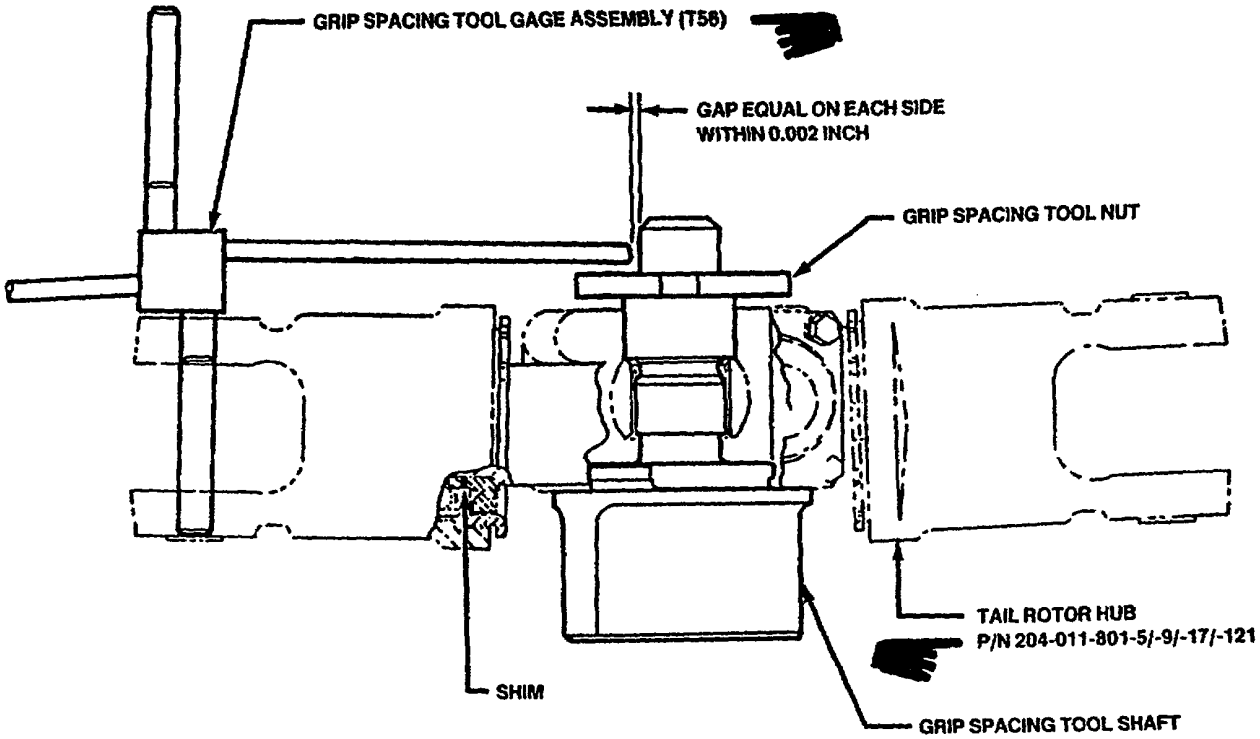


Figure 5-63. Tail Rotor Hub Grip Spacing

5-107. TAIL ROTOR CROSSHEAD CONTROLS.

5-108. Description - Tail Rotor Crosshead Controls. The crosshead controls consist of the tail rotor crosshead and the pitch change links. Movement of the crosshead and pitch links is controlled by a pitch change rod, extending from the crosshead through the tail rotor gearbox to the pitch change mechanism.

NOTE

For maintenance instructions on the pitch change rod and the pitch change mechanism refer to Chapter 11.

5-109. Troubleshooting - Tail Rotor Crosshead Controls. Refer to paragraph 5-87 for troubleshooting procedures.

5-110. Removal - Tail Rotor Crosshead Controls. Refer to paragraph 5-92 for removal of crosshead and pitch change links.

5-111. Inspection - Tail Rotor Crosshead Controls.

a. Use a dial indicator to inspect pitch link rod end bearings for wear. Maximum allowable looseness in axial direction is **0.020** inch. Inspect links for damage and straightness.

b. Inspect crosshead for dam age (figure 5-64.) If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

5-112. Repair or Replacement - Tail Rotor Crosshead Controls.

a. Replace pitch link if damaged or bent. Replace adjustable rod end bearing if worn beyond limits.

b. Repair crosshead as follows:

(1) Perform florescent penetrant inspection in accordance with TM 43-0103.

(2) Smooth damaged areas with 180 grit abrasive cloth (C2) and blend with crocus cloth (C18).

(3) Repairs shall be made in accordance with figure 5-64.

(4) Repair is allowed to 0.131 inch minimum wall thickness after burnishing. Width of repair area shall not exceed 0.163 inch. With the 0.0175 Synthane washer installed, the distance between the crosshead shall be 0.750 inch minimum.

(5) Treat repaired areas with chemical film (C62).

(6) If grease fitting is unserviceable, replace (paragraph 5-104).

5-113. Installation - Tail Rotor Crosshead Controls. Refer to paragraph 5-97 for installation of crosshead and pitch change links.

SECTION VIII. TAIL ROTOR BLADES

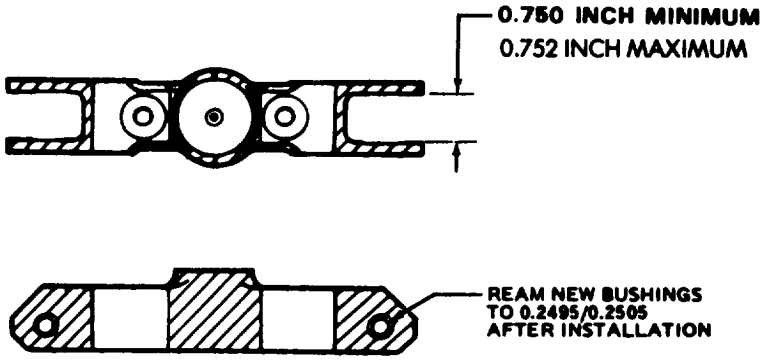
5-114. TAIL ROTOR BLADES.

5-115. Description - Tail Rotor Blades. The tail rotor blades consist of an all metal shell bonded to a honeycomb core. Reinforcing doublers are bonded to the blade in the area of the retention bolt holes. The blade leading edge is covered with an abrasive strip to reduce erosion.

5-116. Cleaning - Tail Rotor Blades. Wash tail rotor blades with a solution of mild soap (C101) and water.

5-117. Inspection - Tail Rotor Blades.

a. Inspect blade for bond separation, cracks, and movement of weights as follows (figure 5-65). Alternate inspection method: If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.



NOTE

Replace bushing if nicks or scratches to bearing faces exceed 0.010 inch in depth.

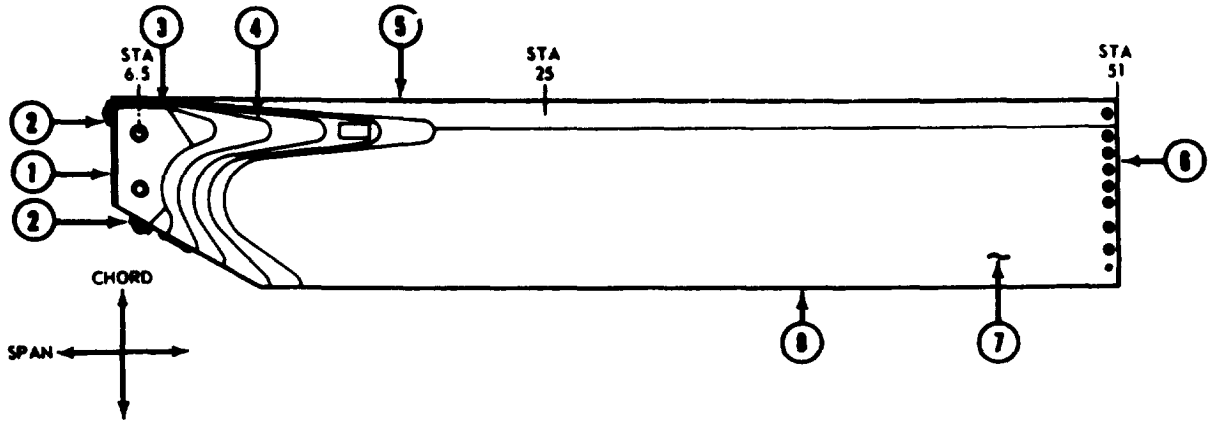
DAMAGE LOCATION SYMBOLS

TYPE OF DAMAGE	MAXIMUM DEPTHS AND REPAIR AREAS ALLOWED	
NICKS, DENTS AND SCRATCHES	0.010 BEFORE AND AFTER REPAIR	0.020 BEFORE ANO AFTER REPAIR
CORROSION	0.005 BEFORE REPAIR 0.010 AFTER REPAIR	0.010 BEFORE REPAIR 0.020 AFTER REPAIR
MAXIMUM AREA PER FULL DEPTH REPAIR	0.04 SQ. IN.	NOT CRITICAL
NUMBER OF REPAIRS	ONE PER SEGMENT	
EDGE CHAMFER:	0.030	0.060

BORE DAMAGE: 0.002 FOR 1/4 CIRCUMFERENCE

BENDING DAMAGE TO TANGS: 0.750 inch minimum cmd 0.752 inch maximum between tangs as illustrated above.

Figure 5-64. Toil Rotor Crosshead Damage Limits



1. Butt block
2. Balance washers
3. Grip plate
4. Doublers
5. Abrasive strip
6. Tip block
7. Skin
8. Trailing edge strip

Figure 5-65. Tail Rotor Blade Inspection

NOTE

Tail rotor blades that are not within allowable repair limits, or have non-reparable damage shall be condemned and demilitarized locally (AVIM).

(1) Bond separation not exceeding 2.25 inches span-wise or 1.25 inches chordwise from the trailing edge of blade tip, with no indication of moisture present, are repairable as outlined in paragraph 5-118e. If any other bond separation is present, dispose of the blade.

(2) If any movement of the tip or root end weight has occurred, dispose of the blade.

(3) If the tip block is cracked, dispose of the blade.

(4) If blade passes the above inspection requirements and no other discrepancies exist, then the blade is serviceable.

b. Nicks and scratches.

(1) Nicks, scratches, and corrosion on the surface of the blade that are 0.008 inch, or less, deep are reparable.

(2) Nicks and notches in the extreme trailing edge of the blade that are 0.050 inch, or less, deep are reparable.

c. Sharp dents that exceed 0.010 inch in depth and rounded dents that exceed 0.030 inch in depth inboard of station 25.0 are unacceptable. Sharp dents that exceed 0.030 inch in depth and rounded dents that exceed 0.040 inch in depth outboard of station 25.0 are unacceptable. Where a scratch or nick is present in a dent, the depth is measured to the bottom of the scratch or nick. The scratch or nick must be repaired if within limits.

d. Any cracks in any location on blade is cause for replacement.

e. Voids.

(1) Between the abrasive strip and the inner doubler, along blade centerline, a void with a maximum width of 0.500 inch is acceptable.

NOTE

If during movement a tinkle or a sandy sound emits from inside of blades, the presence of this condition is not cause for rejection of the blades. This sound is debris (particles of aluminum honeycomb) that was not thoroughly removed during blade manufacture.

(2) At butt end, voids between skin and trailing edge, under doubler rear "fingers" are not acceptable.

(3) At butt end, voids between skin and inner doubler, under front “fingers” are not acceptable.

(4) At blade tip, between skins and traing edge, in the outboard 1.00 inch, voids are not acceptable.

(5) In the blade body between the ends of the blade, between the skin and th core, voids not larger than 0.200 inch wide chordwise, by 0O500 inch long spanwise, are acceptable, providing spacing between centers exceeds 2.00 inches.

(6) In the blade body between the ends of the blade, between the skin and the inner doubler, voids not larger than 0.500 inch wide chordwise, by 1.00 inch long are acceptable, providing spacing between centers exceeds 3.00 inches.

(7) In the blade body between the ends of the blade, between the core and the inner doubler, voids not larger than 0.500 inch chordwise, by 1.500 inch spanwise, are acceptable, providing spacing between centers exceeds 3.00 inches.

NOTE

Any edge void is not acceptable. Replace defective blade and rebalance assembly.

f. Inspect retention bolt hole bushings for looseness or wear. Bushing maximum inside diameter, 0.4380 inches g. Corrosion areas on the blade not in excess of 0.008 inch in depth are permissible, but must be polished out.

h. Corrosion and erosion.

(1) Corrosion on the surfaces of the retaining screws of the blade that is 0.008 inch or less deep, is reparable and must be polished out and coated with adhesive item (C38).

(2) Erosion gaps in the countersink areas of the retaining screws are reparable by filling with adhesive item (C38).

(3) Any evidence of exfoliation corrosion is cause for replacement of the blade.

(4) Corrosion along bond lines at the root and tip ends of the leading edge, and the abrasion cap bond line on both sides of the blade from root to tip, 1.25 inch aft of leading edge, is cause for replacement of the blade.
Corrosion may be indicated by peeling, flaking or bubbling paint.

NOTE

When Installing a new or replacement blade Inspect for corrosion per the following requirements.

(5) Inspection requirements for installing a new or replacement blade

(a) Thoroughly dean tail rotor blades.

(b) Visually inspect the blade for paint distress such as peeling, flaking or bubbling, and corrosion along bound abrasion cap bond line on both sides of the blade from root to tip, 1.25 inch aft of leading edge.

(c) If no evidence of paint distress or Icorrosion is found in these areas, the blade may remain in service and the inspection is complete.

(d) If paint distress or corrosion is found, continue with corrective procedures of paragraph 6.

(6) Correction procedures

(a) If paint distress is noted, remove paint from the area and inspect for corrosion deposits. If no corrosion deposits are noted, refinish blade in accordance with TM 55150034523.

(b) If corrosion deposits are found in the bond lines of the area identified in paragraph 5, no corrosion deanup is authorized. The blade must be removed from service and disposed of by mutilation of part.

5-118. Repair Tall Rotor Blades (AVIM).

a. Nonreparable damage.

NOTE

Tall rotor blades damaged to the following extent should be "condemned and demlitarized" locally rather than returned to an overhaul facility.

(1) Water in the honeycomb area.

(2) Deleted.

(3) If one or more cracks develop and extend from a previously repaired area.

(4) Holes in the skin larger in area than allowed for patching.

(5) Any corrosion that penetrates entirely through the skin larger in area than allowed for patching

(6) If the abrasive strip is worn completely through at the tip.

(7) Edgevoidsdeeperthan0.50 inch at the tip end of any of the root end doublers or grip plates.

(8) Edge voids in the leading edge or trailing edge of the doublers that are 0.25 inch or more in depth and show indications of corrosion in the void.

(9) Any crack in any location in the main bonded part of the blade.

(10) Bond separations on any part of the blade, except as outlined in paragraph 5-117a(l).

NOTE

A void shall be defined as an unbonded area that Is normally bonded. Many sub-definitions of voids are given such as lack of adhesive, gas Nicket, misfit, etc This manual shall make no distinctlon among these, but shall group them In the one general term, Void. All dimensions are In Inches.

(11) Movement of the tip or root end weights.

(12) Cracks in the abrasion strip.

(13) Sharp dents that exceed 0.010 inch and non-sharp dents that exceed 0.030 inch inboard of station 25.0.

(14) Sharp dents that exceed 0.030 inch and non-sharp dents that exceed 0.040 inch outboard of station 25.0.

b. Deleted.

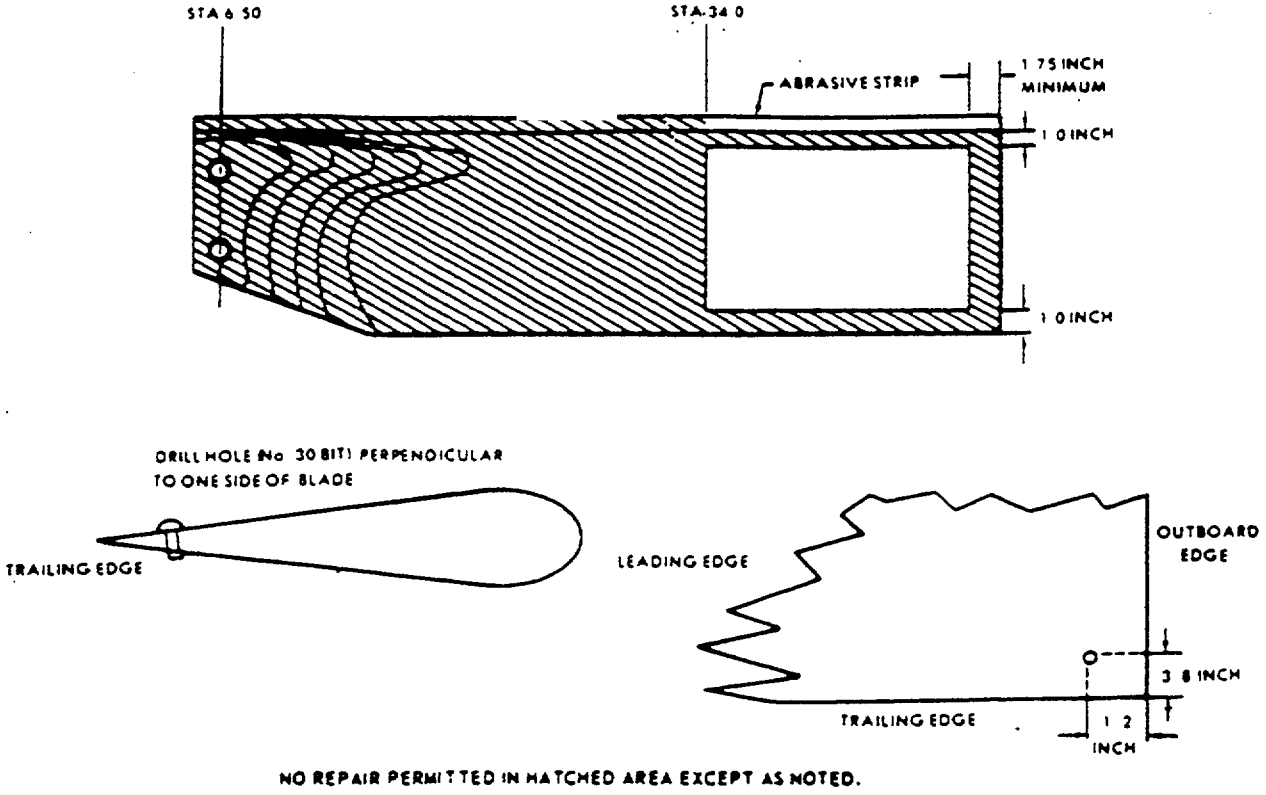


Figure 5-66. Tail Rotor Blade Repair Area

(1) Deleted.
(2) Deleted.
(3) Deleted.
(4) Deleted.

c. Repair nicks, scratches, dents, or corrosion pits as follows:

CAUTION

Damage exceeding the limits of steps (1) through (4) require replacement of blade.

(1) Polish out all nicks and scratches on the surface of the blade that are 0.008 inch deep or less using abrasive cloth (C2) (180 grit or finer). Polish to a smooth finish, removing only enough material to remove scratch or nick. Aluminum wool (C309) may be used on aluminum surfaces and steel wool (C310) may be used on the abrasive strip to polish out defects.

or other mechanical means. If using adhesive (C29), cure at 70° TO 90°F for 24 hours, or at 145°F TO 155°F for 30 minutes.

(11) Refinish repaired area (paragraph 5-119).

e. Repair bond separations outlines in paragraph 5-117a(1) as follows (figure 5-66)

(1) Using dry abrasive cloth, lightly abrade faying surfaces of skin, trailing edge extrusion and tip block as well as possible. Exercise care to ensure skin separation is not increased. Use clean, dry compressed air to remove residue from area.

(2) Drill a no. 30 hole as shown in figure 5-66.

(3) Inject adhesive (C28) along entire separated area.

(4) Install one MS20470AD4-6 rivet immediately after injecting adhesive.

(S) Wipe off excessive adhesive squeeze out.

(6) Fill any remaining edge void with adhesive (C29).

(7) Refinish blade as required.

(6) Rebalance hub and blade.

5-119. Painting — Tall Rotor Blades. (AVIM). Touchup paint using kit (C262).

SECTION IX. TRACKING PROCEDURES

5-120. TRACKING AND OPERATIONAL CHECK – MAIN ROTOR BLADES.

WARNING

Do not operate aircraft below 6600 RPM at any gross weight up to 9500 lbs except at a 2-4 foot hover.

5-121. Vibration Analysis – Main Rotor Blades.
Mechanics are primarily interested in vibrations felt during in-flight or ground operations in the co-pilot's seat. Most vibrations are always present in the helicopter at low magnitudes. It is when the magnitude of any vibration increases that it becomes of concern. The main problem is deciding when a vibration level has reached the point of being excessive. The only sources of vibrations of any frequency are the rotating or moving parts on the helicopter, other parts vibrating only in sympathy with an existing vibration. Extreme low, low frequency, and most medium frequency vibrations are caused by the rotor or dynamic controls. Various malfunctions in stationary components can affect the absorption or damping of the existing vibrations and increase the overall level felt by the pilot. A number of vibrations are present which are considered a normal characteristic of the machine. Two per revolution (2/rev) vibration is the most prominent of these, with 4/rev or 6/rev the next most prominent. There is always o small amount of high frequency present. Flight experience is necessary to learn the normal vibration levels. Even experienced pilots sometimes make the mistake of concentrating on feeling one specific vibration and conclude that the vibration level is higher than normal when actually it isn't. It just seems so because the pilot is concentrating on it. For simplicity and some sort of standardization vibrations are arbitrarily divided in general frequencies as follows:

Extreme low frequency -	Less then 1/rev PYLON ROCK
Low frequency –	1/rev or 2/rev type vibration
Med. frequency –	Generally 4,5, or 6/rev
High frequency –	Tail rotor speed or faster

a. Extreme low frequency vibration. Extreme low frequency vibration is pretty well limited to pylon rock. Pylon rocking two to three cycles per second is inherent with the rotor, mast and transmission system. To keep the vibration from reaching noticeable levels transmission mount dampening is incorporated to absorb the rocking. Malfunctions in the dampening system will allow rocking to start and continue until it can be felt by the pilot. A quick check of the dampening system may be made by the pilot while in a hover. Moving the cyclic fore and oft at about one movement per second will start the pylon rocking. The length of time it takes for the rocking to die out after the motion of the cyclic is stopped is indicative of the quality of the dampening. An abnormal continuation of rack during the check or a continued presence of rock during normal flight is an indication that something is wrong with the transmission mounts or dampers. This may be excessive wear, parts loosening up, breakage, incorrect installation, or the wrong type ports installed. Once the pilot determines that on abnormal amount of pylon rock exists, it becomes the responsibility of the mechanic to locate the exact source and take corrective action.

b. low frequency vibration. Low frequency vibrations, 1/rev and 2/rev are caused by the rotor itself. 1/rev vibrations are of two basic types, vertical or lateral. A 1/rev is caused simply by one blade developing more lift at a given point then the other blade develops at the same point. A lateral vibration is caused by a spanwise unbalance of the rotor due to a difference of weight between the blades, the

alignment of the CG of the blades with respect to the spanwise axis which affects chordwise balance, or unbalance of the hub or stabilizer bar. Rigidly controlled manufacturing processes and techniques, eliminate all but minor differences between blades, resulting in blades which are virtually identical. The minor differences which remain will affect flight but are compensated for by adjustments of trim tabs and pitch settings. Initially the rotor is brought into ground track by normal tracking procedures using the pitch change link (rolling the grip) to make a blade fly higher or tower to bring both blades into the same tip path plane. A track is taken using a higher operating rpm to determine if one blade is climbing (developing more lift) more than the other as its speed increases. This climbing tendency is overcome by using the trim tabs, adjusting them after a flight check is made then re-flying to determine the affect. Because of the physical differences in blades it is sometimes necessary to roll a blade out of track slightly in order to get both blades developing the same amount of lift. Generally, verticals fait predominantly in low power descent at moderato airspeeds (60-70 knots) are because of a basic difference in blade lift and can be corrected by rolling the grip slightly out of track. Verticals felt mostly in forward flight, that get worse as airspeed increases, are usually due to one blade developing more lift with increased speed than the other (a climbing blade). This condition is corrected by adjustment of the trim tabs.

(1) Smoothing of 1/rev verticals is essentially a trial and error process. A basic straight forward procedure is used but the outcome of any adjustment is uncertain and must be flight-tasted and the affect analyzed to determine the path of further action. Because of the Idiosyncrasies of the individual blades, it is occasionally necessary to attempt adjustment procedures not normally utilized; such as lateral procedures for a vertical, using roll when normally tab is used (and vita versa), changing both tabs an equal amount. Once in a while it will be found to be impossible to get two blades flying satisfactorily together and it will be necessary to remove and replace one blade.

(2) Associated with the 1/rev vertical is the intermittent 1/rev vertical. Essentially, this is a vibration initiated by a gust effect causing a momentary increase of lift in one blade giving a 1/rev vibration. The momentary vibration is normal but if picked up by the rotating collective controls and fed back to the rotor causing several cycles of 1/rev then it is undesirable. Sometimes during steep turns one blade will “pop”’ out of track and cause a hard 1/rev vertical. This condition is usually caused by too much differential tab in the blades and can be corrected by rolling one blade at the grip and removing some of the tab (as much as can be done without affecting the ride in normal flight).

(3) Should a rotor, or rotor component, be out of balance, a 1 /rev vibration called a lateral will be present. This vibration is usually felt as a vertical due to the rolling motion it imparts to the aircraft, causing the pilots’ seats to bounce up and down. It can be noted that the seats bounce up and down out of phase, that is the pilot goes up while to co-pilot goes down. An unusually severe lateral can be felt as a definite sideward motion as well as a vertical motion. Laterals existing due to an unbalance in the rotor are of two types; spanwise and chordwise. Spanwise unbalance is caused simply by one blade and hub being heavier than the other (i.e. an unbalance along the rotor span). A chordwise unbalance moans there is more weight toward the trailing edge of one blade than the other. Both types of unbalance can be caused by the hub as well as the blades. Another occasional source of a lateral is the stabilizer bar. Improper balancing of the bar prior to installation is the main reason for this problem. Lateral vibrations are usually felt in a hover and in descending moderate airspeed turns and tend to disappear in forward flight. The correction of 1/rev lateral vibration begins by determining if one blade is heavier than the other. This is done by wrapping one or two turns of a 2.0 inch masking tape (C276) around one blade, a few inches in from the tip so that it won’t be so easily torn off by wind. The aircraft is then hovered either in or out of ground effect, wherever the lateral was most evident, and the effect of the tape noted. A worsening of the vibration means the tape was placed on the wrong blade. Once the correct blade is determined further tape is added, in amounts depending on the severity of the vibration, until a final best balance using 1/2 wraps of tape is obtained. Should the lateral still be excessive or the tape not help on either blade, then a chordwise unbalance exists and it will be necessary to sweep a blade. One blade is arbitrarily picked and swept aft by shortening the drag link. One flat of turn (1/6 of a full turn) is used to start with. The aircraft is then hovered and the effect determined. Once it is ascertained that the correct blade is being swept

continued sweep adjustments in amounts based on the severity of the vibration is used until the lateral is eliminated or further sweep fails to help. If still not satisfactory, it will be necessary to return to taping and adjust tape and sweep until the optimum combination is obtained. If it is still not possible to eliminate the lateral, a small amount of grip spacing should be attempted as in the 1/rev vertical procedure, being careful not to adversely affect forward flight. Should the lateral still be present, a small amount of tab may be tried, and if still not corrected, the hub and blades should be checked for grip spacing and if no problem found, then removed from the aircraft and the alignment checked and the stabilizer bar balanced.

(4) Two per rev (2/rev) vibrations are inherent with two bladed rotor systems and a low level of vibration is always present, A marked increase over the normal 2/rev level can be caused by two basic factors: a loss of designed dampening or absorption capability or an actual increase in the 2/rev vibration level of the rotor itself. The loss of dampening can be caused by such factors as deteriorated transmission mounts or lift link bushing, or an airframe component loosening up and vibrating in sympathy with the inherent 2/rev. An increase in the 2/rev level of the rotor itself can be caused by worn or loose parts in the rotor hub or looseness in the rotating controls. The correction of excessive 2/rev vibrations is primarily dependent upon the mechanic. The pilot generally cannot determine the exact cause and hence cannot prescribe specific corrective procedures. Occasionally it has been found that tab settings, and sweep, affect the overall 2/rev level. If no mechanical cause of excessive 2/rev can be found, an attempt to decrease the level by rotor adjustments maybe made, Unequalizing the tension-torsion strap adjustments sometimes helps as does tabbing both blades down (most usually) or up (rarely) a few degrees. A recheck of boost off forces should be made. It has been found that both blades may be swept in the same direction small amounts and sometimes decrease 2/rev.

c. Medium frequency vibrations. Medium frequency vibrations at frequencies of 4/rev and 6/rev are another inherent vibration associated with most rotors. An increase in the level of these vibrations is caused by a change in the capability of the fuselage to absorb vibration, or a loose airframe component, such as the skids, vibrating at that frequency. Changes in the fuselage vibration absorption can be caused by such things as fuel level, external stores, structural damage, structural repairs, internal loading, or gross weight. Abnormal vibration levels of this range are nearly always caused by something loose; either a regular part of the aircraft or part of the cargo or external stores. The vibration is felt as a rattling in the aircraft structure. The most common cause is loose skids caused by worn, loose, or improper skid retaining straps. Loose skids can be discovered by shaking the ship with cyclic and feeling if they vibrate or looking out the door at the skids while shaking the aircraft. (Excessive or severe shaking is undesirable and will make even tight skids vibrate.) Many times skids will cause considerable vibration during turns and maneuvers if they are excessively loose. Loose skids is not a serious condition but it can cause annoyance to flight crews and passengers. Other sources of medium frequency vibrations are the elevator, access doors, cargo hook electronic gear, safety belt out the door, and engine/transmission cowling. Sometimes air loads will cause the small fire extinguisher doors and the step doors to vibrate. Occasionally portions of the cabin roof, side panels or doors, will “oil can” rapidly in flight, giving the same sensation as a medium frequency vibration.

d. High frequency vibration. High frequency vibrations can be caused by anything in the ship that rotates or vibrates at a speed equal to or greater than that of the tail rotor. This includes many unusual situations such as hydraulic line buzzing, or starter relay buzzing, to the most common and obvious causes; loose elevator linkage at swashplate horn, loose elevator, or tail rotor balance and track. Pilot experience can help greatly in troubleshooting the cause of a high frequency vibration, as a pilot who has experienced a vibration can often recognize the cause the next time he feels the same vibration. Generally, determining the cause of a high frequency should begin with investigating tail rotor track (ground track using a rubber tipped stick with grease pencil, lipstick or some marking substances on the tip to mark the blades and determine whether one is out of track). Should the rotor be properly in track, balance should be checked by removing the tail rotor and hub assembly and checking on a balance stand. Should tail rotor balance check out also, an inspection of the complete driveshaft should be made. Physical damage like loss of balance tabs would be evident. Observing the shaft (covered removed) while the rotor is running may show up a bent shaft, faulty bearing, or some other obvious malfunction. Attempting to

locate the source of the vibration by feeling the fuselage in various places while ground running can sometimes be successful in localizing the cause and at least eliminating some possible causes. It should be recognized that vibrations that are specifically being watched for always appear more severe than when no particular attention is being directed to them. Many points on the airframe, such as the engine mounts, have a surprisingly high level of high frequency vibration and it is easy to decide that the level is higher than normal when actually it isn't. A comparison between the feel of a helicopter without excessive vibration and the aircraft with the vibration is helpful in precluding erroneous conclusion.

5-122. Deleted.

NOTE

All data on pages 5-142 thru 5-146 to include figures 5-67, 5-68, 5-69 and 5-70 are deleted.

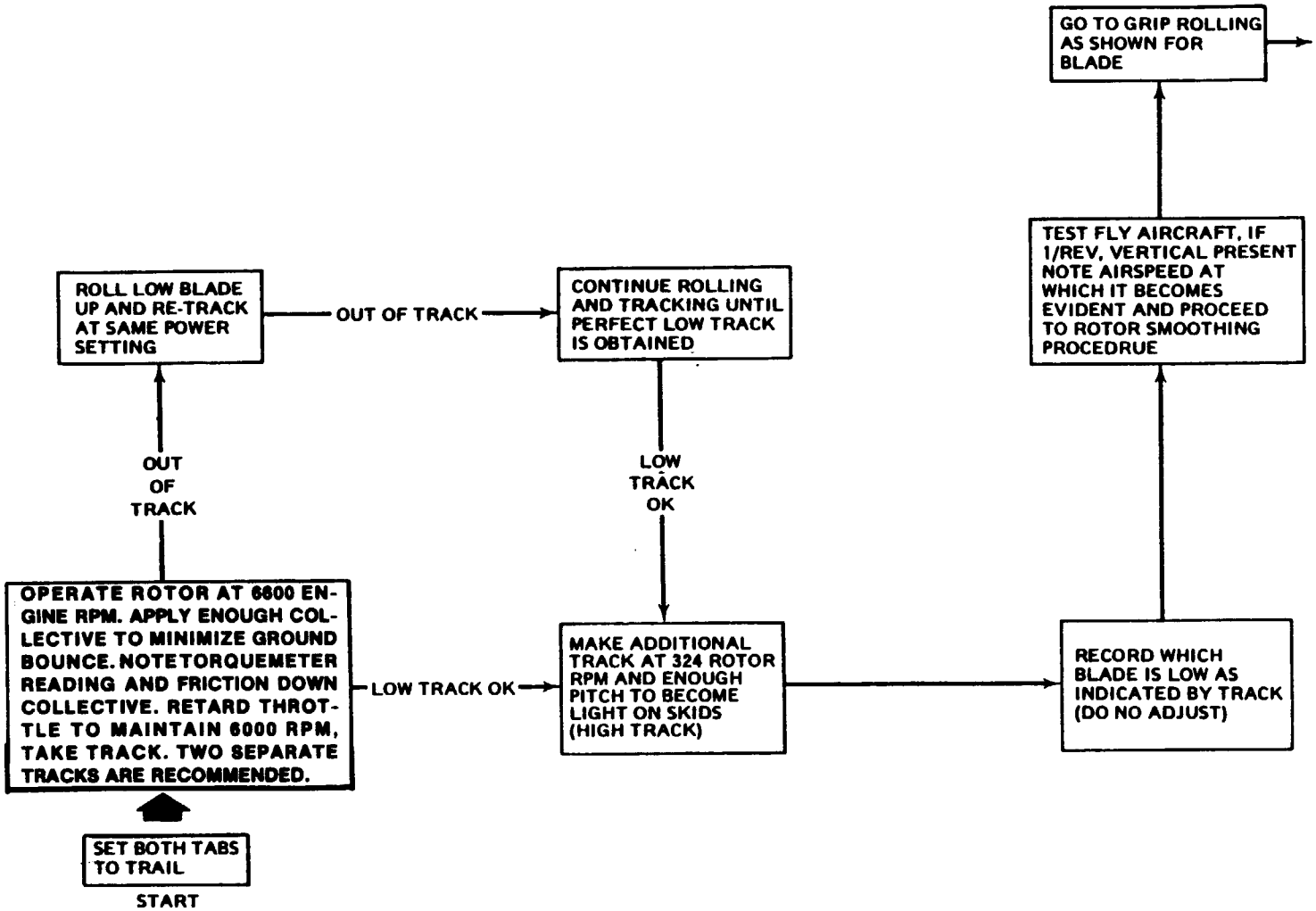


Figure 5-68. Main Rotor Tracking Procedure

d. Correct lateral vibration by applying two-inch wide masking tape (C276) around blade tip. Follow procedures on figure 5-69. When vibration is corrected add weight to blade retaining bolt as follows:

(1) Remove the tape from blade and count the number of wraps.

(2) Remove the cap from the retaining bolt on the taped blade.

(3) For every complete wrap of two-inch wide masking tape, add 3.4 ounces of lead in the retaining bolt

(4) Reinstall and Iockwire (C155) cap.

e. When sweeping blade for lateral vibrations proceed as follows:

WARNING

Troubleshooting lateral vibrations, use blade sweep as the last resort. "NEVER SWEEP BLADES FORWARD. " Strictly follow the procedures outlined in figure 5-69 for blade sweeping.

NOTE

Both ends of the drag brace are fitted with right-hand threads. Drag brace length is changed by rotating the barrel because one end has National Coarse threads and the other end has National Fine threads. Turn jamnuts to the left to loosen, and turn barrel down as viewed from the trailing edge of the blade, to sweep blade aft.

(1) Loosen jamnuts on drag brace enough to turn barrel one flat AFT as shown by direction of arrows.

(2) After adjustment, torque jamnuts. Record the adjustments and fly helicopter.

(3) Make additional adjustments as required, torque jamnuts, (see figure 5-5 for proper torque) but do not exceed two full turns of the barrel.

NOTE

If maximum adjustments fail to correct vibrations, the rotor must be removed from the helicopter and aligned on stand with a scope.

f. Check and correct for vertical vibrations as follows:

(1) When it has been determined there are no lateral vibrations, request pilot perform test flight observing the following:

(a) Stabilize the airspeed at 70 knots, note any 1/Rev vertical vibrations.

(b) Make a 10 PSI (torque pressure) -70 knot descent, note any increase in 1/Rev vibration, level off slowly.

(c) Increase airspeed from 70 knots to VNE, in 10 knots increments, Use the airspeed indicator as a "better or worse" gage. As airspeed increases from 70 knots to VNE note the airspeed where the (1 /Rev only) vibration becomes evident.

NOTE

Keep an accurate record of all roll and, tab adjustments. Check that adjustments have not changed autorotation RPM. (Refer to paragraph 5-10.)

(2) If vertical vibration is felt begin making roll adjust merits according to figure 5-70. (Rotor Smoothing Procedures 1.1 Vertical.)Testfly helicopter after each roll adjustment and continue rolling up until vibration is no longer felt or further roll hurts any phase of flight. Should a vibration still be evident, go to tab procedures as outlined in figure 5-70.

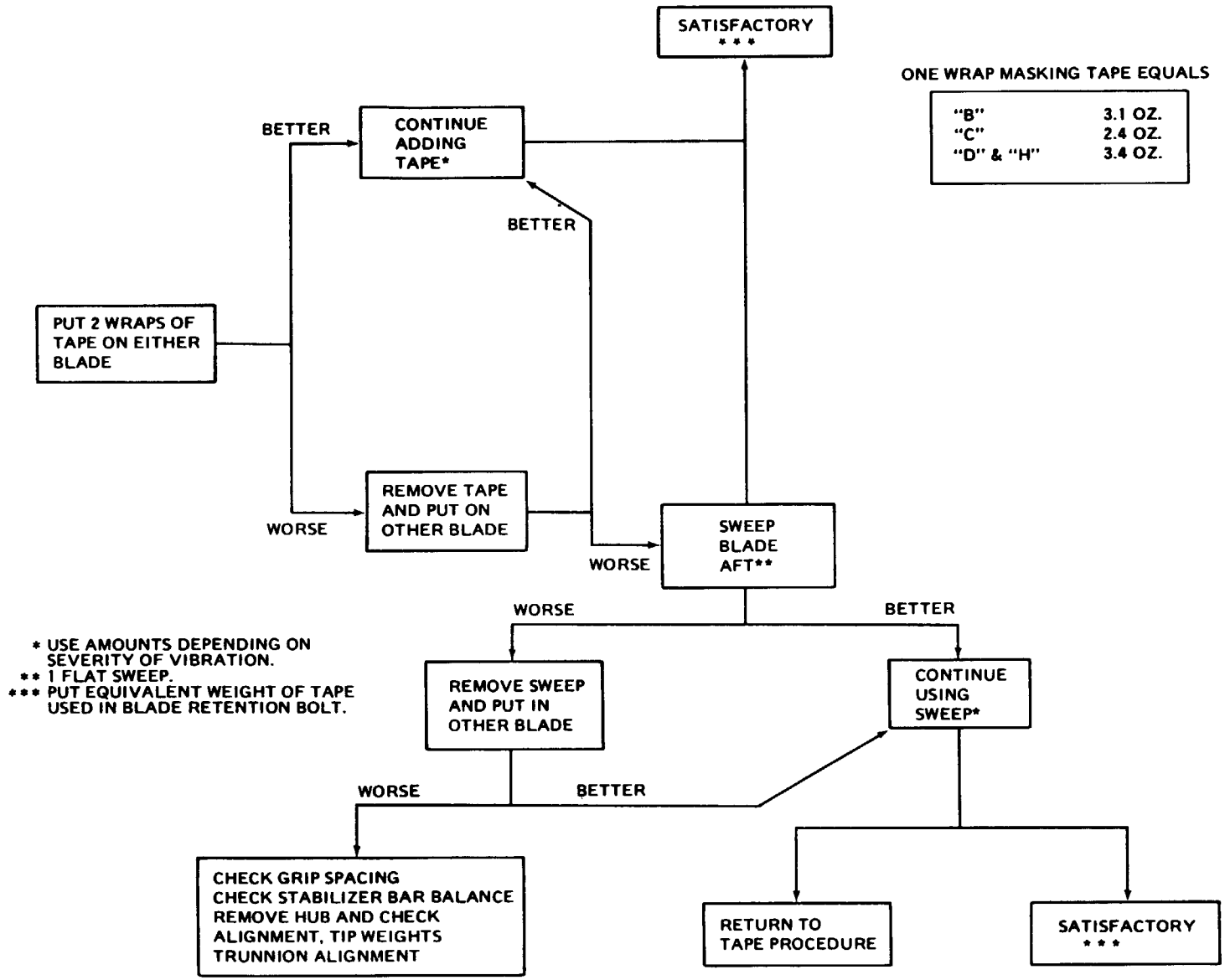


Figure 5-69. Rotor Smoothing Procedure — 1:1 Lateral

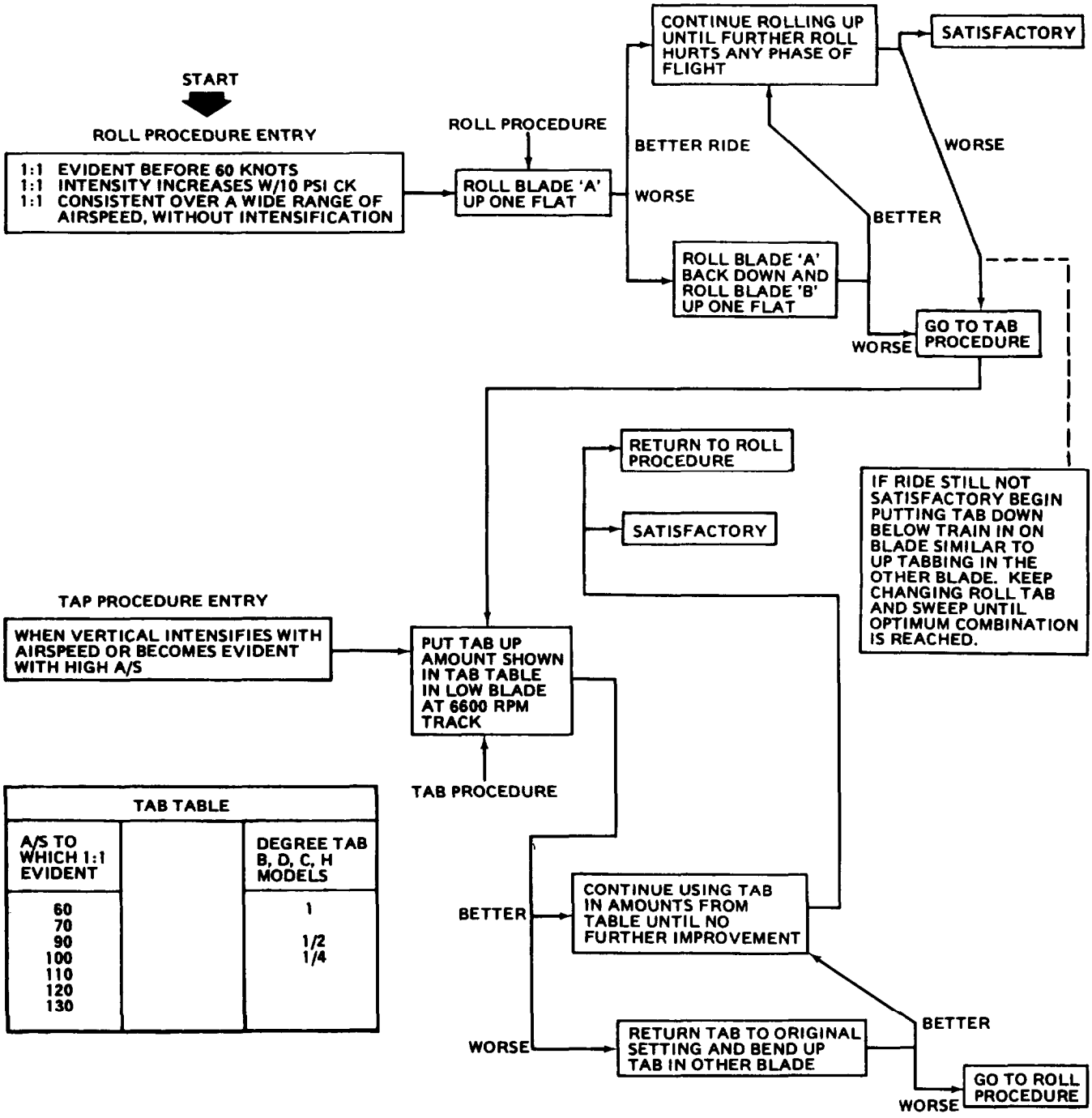


Figure 5-70. Rotor Smoothing Procedure — 1:1 Vertical

5-124. Tracking Tail Rotor Blades

NOTE

The strobe-type tracking device may be used if available. If not available set pitch change links to 2.11 inches between jamnuts. Adjust pitch change links as necessary to achieve correct pedal position in accordance with control rigging check, TM 55152021023 MTF, In Flight Check #1. Adjust tail rotor to vertical fin clearance by adjusting shimming in accordance with paragraph 5-97. At no time should clearance be allowed to be less than 2.5 inches.

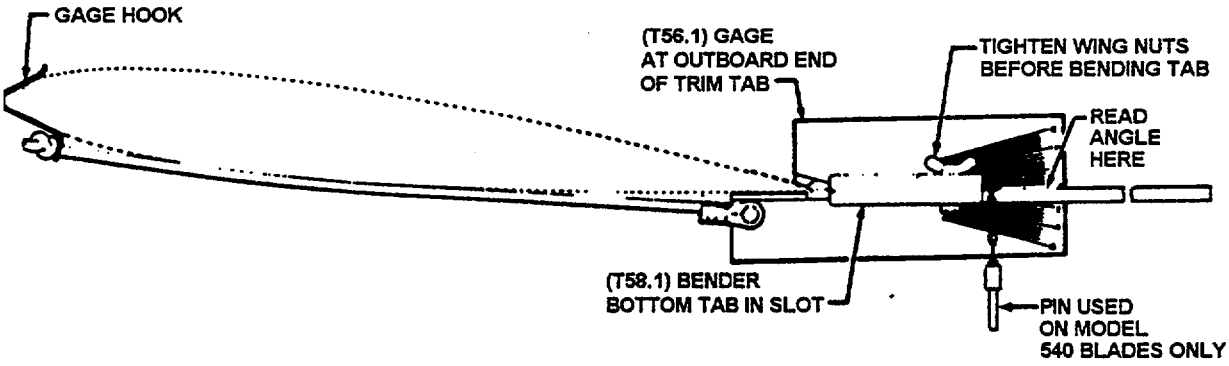


Figure 5-71. Main Rotor Blade Trim Tab Bender and Gage Application

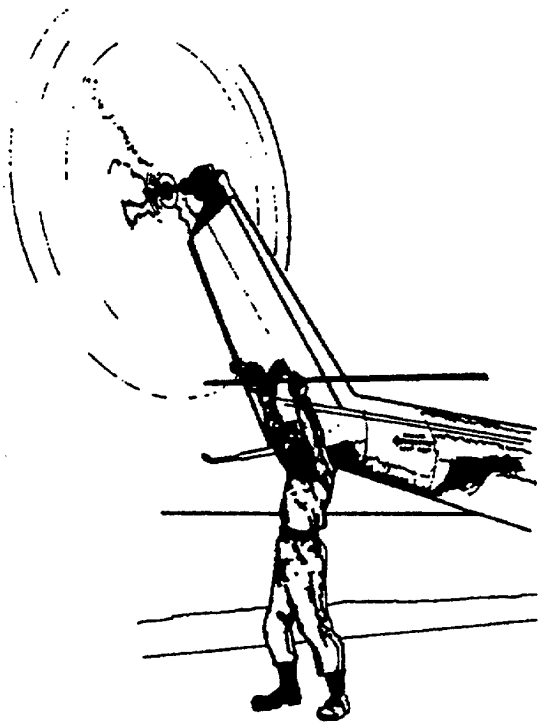


Figure 5-72. Tail Rotor Tracking

a. Attach a piece of soft rubber hose six inches long on the end of a 1/2 x 1/2 inch pine stick or other flexible device. Cover rubber hose with prussian blue or similar type of coloring thinned with oil.

NOTE

Ground run-up shall be performed by authorized personnel only.

b. Start engine in accordance with TM 55152021010. Run engine at 6600 rpm, with pedals in neutral position.

Reset marking device on underside of tailboom assembly. Slowly move marking device into disc of tail rotor just far enough to touch near blade approximately one inch from tip.

c. When near blade is marked, stop engine and allow rotor to stop. Shorten pitch link on marked blade one full turn. Repeat this procedure until tracking mark crosses over to unmarked blade then extend the opposite pitch link one half turn.

5-125. TRACKING AND BALANCING WITH THE VIBREX 4591 SYSTEM

NOTE

For Aviation Vibration Analyzer (AVA), refer to TM 1662572413 & P.

5-126. General. The Vibrex balancing system is primarily used to measure the amount and indicate the location of imbalance in main rotors and tail rotors. The system can also be used to locate other sources of vibration caused by rotating parts such as drive shafts and gearboxes. In use, the system analyzes the vibration in terms of amplitude and clock angle. When this information is plotted on a chart designed for the helicopter being tested, the chart will show the amount and location of weight, sweep, or track change needed to correct the imbalance. The system operates off 28 V dc power supplied by the helicopter.

5-127. Equipment Description. Equipment provided with the Vibrex 4591 system is shown in figure 5-73 and the individual components are described in the following paragraphs:

a. Strobex Model 135M-11. The Strobex (figure 5-74) is a bright, collimated, stroboscopic light used in conjunction with the model 177MA Balancer/Phazor for ground or in flight tracking and balancing operations. The Strobex may also be used as a conventional speed measuring strobe by adjusting the RPM dial to obtain a stopped image, and reading the speed directly off the dial. For balancing and tracking operations, reflective targets are attached to the main and tail rotors. The reflected images picked up by the strobe are used for tracking the main rotor, and for tracking and balancing the tail rotor. Controls and indicators include a power indicator light that lights when the trigger switch is in the on position, an RPM dial that controls the flash rate in all MODE switch positions except A, a trigger switch that turns the 28 V dc power on and off, and a MODE switch that operates as follows:

(1) MODE A (low intensity). Mode A is used for main rotor tracking and tail rotor balance. In this mode, an external signal is required, and the strobe lamp will flash once in response to each external signal. For main rotor tracking, the external signal is supplied by a magnetic pickup and two interrupters. The magnetic pickup is attached to the fixed swashplate, and two interrupters (one for each blade) are attached to the rotating swashplate. As an interrupter passes a magnetic pickup, an electrical pulse is generated that triggers the strobe lamp. When the Strobex is aimed at the rotor tip path, both tip targets (one tip target is attached to each blade) will be seen superimposed. When balancing a tail rotor, the electrical pulse to trigger the strobe lamp is supplied by an accelerometer attached to the tail rotor gearbox. The observed clock angle of the rotor together with the vibration amplitude indicated by the Balancer/Phazor unit are used to determine the corrections needed. In mode A, the strobe lamp operates at low intensity which is sufficient for tracking UH1 rotors in all daylight conditions.

(2) MODE B (high intensity). Mode B is used when the helicopter is fitted with only one interrupter, and is not normally used for the UH1. It can be used, when a brighter light is desired, however, by setting the RPM dial to about 240 or less to allow viewing the targets at the head of the ship. Setting the RPM dial to about 500 or less allows viewing the targets at the head of the ship and at about 3:00 and 9:00 o'clock (for advancing and retreating blades.)

(3) MODE C (high intensity). Mode C is used for rpm measurement; the internal freerunning oscillator is activated and external signals are disconnected. By controlling the flash rate with the RPM dial until the image appears stopped, the rpm of the object can be read directly from the dial. The maximum flash rate is 1,000 per minute for measuring rpm in the range of 100 to 1,000 rpm +2 percent.

(4) MODE D (low intensity). Mode D is used for tail rotor tracking and rpm measurement; the internal freerunning oscillator is activated as in MODE C. The RPM dial reading, however, is multiplied by ten which generates a flash rate of 10,000 flashes per minute. For tail rotor tracking, the RPM dial is adjusted to cause the single griptarget to appear as a stopped image of four. The tail rotor is then viewed edgeon and the tiptargets observed for track.

(5) MODE E (low intensity). Mode E operates the same as mode B except a higher flash rate of up to 10,000 flashes per minute is generated. It is used primarily to track airplane propellers.

b. Balancer/Phazor Model 177M-6A. The Balancer/Phazor (figure 5-75) uses signals from the accelerometers and magnetic pickup to indicate the amount and location of weight, sweep, or track change needed to balance main rotors. The operating characteristics and use of the controls and indicators are as follows:

(1) MAGNETIC PICKUP switch. COMMON connects the two pulses from the magnetic pickup together so that the accelerometer inputs are referenced to the same magnetic pickup pulse. INDEPENDENT is used only if two magnetic pickups are used; the left and right propellers of an airplane, for example.

(2) FUNCTION switch. TRACK position switches the magnetic pickup signal to trigger the Strobex. Position A connects the unit to the lateral accelerometer to measure vibration for main rotor balancing. Position B connects the unit to the vertical accelerometer to measure vibration for main rotor balancing and in-flight tracking. Position B is also used for tail rotor balancing.

(3) IPS meter. Gives vibration amplitude in IPS (inches per second). The meter has two scales: scale 1 is calibrated from 0 to 1.0 IPS; scale 2 is calibrated from 0 to 10.0 IPS.

(4) PUSH FOR SCALE 2 button. Used when the IPS meter is off scale (vibration level too high). When pushed, the input signal from the accelerometer is divided by ten and the IPS meter is read on scale 2.

(5) RPM RANGE switch. Used to set up the rpm (revolutions per minute) range for the rotor (or other rotating part) being balanced or checked. Three ranges cover from 100 to 99,900 rpm.

(6) RPM TUNE dial. Used in conjunction with the VERIFY TUNE button to adjust the frequency of the band-pass filter. When properly adjusted, the band-pass filter will pass the rate of the rotor being balanced, but reject all other disturbing frequencies both above and below that rate. The RPM TUNE dial may also be used to search for vibrations by turning it through its range while observing the IPS meter. A vibration is indicated when the meter peaks, and the rpm of the probable source can be read from the dial.

(7) VERIFY TUNE button. Used to verify band-pass filter tuning. When the filter is properly tuned, the observed clock angle of the rotor will remain the same whether the button is pushed or released.

(8) INTERRUPTER LOGIC switch. Used in the SINGLE position when only one interrupter is installed on the swashplate. Used in the DOUBLE position when two interrupters (one per blade) are installed on the swashplate. One of the interrupters is double to provide the one per revolution reference signal for the PHAZOR.

(9) PHAZOR. The PHAZOR is a light ring consisting of 24 indicator lamps. A lighted lamp indicates the rotor clock angle used to plot balance and in-flight track corrections. The clock angle is derived from signals generated by the accelerometers and magnetic pickup.

(10) TEST button. Disconnects the accelerometer inputs from the PHAZOR, causing the magnetic pickup signals to light the 6 and 12 o'clock lamps, This indicates that the PHAZOR is ready for use.

c. Vibrex Tester. The Vibrex tester is used for functional testing of the Vibrex equipment. For test procedures, refer to TM 54-4920-402-13&P).

d. Accessories.

(1) Magnetic pickup and interrupters. Pickup devices to provide impulses from the main rotor to the Balancer/Phazor. The magnetic pickup is located on the stationary swashplate, and the interrupters are located on the rotating swashplate.

(2) Accelerometers. Sense the vibration of rotors, shafts, bearings, or other rotating parts.

(3) Reflective targets. Reflect Strobex flash pulses back to the operator. Two types of tip targets are supplied: removable, and permanently mounted.

(4) Balance and tracking charts. Used to calculate the weight, sweep, pitch, and tab adjustments needed to correct rotor problems.

(5) Signal simulator. Provides signal simulation for troubleshooting the Vibrex equipment (TM 55-4920-402-13&P).

(6) Gram scale. Provides accurate measurement of weights to be installed on rotors.

(7) Cables. Connects Vibrex equipment to power and helicopter mounted components.

(8) Brackets. For mounting accelerometers and magnetic pickups.

(9) Checklists. Gives installation and operating procedures for individual aircraft.

(10) Carrying case. Provides a compact and secure way to transport the equipment.

5-128. Main Rotor Track and Balance.

Premaintenance requirements for main rotor tracking and balancing

Condition	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T56.1) (T58.1)
Test Equipment	Vibrex 4591 Balancing Kit MB Balance Chart 4262, NSN 7610-01-006-4428
Support Equipment	1/4-28 x 1 Capscrews (2 req) 1/4-28 Locknuts (2 req) 1/4 Flat washers (4 req) Ruler or straightedge
Minimum Personnel Required	Two
Consumable Materials	(C155) (C178) (C247) (C275)
Special Environmental Conditions	None

NOTE

Run-up of helicopter shall be performed only by personnel authorized according to AR95-1, and In accordance with TM 55-1520-210-10.

5-128.1 CB Main Rotor Track and Balance

a. CB When the composite main rotor blades are installed a different basic procedure is used to smooth the rotor than that used with metal blades installed. This procedure is flow charted in Figure 5-75.1. The procedure relies on tracking the rotor on the ground at engine idle and at 6600 engine RPM using both pitch links and trim tabs prior to initial flight of a rotor with replacement blades. The purpose of this is to provide a coarse adjustment of the rotor to minimize the vibration levels on the first flight. Once the rotor has been tracked on the ground the rotor 1/rev vibration is reduced in flight using the same lateral balance chart as the metal blades, but a different vertical chart.

b. CB When changing from metal to composite blades the following adjustments are different and must be accomplished prior to track and balance of main rotor.

(1) Composite blades aligned per paragraph 5-7.

(2) T-T straps set properly for the composite blades per paragraph 5-8.1.

(3) The trail or “zero” position for the trim tab on the composite blade is a “down 6 degrees” when using the bender (T58.1) and the gage (T56.1) per paragraph 5-130.1.

5-129. Attach Test Equipment To Aircraft.

CAUTION

Avoid handling the reflective target surface, and do not coat the targets after installation. Dirt, varnish, or other coatings impair the reflective properties of the targets and render them difficult or impossible to see.

a. Tip-targets. Two types of tip-targets may be used: removable, bracket mounted, No. 3387, and adhesive backed, No. 4270, for permanent mounting. Either type of tip-targets maybe installed.

(1) Use 1/4-28 capscrews, washers, and locknuts, and install tip-targets No. 3387 (bracket mounted) as follows:

(a) Install the tip-target with the horizontal reflective target on the red blade tie-down bracket, with the reflective tape facing inboard (figure 5-76). This is called the target blade on the track and balance charts.

(b) Install the tip-target with the vertical reflective target on the white blade tie-down bracket, with the reflective tape facing inboard. This is called the blank blade on the track and balance charts.

(2) Clean the blade tips with naphtha (C143) and install the self-adhesive tip-targets to underside of blades (figure 5-77). Align the targets with edge of tip caps with their center lines equidistant from blade tips. Install horizontal target on red (target) blade; install vertical target on white (blank) blade.

b. Magnetic pickup (figure 5-78).

NOTE

To aid access, place collective stick to full up, cyclic stick to right aft, antitorque pedals neutral, and open transmission fairing.

(1) Remove the nuts, washers, and the top two bolts on the left cyclic horn.

(2) Install bolts with heads facing inboard, install magnetic pickup bracket No. 3104 on outboard side of horn, and secure with nuts and washers. Torque nuts 50 to 70 inch-pounds.

NOTE

If the magnetic pickup is already installed in the bracket, loosen the jamnuts and adjust the pickup until it is flush with the inboard jamnut.

(3) Using a thin jamnut on each side of the bracket, install magnetic pickup No. 3030 in the bracket. Adjust the pickup until it is flush with inboard jamnut, and tighten jamnuts finger tight.

c. Interrupters (figure 5-79).

(1) Rotate the red blade forward and remove tour nuts (figure 5-79) located 180 degrees apart and in line with the scissors link trunnions from outer swashplate ring.

(2) With red blade still forward, install double interrupter No. 3103-2 aligned with magnetic pick-up. Install single interrupter pickup No. 3103-1 on the opposite set of studs.

NOTE

The mounting holes in interrupters are elongated to allow adjustment.

(3) Install nuts, push the interrupters toward mast, and snug-tighten nuts.

(4) With red blade forward, adjust clearance between magnetic pickup and double interrupter to 0.060 ± 0.010 inch by adjusting jamnuts on magnetic pickup.

(5) Rotate white blade forward and adjust clearance between magnetic pickup and single interrupter to 0.060 ± 0.010 inch by moving interrupter on its elongated slots.

NOTE

A difference of 0.020 inch between interrupters is acceptable. If the difference is too great, it may be necessary to move double interrupter and readjust magnetic pickup.

(6) When clearance on both interrupters is satisfactory, tighten and lockwire (C127) the jamnuts on magnetic pickup, and torque nuts holding the interrupters 50 TO 70 inch-pounds.

d. Magnetic pickup cable.

WARNING

The aircraft will be flown with this equipment installed. Make sure that the cable cannot foul or interfere with the controls or rotating parts. To avoid engine FOD, do not use tape on the roof in front of the engine air intake.

(1) Plug cable No. 3319-2 into the magnetic pickup, allow approximately one inch of slack, and tape the cable to the left cyclic control tube.

(2) Tape the cable to hydraulic lines allowing sufficient slack to prevent binding the aircraft controls.

(3) Route cable through opening in the fairing, over the left side of the fuselage, and through the forward edge of the cargo door. Secure the tape as required.

(4) Position the Balancer/Phazor near the pedestal and plug magnetic pickup into CHANNEL A MAGNETIC PICKUP receptacle (figures 5-75 and 5-80).

(5) Move the cyclic stick through all positions to check for interference and free movement of controls.

(6) Close and secure the transmission fairing.

e. Accelerometers.

(1) Mount one accelerometer No. 4177B on bracket No. 3383; this will be known as the lateral accelerometer. Mount the other accelerometer on bracket No. 3382; this will be known as the vertical accelerometer.

NOTE

The lateral accelerometer must be mounted high on the bulkhead In a horizontal position with its connector pointing to the left side of the helicopter.

(2) Install the lateral accelerometer and bracket No. 3383 high on the forward transmission bulkhead using one of the tapped, 5/16-inch tie-ring holes (figure 5-81). Install accelerometer horizontally, with the connector to left side of the helicopter.

(3) Connect cable No. 4296-2 to the lateral accelerometer, and plug it into the CHANNEL A ACCELEROMETER receptacle on the Balancer/Phazor (figures 5-75 and 5-80).

(4) Install the vertical accelerometer and bracket No. 3382 on the bottom of the instrument panel using an existing screw (figure 5-82). Install the accelerometer vertically with the connector pointing down.

(5) Connect the other cable No. 4296-2 to the vertical accelerometer and plug it into the CHANNEL B ACCELEROMETER receptacle on the Balancer/Phazor (figures 5-75 and 5-80).

f. Connect the Strobex to the Balancer/Phazor (figures 5-75 and 5-80).

g. Using dc adapter cable No. 3140-1, connect the Balancer/Phazor to heated blanket receptacle J105 (figures 5-75,5-80, and 5-81).

h. Check the focus of the Strobex, and adjust as necessary (TM 55-4920-402-13&P).

5-130. MB Hover Track of Main Rotor with Metal Blades.

a. Using blender (T58.1) and gage (T56.1), set main rotor trim tabs to 0 degrees.

b. Set Balancer/Phazor controls as follows:

(1) MAGNETIC PICKUP switch to COMMON.

(2) INTERRUPTER LOGIC switch to DOUBLE.

(3) FUNCTION switch to TRACK.

(4) RPM RANGE switch to X1.

(5) RPM TUNE dial to 324.

NOTE

With the Strobex in MODE A, the light is at low intensity. if a higher intensity light is needed, set the Strobex to MODE B, and the Strobex RPM dial to 240 or less (see formula on back of Strobex); this allows viewing the targets at the front of ship. To view the targets at 3:00 and 9:00 o'clock (for advancing and retreating blades) as well as the head of the ship, set the RPM dial to 500 or less. In MODE A, turning the RPM dial has no effect and the setting is unimportant.

c. Set the Strobex MODE switch to A.

NOTE

If desired, initial tracking may be dons on the ground at 324 rotor rpm, flat pitch, cyclic control centered, and anti-torque pedals neutral.

NOTE

One flat pitch link barrel adjustment will be equal to 3/8 inch change in track.

d. Hover the helicopter, pull the trigger switch on the Strobex, and direct the strobe light at the rotor tip path toward the front of the ship.

NOTE

Look directly over the Strobex when searching for the targets. If difficulty is experienced in finding the tip-targets, move the Strobex in a W pattern until the targets are located. If the vertical target is leading or trailing the horizontal target more than 2 inches, it may be difficult to determine the correct pattern.

NOTE

If necessary, correct the pattern in accordance with step e; if pattern is satisfactory, proceed to step f.

e. Correct vertical target for lead or trail as follows:

(1) Record the target pattern, land the helicopter, and shut down the engine.

(2) Turn the rotor so that the single Interrupter is opposite the magnetic pickup (figure 5-79).

NOTE

Bending the interrupter tip 1/16 inch will move the vertical target approximately 2 inches.

(3) To move the target to the left, bend the interrupter tip clockwise (when viewed from above).

(4) To move the target to the right, bend the interrupter tip counterclockwise.

(5) Check the pattern at ground run. Readjust as necessary and proceed with hover tracking.

f. Locate and record the tip-target pattern, land the helicopter, and shut down the engine.

g. Loosen the jamnuts on the low blade pitch link, and adjust in accordance with figure 5-83.

NOTE

One flat pitch link barrel adjustment will be equal to 3/8 Inch change in track.

h. lighten jamnuts 650 TO 800 inch-pounds and lockwire (C155) the upper and lower jamnut to the barrel.

i. Repeat steps d through f. above, and make additional corrections as necessary.

j. When main rotor track is satisfactory, continue to hover and check main rotor balance (paragraph 5-131).

5-130.1 CB RPM Ground Tracking of Main Rotor with Composite Blades.

NOTE

RPM ground tracking of the CMRBs is conducted only when one or more blades have been changed. This step can be skipped if the only minor rotor trimming Is being conducted.

NOTE

When bending trim tab to a required setting, it will be neceasary to over bend the trim tab then return to desired setting. This is required due to "springback" of the stainless steel material. Failure to overbend may cause tab to wash out especially during forward flights.

a. Using bender (T58.1), locate forward edge of bender on trim tab 0.25 to 0.30 inches aft of the trailing edge of the composite blade. Initially set the composite blade tabs down 6 degrees from zero on the gage (T56.1). Refer to application in figure 5-71.

b. Set Balancer/Phazor controls as follows:

(1) Magnetic Pick-up switch to COMMON.

(2) Interrupter Logic switch to DOUBLE.

(3) Function switch to TRACK.

(4) RPM Range switch to Xl.

(5) RPM Tune dilate 324.

c. Set the Strobex Mode switch to A.

d. Operate the aircraft at engine idle with the cyclic centered and the collective fully down. A slight increase in rpm may be required to minimize vibration.

NOTE

If the targets are too far apart in the lateral direction to determine the vertical track spread note the blade positions and refer to paragraph 5-130.e for the proper procedures to correct for the for the lateral spread.

e. Aim the Strobex at the 12 o'clock position and pull the trigger switch: Move the Strobex until the reflective targets on the blade are visible.

f. Estimate and record the track of the blades at engine idle.

NOTE

One fiat pitch link barrel adjustment will be equal, to 1/2 inch change in track.

g. If rotor is out-of-track at engine idle more than the width of the reflective tape (1/4 inch), shut down and adjust the pitch links to correct the track.

h. Loosen the jamnut on the low blade pitch link, and adjust in accordance with figure 5-83.

i. Torque jamnuts on pitch change links, 650 to 800 inch-pounds. Lockwire (C155) upper jamnut to both barrel and clevis. Lockwire (C155) lower jamnut to barrel. Check hole in barrel to ensure minimum thread engagement.

j. With rotor in track at engine idle, increase the rpm to 6600 (flat pitch).

k. View the rotor blade track 6600 rpm.

l. Estimate and record the track. If the track change between low and high rpm is less than 1/2 inch then the rotor is ready to be balanced in a hover per paragraph 5-131. If the rotor track changes 1/2 inch or more between low and high rpm then the track must be corrected as follows:

NOTE

One degree change in trim tab is equivalent to 1/4 inch change in track at 6600 rpm.

(1) Determine the total amount of tab adjustment required.

NOTE

To correct a diving blade bend the trim tab up. To correct a climbing blade bend the trim tab down. Tab adjustment should have no effect on track 'at engine idle rpm.

NOTE

When trim tab adjustments are made during RPM tracking and forward frights, DO NOT put all adjustments into one trim tab. Final tab settings that are approximately aqual in opposite directions tend to provide the smoothest overall rotor system.

(2) Adjust trim tabs.

(a) Using bender (T58.1), position edge of bender on trim tab 0.25 to 0.30 inches from the trailing edge of the blade. Position gage (T56.1) flush with the tab angle indicator on the bender.

NOTE

The purpose of overbending the trim tab is to achieve a permanent setting on the tab. Just bending the tab to the desired setting without overbending it will cause the blade to loose tab angle over time.

(b) Determine the new tab setting required to achieve the desired amount of adjustment. Bend the tab in the desired direction until the tab has an "at rest" (no load on the bender) setting approximately 2 degrees beyond the desired final setting. Once this has been achieved, bend the tab back until the tab has an "at rest" setting at the desired final angle and remove bender and gage.

m. Repeat steps 5-130.1 (j) thru (m) until the rotor is in track at high RPM (within 1/4 inch of perfect track). Proceed to paragraph 5-131 for hover balancing.

5-131. Check Main Rotor Balance.

NOTE

Main rotor blades must be in track (paragraph 5-130) before checking balance.

a. Set Balancer/Phazor FUNCTION switch to A. Leave all other controls as set in paragraph 5-130b.

b. While hovering, press TEST button on Balancer/Phazor and check for lights at 12:00 and 6:00 o'clock on the PHAZOR, indicating that the equipment is ready for use. If the 12:00 and 6:00 o'clock lamps fail to light, troubleshoot the equipment (table 5-9). When the 12:00 and 6:00 o'clock lamps light, release the TEST button.

c. Observe the clock angle on the PHAZOR.

d. Press the VERIFY TUNE button and adjust the RPM TUNE dial to obtain the clock angle observed in step c, above.

e. Release the VERIFY TUNE button and observe the clock angle. If the clock angle changes when the button is released, readjust in accordance with steps c and d, above. Continue to adjust until the clock angle remains the same whether the VERIFY TUNE button is pressed or released.

NOTE

The clock angle may be erratic and difficult to read, especially if the amount of imbalance is slight (0.20 IPS or less). With the VERIFY TUNE button pushed the clock angle will be steadier and should lie in the center of the more erratic image found with the button released. Use the average clock angle with the button released. Usually, clock angles at 0.5 IPS are unreadable and balance is considered acceptable. As long as the clock angle is readable, however, balance can be improved, and corrections should be made.

NOTE

If the IPS meter reads off-scale, use the PUSH FOR SCALE 2 button to take the reading.

f. Record the clock angle and IPS reading in the spaces provided on the balance chart (figure 5-84).

g. Land helicopter and correct main rotor balance (paragraph 5-132).

5-132. Correct Main Rotor Balance. Main rotor balance correction is achieved by adding or subtracting weight to the blade retaining bolts (4, figure 5-24) for spanwise correction, and by sweeping the blades for chordwise correction. The location and amount of correction needed is determined by plotting the IPS and clock angle readings on a main rotor balance chart. A main rotor balance chart (figures 5-84) consists of: a clock face of 12 radial lines representing the clock angle where the vibration takes place; 10 concentric circles representing 0.1 to 1.0 IPS: a graph overlaid on the clock face and IPS circles that indicates the amount (weight or sweep) and the location (target or blank blade) of the corrections to be made. Various charts are available for different helicopters and rotor configurations; be sure the correct chart No. 4262 (NSN 7601-01-006-4428), is being used. Differences in the vibrational characteristics of individual helicopters, however, may require a clock angle corrections to the chart. When making the corrections indicated by the balance chart, it is best to make only one change (weight or sweep) and recheck the balance. This will indicate if a clock angle correction is needed. If successive balance changes result in erratic points that cannot be predicted from the charts,

Restore the rotor to its original balance condition and recheck the balance. If the IPS and clock angle readings differ greatly from the original readings, inspect the rotor for improper buildup, worn, or failed components. There is no difference in the balancing sensitivities between composite and metal main rotor blades. All balancing is done at 6600 engine rpm with Vibrex tuned to 324 rpm.

Correct the main rotor balance as follows:

NOTE

If the IPS meter was off scale during the balance check and the PUSH FOR SCALE 2 button was used to take IPS reading, divide the meter reading by 10, or some other convenient factor. Then, after the corrections are plotted, multiply the change needed (weight or blade sweep flats) by the chosen factor. Use these figures to make the needed blade changes.

a. Plot corrections on balance chart. The steps used to plot balance corrections are best shown by example. For this purpose, assume that a clock angle of 11:00 o'clock and an IPS of 0.6 were recorded during the balance check (paragraph 5-131 f.), and plot the corrections as follows (figure 5-84, sheet 1).

(1) Find the point on the balance chart that corresponds to 11:00 o'clock and 0.6 IPS, and mark it as point 1.

(2) From point 1, draw a dotted line parallel to the graph lines and extending to the weight change line.

(3) Draw another dotted line from point 1 to the sweep change line.

(4) The plotted chart calls for the following corrections:

(a) Add 800 grams to the target (red) blade or remove 800 grams from the blank (white) blade.

(b) Sweep blank blade aft 4 flats.

NOTE

Never sweep forward of scoped position.

(5) Because the needed weight change is farther from the zero axis than the needed sweep change, only the weight will be changed at this time. The 800 grams is added to the target blade and recorded on the balance chart. A second run is made, and balance (paragraph 5-131) is rechecked.

(6) Assume that a clock angle of 1:15 and an IPS reading of 0.25 are recorded during the second run.

NOTE

A clock angle of 1:15 is indicated when the PHAZOR lights are fluctuating between 1:00 and 1:30.

(7) Find the point on the balance chart that corresponds to 1:15 o'clock and 0.25 IPS, and mark it as point 2 (figure 5-84, sheet 2).

(8) Draw a solid line between points 1 and 2. This is called the move line.

NOTE

The dotted lines drawn on the balance chart represent a prediction of what weight and sweep changes should accomplish. In this case, the move line between points 1 and 2 overlays the dotted line and indicates that the balance chart is correct for the helicopter being tested. A move line tangent to the predicted change indicated that a chart clock angle correction is needed (see step b., below).

(9) Notice that point 2 has fallen on the zero axis of the weight change line. This indicates that the weight change of 800 grams added to the target blade was correct. The IPS reading of 0.25, however, indicates that the sweep change of 4 flats aft on the blank blade is still needed.

(10) The sweep change of 4 flats aft on the blank blade is made and recorded on the balance chart. A third run is made and balance (paragraph 5-131) is rechecked.

(11) Assume that a clock angle of 1:00 and an IPS reading of 0.05 are recorded during the third run.

(12) Find the point on the balance chart that corresponds to 1:00 o'clock and 0.05 IPS, mark it as point 3, and draw a line between points 2 and 3 (figure 5-84, sheet 3). This indicates excellent results and no further corrections are necessary. The above steps indicate what an experienced operator should achieve under ideal conditions. Difficulty in interpreting the charts or clock angle, however, may yield different results. For example, if the corrections called for during the second run (figure 5-84, sheet 2) indicated a clock angle of 1:30, the move line would extend through the zero axis line for weight change. The corrections made before the third run would call for removal of about 62 grams from the target bolt as well as the indicated sweep change. The important thing to remember is that the move line must follow the predicted change. If the move line runs at a tangent to the predicted change (dotted line), the chart clock angle is wrong and must be corrected.

b. Chart clock angle correction. Use clock angle corrector No. 3597 (figure 5-85) to correct a balance chart as follows:

(1) Assume that a balance correction generated a move line as shown in figure 5-86, sheet 1. Even though the chart shows a change in weight it is incorrect because the move line is tangent to the predicted change. Also, a change in sweep from that predicted by point 1 is indicated; this cannot be correct because the sweep was not changed prior to the second run.

(2) To correct the chart, place eyelet A of the clock angle corrector (figure 5-85) over point 1 on the chart with line A-O overlaying the dotted prediction line.

(3) Swing index A-B over the move line and read the amount of correction needed. In this case, the clock angle corrector calls for subtracting one hour from the chart clock angles.

(4) Renumber the clock angles on the chart by subtracting one hour from each of the numbers, and replot points 1 and 2 using the new clock numbers. Number the new points 1a and 2a (figure 5-86, sheet 2).

(5) The corrected chart shows that only 600 grams should have been added to the target blade, and the required sweep should be 9 flats aft on the blank blade.

NOTE

The weight change is made by removing 200 grams from the target blade.

(6) After the changes are made, the third run results should show a move line to the approximate center of the clock face (3a, figure 5-86, sheet 3). In this case the tangent move line is correct because both a weight and sweep change were made prior to run 3. The balance is correct and no further changes are necessary.

c. Using the IPS and clock angle determined in paragraph 5-131f, plot the necessary corrections in accordance with steps a and b, above.

NOTE

Use the gram scale to weigh the amount of shot (C247) added to or removed from the blade bolt.

d. Remove the plug from the blade retaining bolt (4, figure 5-24) and "add or subtract weight (C247) as determined from the balance chart. Reinstall plug and lockwire (C155).

e. Loosen the jamnuts on the drag brace (8) and sweep the blade as determined from the balance chart. Torque the jamnuts 650 TO 800 inch-pounds.

f. Re-check balance (paragraph 5-131).

g. Repeat the above balancing procedures until the amount of imbalance is 0.1 IPS or less.

h. When track and balance are satisfactory, check main rotor in-flight track (paragraph 5-133).

5-133. MB Check Main Rotor In-Flight Track. Checking main rotor in-flight track consists of recording the tip-target pattern, IPS meter reading, and PHAZOR clock angle at hover, 60,90, and 110 (VNE) knots on the in-flight tracking chart (reverse side of track and balance chart 4262). This data will be used to plot the track changes needed to correct vertical imbalance.

a. Set Balancer/Phazor FUNCTION switch to TRACK. Leave all other controls as set in paragraph 5-130 b.

b. Fly the ship at 60 knots, observe the main rotor track (paragraph 5-130), and record the pattern in the space provided on the in-flight tracking chart (figure 5-87, sheet 1).

NOTE

With the FUNCTION switch set to B, data is received from the vertical accelerometer (figure 5-82).

c. Set the Balancer/Phazor FUNCTION switch to B.

d. Check for 12:00 and 6:00 o'clock lights on the PHAZOR and fine tune the check angle in accordance with paragraph 5-131, steps b through e.

e. Observe and record the 60 knot clock angle and ips reading in the spaces provided on the in-flight tracking chart (figures 5-87, sheet 1).

f. Repeat steps a through e, above, at 90 knots, and again at 110 (VNE) knots.

g. Land the helicopter and correct the in-flight track (paragraph 5-1 34).

5-133.1 CB Check Main Rotor in-Ffight l/Rev Vibration. Checking main rotor vertical vibration in flight consists of recording the IPS meter reading and PHAZOR clock angle for the lateral channel in a hover and the vertical channel at 60 knots and 110 knots. In addition to the vibration readings, the tip target pattern is observed and recorded in a hover and at 60 knots and 110 knots. The data, used in conjunction with the balance chart shown in figure 5-87.1 and the chart shown in figure 5-84, will minimize the rotor 1/rev vibration.

NOTE

Fine tune the Vibrex at each test condition as described In paragraph 5-131.

a. To minimize rotor l/rev vibration in-flight, perform the following:

(1) Tune the Vibrex to 324 rpm and set the Balancer/Phazor FUNCTION switch to A (lateral channel).

NOTE

If the lateral l/rev vibration Is above 0.2 IPS correct rotor balance per paragraph 5-132.

(2) Hover the helicopter at 6600 rpm and record the IPS and PHAZOR readings for the channel A. Set the Balancer/Phazor FUNCTION switch to TRACK and observe and record the pattern of the tip targets.

NOTE

Composite Blade forward flight track is performed at 314 rotor rpm.

(3) Fly the helicopter at 60 knots and 6400 rpm. Tune the Vibrex to 314 rpm and set the Balancer/Phazor FUNCTION switch to B (vertical). Record the IPS and PHAXOR angle readings. Set the Balancer/Phazor FUNCTION switch to TRACK and observe and record the tip target pattern. If the l/rev levels are high, the vibration should be reduced before proceeding to 110 knots. Procedures for correcting vertical vibration are contained in paragraph 5-134.1. If the vibration at 60 knots is not excessive, proceed to 110 knots and accomplish step (4) below.

NOTE

On the initial flight, check and adjust autorotation rpm (paragraph 5-10) and boost-off control forces (paragraph 5-8.1).

(4) Fly the helicopter 110 knots and 6400 rpm. Set the Balancer/Phazor FUNCTION switch to B (vertical). Record the IPS and PHAZOR angle readings.

Set the Balancer/Phazor FUNCTION switch to TRACK and observe and record the tip target pattern.

(5) Correct in-flight track per paragraph 5-134.1.

5-134. MB Correct In-flight Track. Correcting in-flight track consists of plotting and interpreting the tracking chart, and making the necessary pitch link or tab changes to reduce imbalance to 0.2 IPS or less. The steps used to plot and interpret the tracking chart are similar to those used to plot and interpret the balance chart (paragraph 5-1 32). As with the balance chart, the steps are best shown by example. Assume that the data recorded in paragraph 5-133 is as shown in figure 5-87, sheet 1, and proceed as follows:

a. Using the 110 knot data, find the point on the balance chart (sheet 2) that corresponds to 1:00 o'clock and 0.6 IPS and mark it as point 1.

b. Refer to figure 5-88 and determine whether a tab adjustment on a pitch link adjustment is needed:

(1) If blade spread increases with increasing air speed, a tab change is needed.

(2) If blade spread remains fairly uniform throughout the speed range, a pitch link change is needed.

c. Since the target patterns shown (figure 5-87, sheet 1) call for a tab change, draw a dotted line from point 1 to the tab line on the chart (sheet 2). The chart calls for bending the target blade tap up approximately 7/8 degree.

NOTE

Use the data gathered in paragraph 5-133 to plot the tracking chart before making changes.

d. Make tab changes or pitch link changes as follows:

(1) Make the necessary tab changes by bending the tab using gage (T56.1) and bender (T58.1) (figure 5-71).

NOTE

Bender T58.1, must be modified to accept CMRB, see figure 5-72.1 for data.

(2) Make necessary pitch link changes using the general instructions given in paragraph 5-130 g and h.

e. fly the helicopter and check and correct the hover track (paragraph 5-130), and main rotor balance (paragraphs 5-131 and 5-132), then recheck the in-flight track (paragraph 5-133) and plot the data on the chart.

f. The example shown (figure 5-87, sheet 3) indicates that the move line (points 1 and 2) has followed the 1 o'clock line through the center of the chart to the 7 o'clock position. This indicates that the tab change was slightly excessive. An IPS of 0.05, however, indicates acceptable performance and no further changes are needed. The chart shows near ideal results, but a move line that parallels the 1:00 to 7:00 o'clock line with point 2 falling within the 0.2 IPS circle is equally satisfactory.

NOTE

Adjustments cannot be made to generate a move line in the 4:00 to 10:00 o'clock direction. A chart calling for this kind of correction indicates variations in the blade flight characteristics that prevents that particular pair of blades from flying together. If point 2 falls outside of the 0.2 IPS circle on the 400 to 1000 o'clock line, replace the blades.

g. Repeat the above in-flight tracking procedures until the amount of imbalance is 0.2 IPS or less.

NOTE

Adjust the in-flight track for the lowest possible IPS reading even if the visual image indicates a alight out-of-track condition.

h. After the main rotor hover track, balance, and in-flight track are correct, check the autorotation rpm and adjust as necessary (paragraph 5-10).

i. Remove the Vibrex equipment from the helicopter as follows:

(1) Disconnect the Strobex from the Balancer/Phazor, and remove all connecting cables from the aircraft (figure 5-80).

(2) Remove the vertical accelerometer (figure 5-82).

(3) Remove the lateral accelerometer (figure 5-81).

(4) Remove the interrupters (figure 5-79), reinstall the nuts, and torque 50 TO 70 inch-pounds.

(5) Remove the magnetic pickup and bracket (figure 5-78), reinstall the bolts, nuts, and washers, and torque 50 TO 70 inch-pounds.

(6) Remove the bracket mounted tip-targets (figure 5-76) and retain the capscrews, washers, and locknuts for reuse.

(7) Store Vibrex components in carrying case.

5-134.1 CB **Correct In-Flight Track Rev Vibration.** Correcting in-flight track consists of plotting and interpreting the tracking chart (figure 5-87.1) and making the necessary pitch link or tab changes to reduce imbalance to 0.2 IPS or less.

a. Graph the vertical 1/rev levels on the composite main rotor blade chart, shown in figure 5-87.1 and determine the corrective action required based upon the following:

(1) A tab adjustment is most likely required if the track and/or the 1/rev levels change significantly from 60 to 110 knots (figure 5-88).

(2) A pitch link adjustment is most likely required if the track and/or the l/rev levels change significantly from 60 to 110 knots (figure 5-88).

(3) A combination pitch link and tab adjustment is required if the vertical 1/rev is plotted in the shaded area of the chart (i.e. make both a tab and pitch link move simultaneously to get the clock angle of the 1/rev into the unshaded area where single adjustments can be used).

b. An alternate method is to tab the rotor until the track does not change with airspeed, then use pitch link adjustments to reduce the 1/rev vibration.

c. Repeat the procedures of paragraphs 5-133.1 and 5-134.1 until the vertical 1/rev at both 60 and 110 knots are acceptable.

NOTE

Correction of vertical l/rev may cause the hover lateral vibration to exceed 0.2 IPS. Correction of vertical l/rev can only be accomplished if the hover lateral vibration is reduced per paragraph 5-132.

The following are examples on how to use the composite blade vertical charts.

EXAMPLE NO. 1

The vertical 1/rev at 60 knots is measured to be 4 IPS at between 12:30 and 1:00 and is .75 IPS at 12:00 at 110 knots. Plot these two points on the vertical chart as shown in figure 5-87.2. Since the I/rev is in the unshaded area, single tab and/or pitch link moves can be made. By drawing lines (shown as dashed lines) between the move lines and the l/rev points it can be seen that at 60 knots the chart is calling for approximately a 3/4 flat of pitch link adjustment while 1-1/4 flats would be needed at 110 knots. If the tab move is checked, however the chart shows that approximately 1 degree of tab is called for to smooth both 60 and 110 knots. The proper move to make is the tab move. This is reinforced in that the vertical data is plotted along the same line as the tab line while the pitch link move line is clocked one hour off. A third indicator to verify the use of tab is to check the track (figure 5-88).

EXAMPLE NO. 2

The vertical I/rev at 110 knots is measured to be 0.5 IPS at between 4:30 and 5:00. This plots onto the chart as shown in figure 5-87.3. Note that this falls in the shaded area of the chart. In this area a single pitch link or tab move will not significantly improve the vibration. To correct the vibration it will be necessary to adjust the pitch link opposite of the tab (making both move at the same time). To accomplish this draw a line between the plotted point and the double axis at the upper right of the chart. In this case the chart is calling for a 2 flat pitch link adjustment and a 1-1/2 degree tab move in the opposite direction (e.g. roll the target up 2 flats and tab the target down 1-1/2 degrees). While the results of this move may not be perfect it should move the l/rev into the unshaded

area where single moves can be used to smooth the rotor.

d. Make tab changes or pitch link changes as follows:

NOTE

One degree change in trim tab is equal to 1/4 inch change in track.

(1) Make the necessary tab changes by bending the tab using instructions in paragraph 5-130.1.a.

NOTE

One flat pitch link barrel adjustment is equal to 1/2 inch change in track.

(2) Make necessary pitch link changes using the general instructions given in paragraph 5-130.1.h and i.

e. Repeat the above in-flight tracking procedures until the amount of imbalance is 0.2 IPS or less.

f. After the rotor vibration has been reduced to acceptable limits, recheck boost-off (paragraph 5-8.1) and autorotational rpm (paragraph 5-10), and correct if necessary.

g. Remove the vibrex equipment from the helicopter as follows:

(1) Disconnect the Strobex from the Balancer/Phazor, and remove all connecting cables from the aircraft (figure 5-80).

(2) Remove the vertical accelerometer (figure 5-82).

(3) Remove the lateral accelerometer (figure 5-81).

(4) Remove the interrupters (figure 5-79), reinstall the nuts, and torque 50 TO 70 inch-pounds.

(5) Remove the magnetic pickup and bracket (figure 5-78), reinstall the bolts nuts, and washers, and torque 50 TO 70 inch-pounds.

(6) Remove the bracket mounted tip-targets (figure 5-76) and retain the capscrews, washers, and locknuts for reuse.

(7) Store Vibrex components in carrying case.

h. Record final trim tab settings and record them in the aircraft maintenance records for future reference.

NOTE

If after repeated effort, a 0.2 IPS or less level cannot be achieved then the maintenance officer must decide if the level achieved is acceptable to return the aircraft to service. If they are not, then the hub and control system should be inspected for excessive freeplay. If freeplay is found it should be corrected and the aircraft reflown. If this fails to correct problem, the blades should be changed.

5-135. TAIL ROTOR TRACK AND BALANCE.

5-136. General. Tracking and balancing a tail rotor with the Vibrex system is essentially the same as tracking and balancing the main rotor; one exception, however, is determining the clock angle. The Phazor requires a signal from both a magnetic pickup and accelerometer to determine clock angle. Because a magnetic pickup is not used for tail rotor balancing, the Phazor cannot be used to determine the clock angle and should be disregarded. Instead, the clock angle is determined visually by observing the target image with the Strobex. Plotting balance corrections

on the tail rotor chart is substantially the same as for the main rotor. Two different charts, however, are available: chart No. 3413 (figure 5-89) which is configured to the tail rotor's 24 degree grip bolt angle, and chart No. 4020 (figure 5-90). The use of chart No. 4020 requires the permanent installation of tail rotor balance arms No. 4016. The balance arms No. 4016. The balance arms allow span and chord weight changes to the made 90 degrees apart rather than the 24 degree angle of the grip bolt geometry. Also, the balance arms allow the use of No. 10 bolts, nuts, ad washers as balance weights; this avoids the necessary of replacing the grip bolts should they be too long or short for the number of balance washers required.

NOTE

Chadwick balance arms are for Dynamic trim balance only.

NOTE

A replacement tail rotor shall be static balanced (paragraph 5-96) before installation.

Premaintenance requirements for tail rotor tracking and balancing

Condition	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	None
Test Equipment	Vibrex 4591 Balancing Kit Balance Chart 3413, NSN 761001 1233222 Balance Chart (old series) 4020, NSN7610-01-123-3223
Support Equipment, Minimum Personnel Required	Ruler or Straightedge Two
Consumable Materials	(C178) (C275)
Special Environmental Conditions	None

5-137. Attach Test Equipment to Aircraft.

a. Apply reflective targets No. 3300 or 4270 to tail rotor as follows:

NOTE

Before applying the self adhesive targets, clean the grip and blade tip areas with naphtha (C178).

(1) Attach a vertical target to the outboard side of one blade grip (A, figure 5-91). This will be the target blade.

(2) Attach a horizontal target to one blade tip and a vertical target to the other blade lip with the targets centered chordwise and equidistant from the leading edge (B, figure 5-91).

b. The installed position of the accelerometer depends on which balance charts to be used. Attach accelerometer No.

(1) Chart No. 3413. Remove the nut from the top stud on the tail rotor gearbox and install the accelerometer with the connector facing up (A, figure 5-92). Reinstall the nut tighten to standard torque.

(2) Chart No. 4020. Remove the nut from the bottom right stud on the tail rotor gearbox and install the accelerometer with the connector facing 4:30 as viewed from the rotor side (B, figure 5-92). Reinstall the nut and tighten to standard torque.

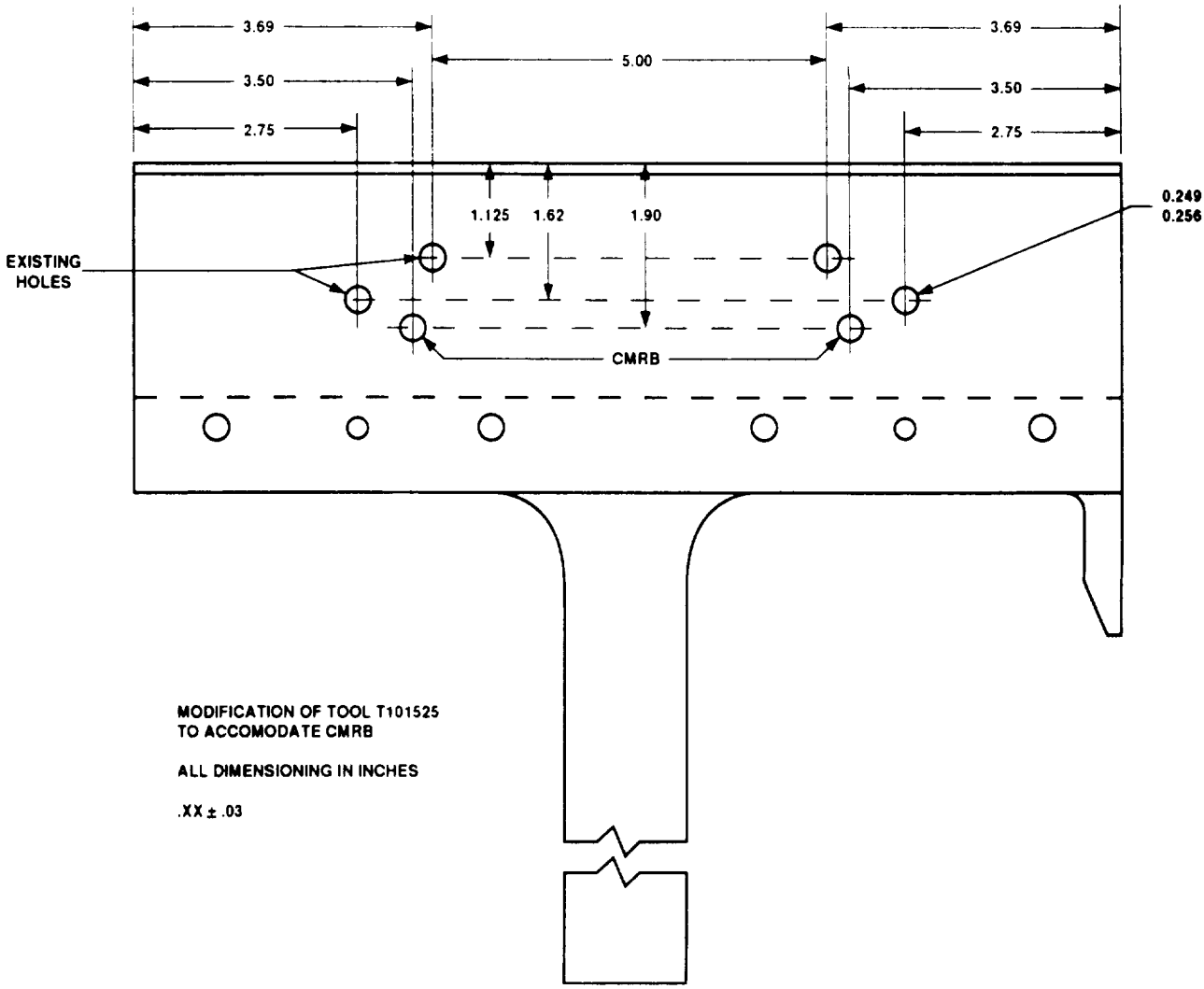


Figure 5-72.1 CMRB Modification of Bender T58.1

c. Attach accelerometer cable No. 4296-2 to accelerometer as follows:

(1) Run cable between the gearbox and chain drive cover opening, and attach it to the accelerometer.

(2) Route the cable down the back side of the tail fin, wrap around tail skid, and run over right synchronized elevator (figure 5-93).

(3) Run cable under tail boom to tail rotor side and extend to approximately 15 TO 20 feet.

(4) Plug the cable into the CHANNEL B ACCELEROMETER receptacle on the Balancer/Phazor (figures 5-75 and 5-80).

d. Connect the Strobex to the Balancer/Phazor (figures 5-75 and 5-80).

e. Using dc extension cable No. 3529 and dc adapter cable No. 3140-1, connect the Balancer/Phazor to heated blanket receptacle J105 (figures 5-75, 5-80, and 5-81).

f. Check the focus of the Strobex and adjust as necessary (TM 55-4920-402-13 & P).

g. Tape accelerometer and dc power cables as necessary to prevent tangling.

5-138. Track Tail Rotor.

a. Set Balancer/Phazor controls as follows:

(1) FUNCTION switch to B.

(2) rpm RANGE switch to X 10.

(3) rpm TUNE dial to 165 (1650 tail rotor rpm).

NOTE

MAGNETIC PICKUP and INTERRUPTER LOGIC settings are unimportant and do not affect tail rotor track and balance procedures.

b. Set the Strobex controls as follows:

(1) MODE switch to D.

(2) rpm dial to 660. This is equal to 6600 rpm and gives four strobe images per tail rotor revolution.

c. With the helicopter on the ground and headed into the wind, run at 100% rpm, flat pitch, and pedals centered. Track the tail rotor as follows:

CAUTION

To avoid equipment damage, be sure that cables cannot foul the tail rotor. Remove slack and tie or tape as necessary.

(1) Stand at the side of the helicopter (observation point 1, figure 5-93), pull the trigger switch on the Strobex, and direct the strobe light at the rotor grip target area; four targets should be visible.

(2) Tune the Strobex rpm dial until the four target images appear stopped.

(3) Move the equipment to the side of the helicopter near the rear cargo door (observation point 2, figure 5-93).

NOTE

If the horizontal bar appears above or below the vertical, it indicates that the Targets were not placed an equal distance from the leading edge of the blades. This is not important, provided the difference is only an inch or two; the Important observation is the left-to-right relation of the vertical to horizontal bars.

(4) Direct the Strobex at the tail rotor edges, and observe and record the tip pattern. If the image has a tendency to rotate one way or the other, adjust the rpm dial to keep the image in view.

d. Good rotor track is indicated if the vertical target is centered on the horizontal target. If the vertical target appears to the left or right of the horizontal target, adjust the inboard blade away from the tail fin as follows:

NOTE

Since the finest adjustment of the pitch link is one-half turn of the rod end, it may not be possible to achieve perfect track.

(1) Loosen the jamnut on the inboard blade pitch link, and disconnect the pitch link from the crosshead by removing the cotter pin, nut, bolt, and washers (figure 5-53).

(2) Shorten the pitch link one-half tum, and reconnect the pitch link to the crosshead using the washers, bolt, and nut. Torque 60 TO 100 inch-pounds and install the cotter pin.

(3) Make certain that the pitch link rod end bearings are centered, and torque the jamnut 60 TO 100 inch-pounds.

(4) Recheck the tail rotor (step c, above) and if further adjustment is necessary, lengthen the pitch link on the blade farthest from the tail fin by one-half turn.

(5) Repeat the above procedure until the best possible tail rotor track is obtained.

e. When the rotor track is satisfactory, continue to run, as in step c, above, and balance tail rotor (paragraph 5-139).

5-139. Balance Tail Rotor.

NOTE

Tail rotor must be in track (paragraph 5-138) before balancing or pitch links set to vc 2.11 Inches between jamnuts.

a. Move the equipment to observation point 1 (figure 5-93).

b. Set the Strobex MODE switch to A. Leave all other controls as set in paragraph 5-138 a and b.

NOTE

The Phazor is used only for main rotor balancing; ignore the Phazor lights when balancing the tail rotor. Tail rotor clock angle is observed with the Strobex.

c. Pull the Strobex trigger switch, direct the strobe light at the tail rotor, and observe the clock angle of the grip target.

d. Press the VERIFY TUNE button on the Balancer/Phazor and adjust the rpm TUNE dial to obtain the clock angle observed in step c, above.

e. Release the VERIFY TUNE button and observe the clock angle. If the clock angle changes when the button is released, readjust in accordance with steps c and d, above. Continue to adjust until the clock angle remains the same whether the VERIFY TUNE button is pressed or released.

NOTE

The clock angle may be erratic and difficult to read, especially if the amount of Imbalance is slight (0.5 IPS or less). With the VERIFY TUNE button pushed the clock angle will be steadier and should lie in the center of the more erratic image found with the button released. Use the average clock angle with the button released. Usually, clock angles at 0.2 IPS are unreadable and balance is considered acceptable. As long as the clock angle is readable, however, balance can be Improved, and corrections should be made.

f. Record the clock angle and IPS meter reading in the spaces provided on the balance chart (figure 5-89 or 590), and shut down the helicopter.

g. Using the clock angle and IPS reading recorded in step f, above, plot the corrections needed on the balance chart. Plot the corrections in accordance with the general instructions given in paragraph 5-132, and correct the balance as follows:

(1) Make only the larger of the two indicated weight changes for the first move by adding or subtracting washers at the blade grip bolts (chart No. 3413), or at the balance arms (chart No. 4020).

NOTE

Maximum additional weight for balance arm 4016-1 is 35 grams and for 4016-2, 70 grams.

(2) If the move line on the chart does not follow the predicted change, correct the balance chart (paragraph 5-132b).

(3) If the move line follows the predicted change, make the necessary weight correction, and repeat the above balancing procedure until the amount of imbalance is 0.1 IPS or less.

NOTE

If the rotor cannot be balanced after a few moves, restore the weights to the original form and recheck the clock angle and ips reading. If the ips and clock angle readings differ greatly from the original readings, check for faulty bearings, shafts, or other rotating parts.

h. Remove the Vibrex equipment from the helicopter as follows:

(1) Disconnect the Strobex from the Balancer/Phazor, and remove all connecting cables from the helicopter.

(2) Remove the accelerometer and bracket from the tail rotor gear box, reinstall the nut, and tighten to standard torque.

(3) Store Vibrex components in carrying case.

5-140. VIBRATION SOURCE LOCATION. The Balancer/Phazor can be used as a trouble-shooting tool to locate sources of helicopter vibration. By observing the IPS meter while tuning the RPM dial, the rotational speed at which the vibration takes place can be determined. Then, the source is located by comparing the indicated rpm with the known rpm (including harmonics or multiples) of various rotational components (table 5-7). Important considerations to be used when performing a vibration analysis are contained in paragraph 5-121. No hard and fast rules can be given, but the general instructions that follow should aid the experienced operator in locating vibrational sources:

a. Connect an accelerometer to CHANNEL A or B and connect the Balancer/Phazor to 28 V dc power.

b. Set the RPM RANGE switch to the desired rmp range.

NOTE

The accelerometer must be mounted or held at right angles to the rotational axis of the component being checked. Mount or tightly hold the accelerometer to a solid structure near the component to be checked: mounting or holding the accelerometer to a thin, sheet metal panel, for example, could result in false indications.

c. Mount the accelerometer to (or hold it firmly against) a rigid structure near the suspected source of vibration.

d. Adjust the RPM TUNE dial through its range while observing the IPS meter for indications.

e. When indications are noted, fine tune the IPS meter to peak vibrations using the VERIFY TUNE button and RPM TUNE dial.

f. Read the RPM dial at peak IPS meter reading and compare to known rotational speeds (table 5-7).

NOTE

If the IPS meter does not indicate unacceptable vibration levels, move the accelerometer until the vibration source is located. For further information on vibration analysis and interpretation, refer to paragraph 5-121.

NOTE

Do not set RPM TUNE below 100. Settings below 100 will cause false IPS readings.

Table 5-7. Operating Speeds

ROTORS	OPERATING RPM
Main Rotor (1/rev)	324
Main Rotor (2/rev)	648
Main Rotor (4/rev)	1296
Main Rotor (6/rev)	1944
Tail Rotor	1650
DRIVE TRAIN	
Oil Pump (Transmission)	4140
DC Generator	6600
Hydraulic Pump	4300
Tail Rotor Drive Shaft	4300
Main Drive Shaft	6600
Hanger Assemblies	4300
42° Gearbox	4300
90° Gearbox Input Quill	4300
90° Gearbox Output Quill	1650

5-141. TROUBLESHOOTING. Troubleshooting procedures for the Vibrex equipment are contained in Table 5-8. Only those problems that are most likely to occur during use are included. For general repair the adjustment procedures and use of the Vibrex tester, refer to TM 55-4920-402-13&P.

Table 5-8. Troubleshooting

CONDITION
TEST OR INSPECTION
CORRECTIVE ACTION

1. Phazor lamps do not light.
Step 1. Check circuit breaker position.
Turn circuit breaker on.
Step 2. Check power supply polarity.
Ensure power supply is positive (+) to pin B and negative (–) to pin A.

2. No Phazor test pattern when TEST button is pressed.
Step 1. Check RPM RANGE switch setting.
Set RPM RANGE switch to X1.
Step 2. Check INTERRUPTER LOGIC switch setting.
Set INTERRUPTER LOGIC switch to DOUBLE.
Step 3. Check that magnetic pickup cable is properly installed.
Disconnect magnetic pickup cable, check that indexing key is correctly aligned, and reconnect cable.
Step 4. Check gap between the magnetic pickup and interrupters.
Adjust gap between each interrupter and the magnetic pickup to 0.060 ±0.010 inch (paragraph 5-129 c).

Table 5-8. Troubleshooting (cont)

CONDITION
TEST OR INSPECTION
CORRECTIVE ACTION

2. No Phazor test pattern when TEST button is pressed (cont.).
Step 5. Check for faulty magnetic pickup or cable (TM 55-4920-402-13&P).
Repair or replace as required.

3. Erratic tail roter balance image.
Step 1. Check circuit breaker position.
Turn ciruit breaker on.
Step 2. Check Strobex MODE switch position.
Set MODE switch to A.

4. Targets difficult or impossible to detect.
Step 1. Check Strobex and Balancer\Phazor control settings.
Set controls to correct position for job being performed.
Step 2. Check Strobex focus (TM 55-4920-402-13&P).
Adjust focus as necessary.
Step 3. Check for cracked or defective flash tube (weak blue flash).
Replace flash tube (TM 55-4920-402-13&P).
Step 4. Check for worn, dirty, or varnish coated targets.
Replace targets.
Step 5. Check for incorrect aiming procedure.
Look directly over top of Strobex and search in a W pattern along the tip path.

Table 5-8. Troubleshooting (cont.)

CONDITION
TEST OR INSPECTION
CORRECTIVE ACTION

5. Targets appear scattered when tracking main rotor.
Step 1. Check Strobex MODE switch position.
Set MODE switch to A.
Step 2. Check for bent interrupter.
Straighten or replace interrupter.

6. Incorrect reading on IPS meter.
Check setting of RPM TUNE dial.
Do not set RPM TUNE dial below 100.

7. Clock angle and IPS readings are erratic and not repeatable.
Check rotor components for looseness and wear.
Repair or replace faulty components.

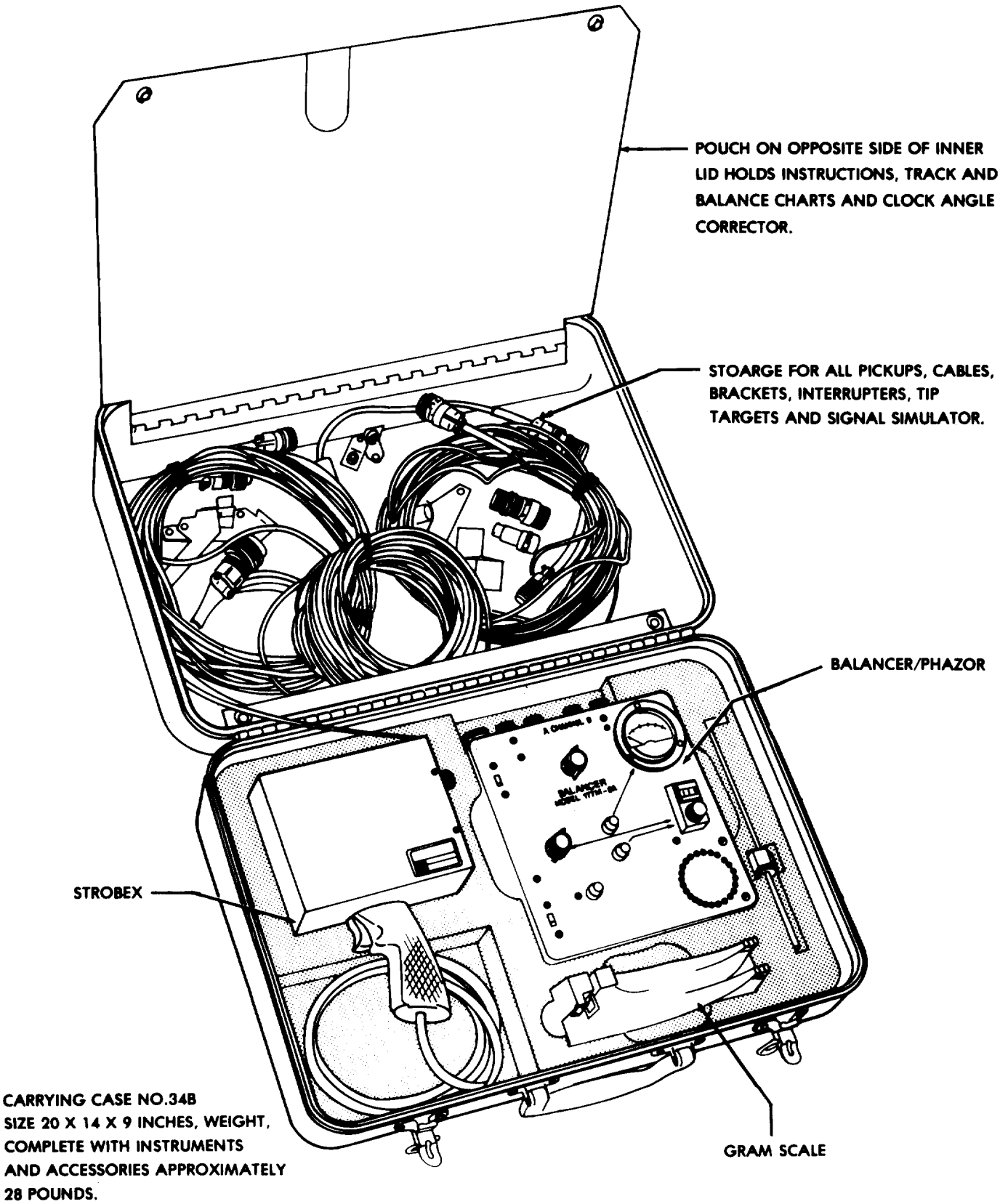


FIGURE 5-73. Elements of the VIBREX 4591 System

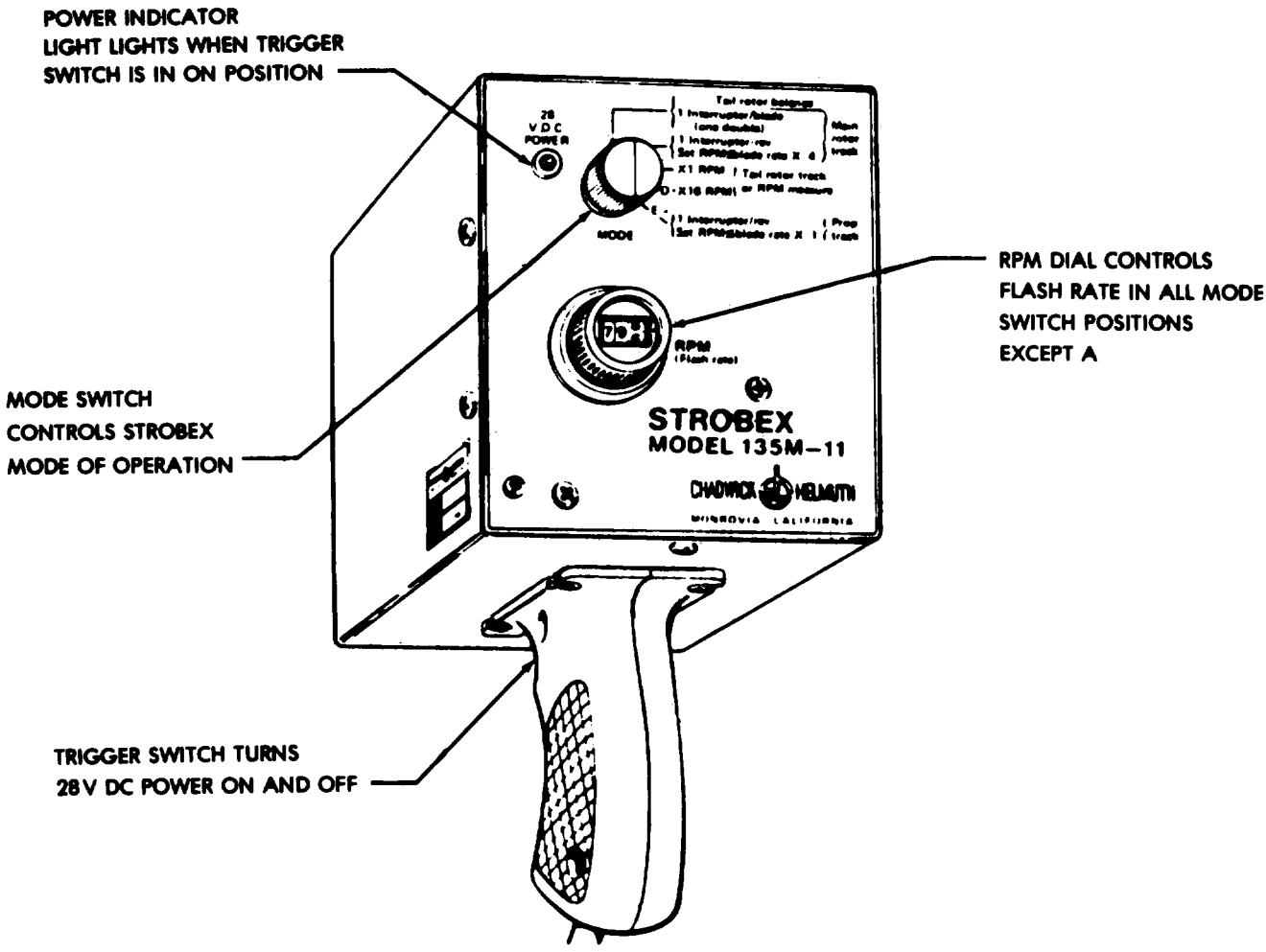


FIGURE 5-74. Strobex Model 135M-11.

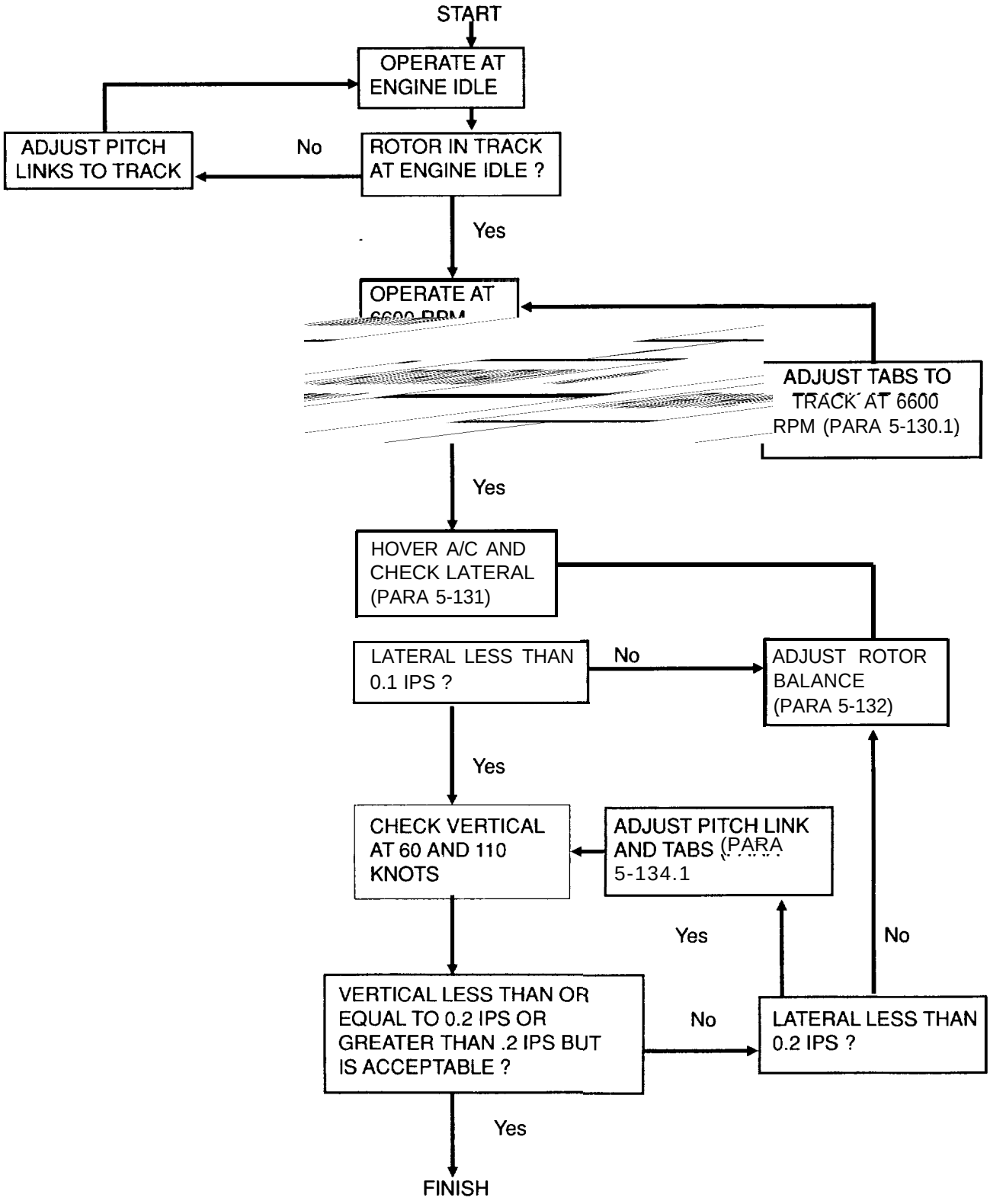


Figure 5-74.1 Flow Chart for Smoothing Rotor with Composite Blade

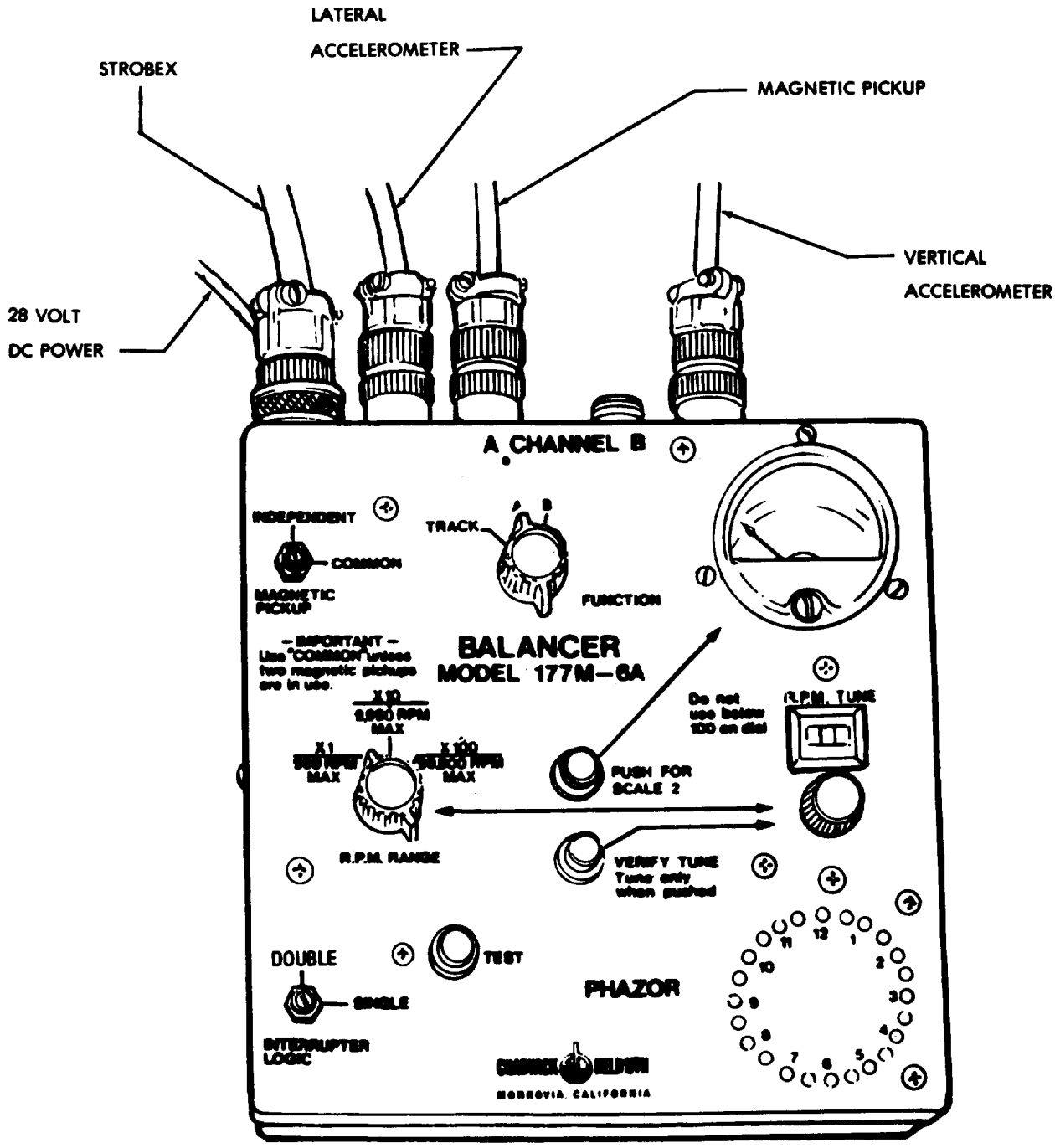
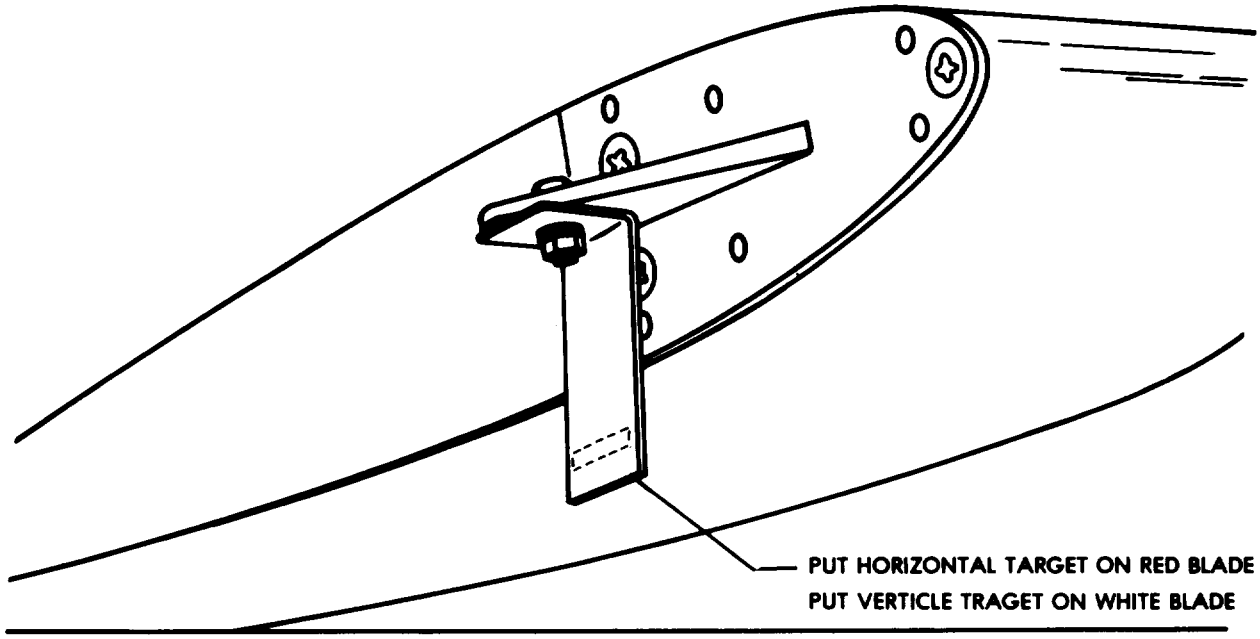


FIGURE 5-75. Balancer/Phazor Model 177M-6A



ATTACH TIP TARGET NO. 3387 TO
EACH BLADE TIP. THE REFLECTIVE
TAPE MUST FACE INBOARD.

FIGURE 5-76. Attaching Tip Targets No.3387

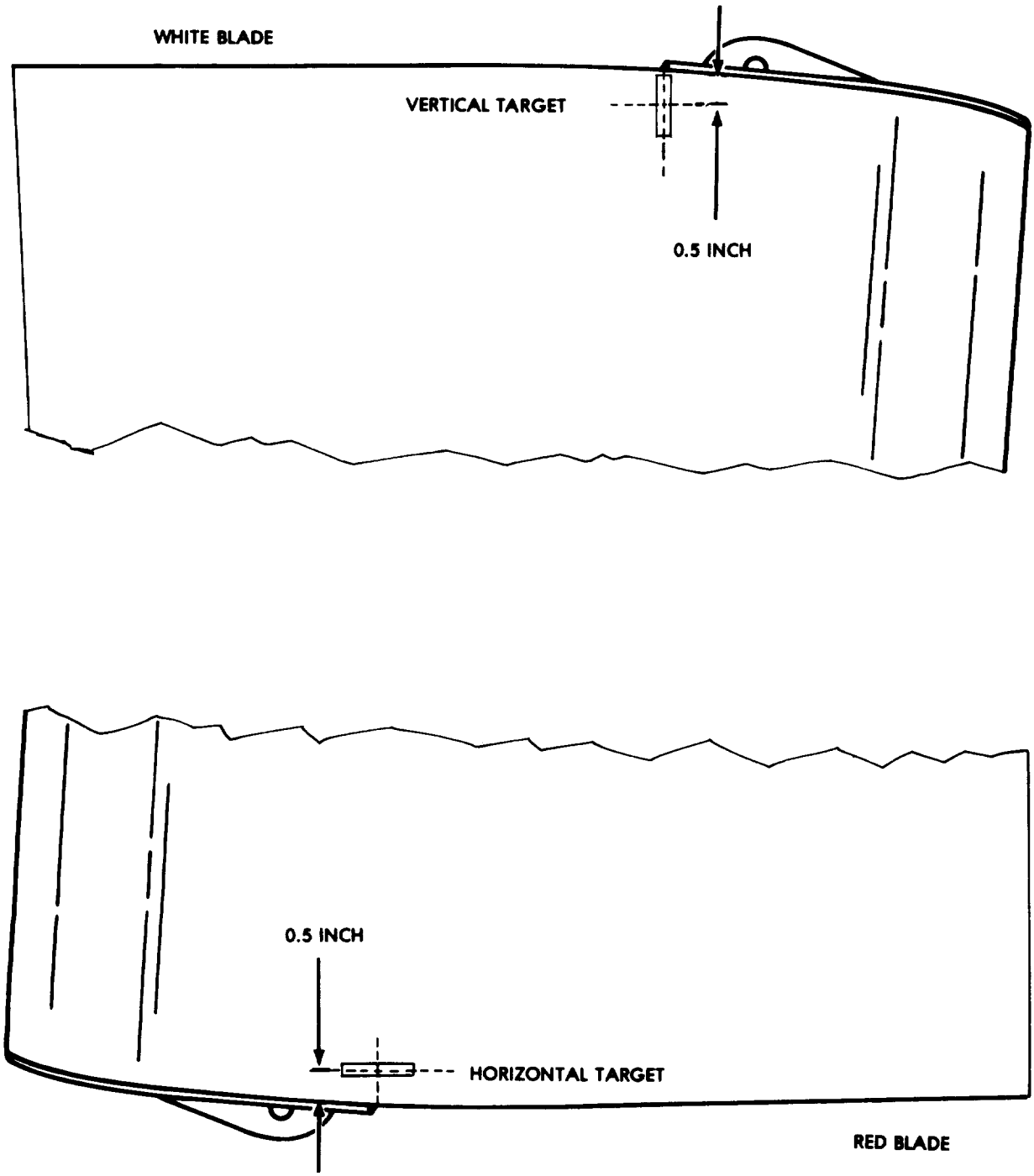


FIGURE 5-77. Attaching Tip Targets No. 4270

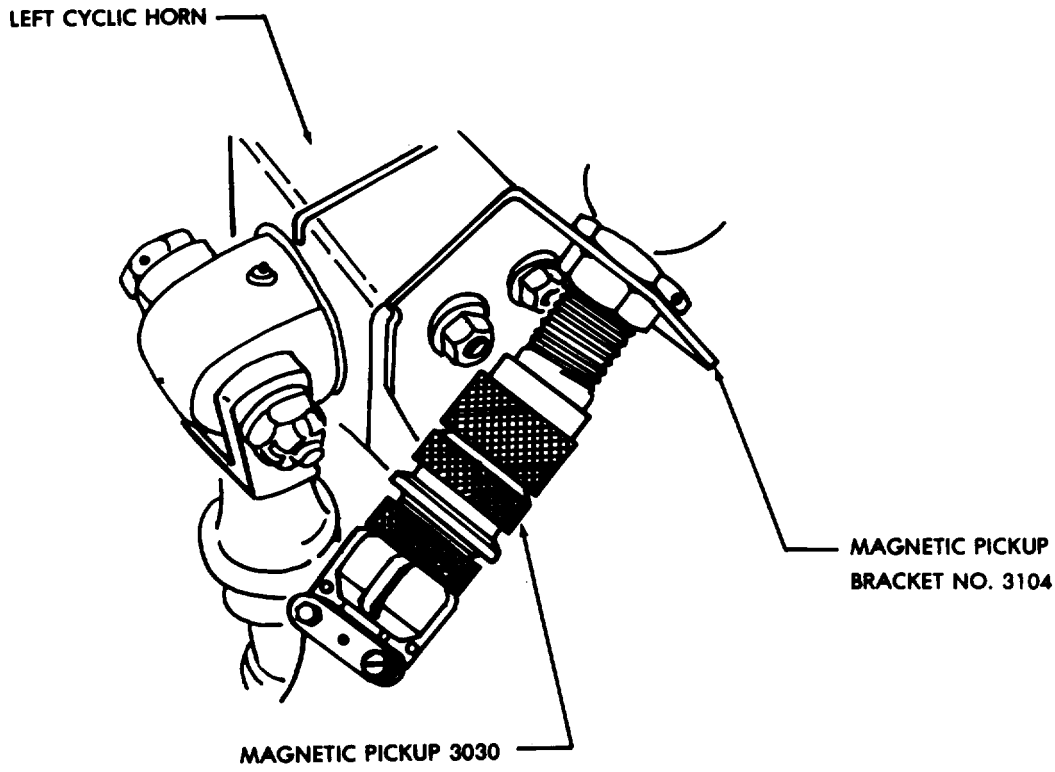


FIGURE 5-78. Magnetic Pickup Installation

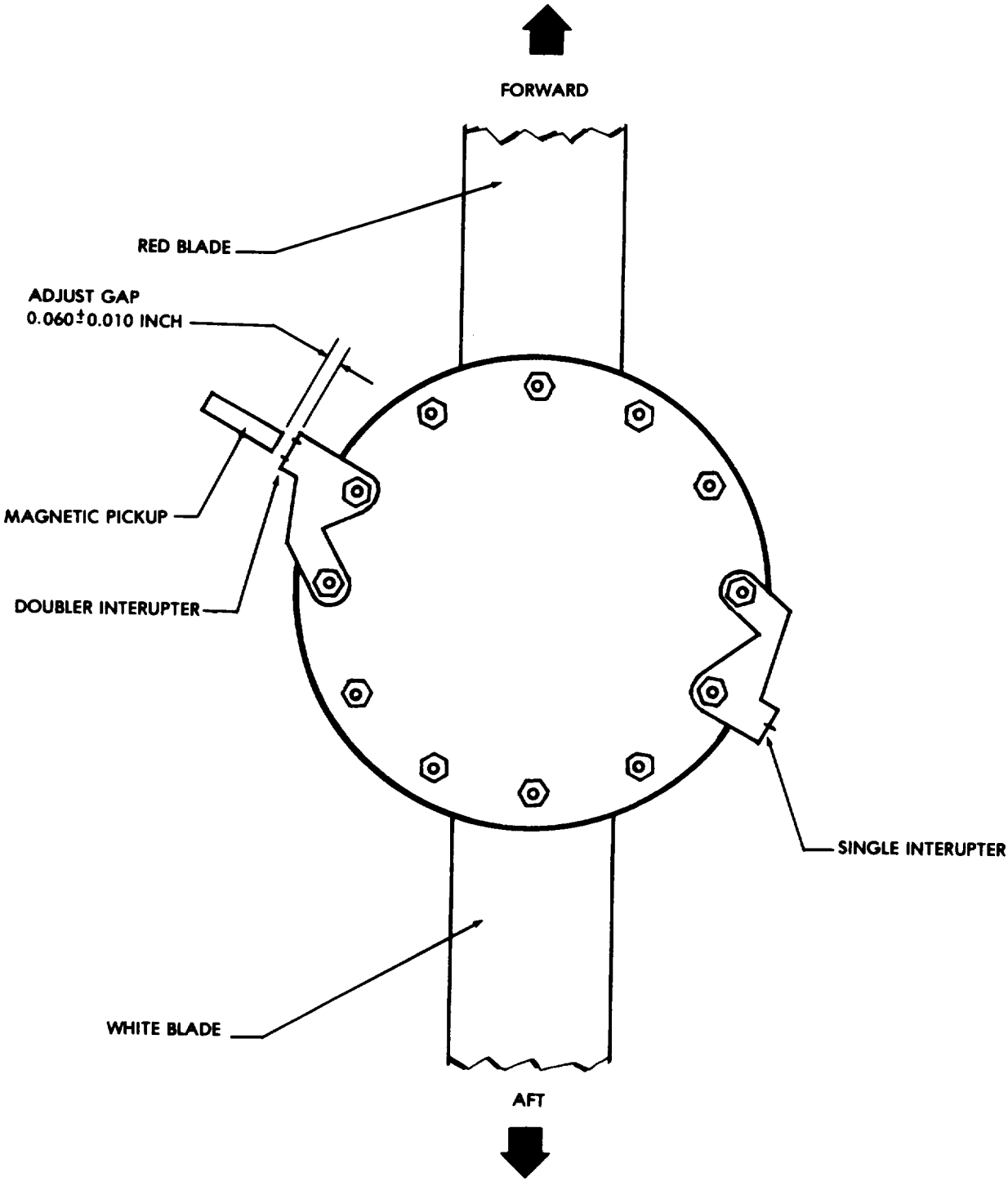


Figure 5-79. Interrupter Installation

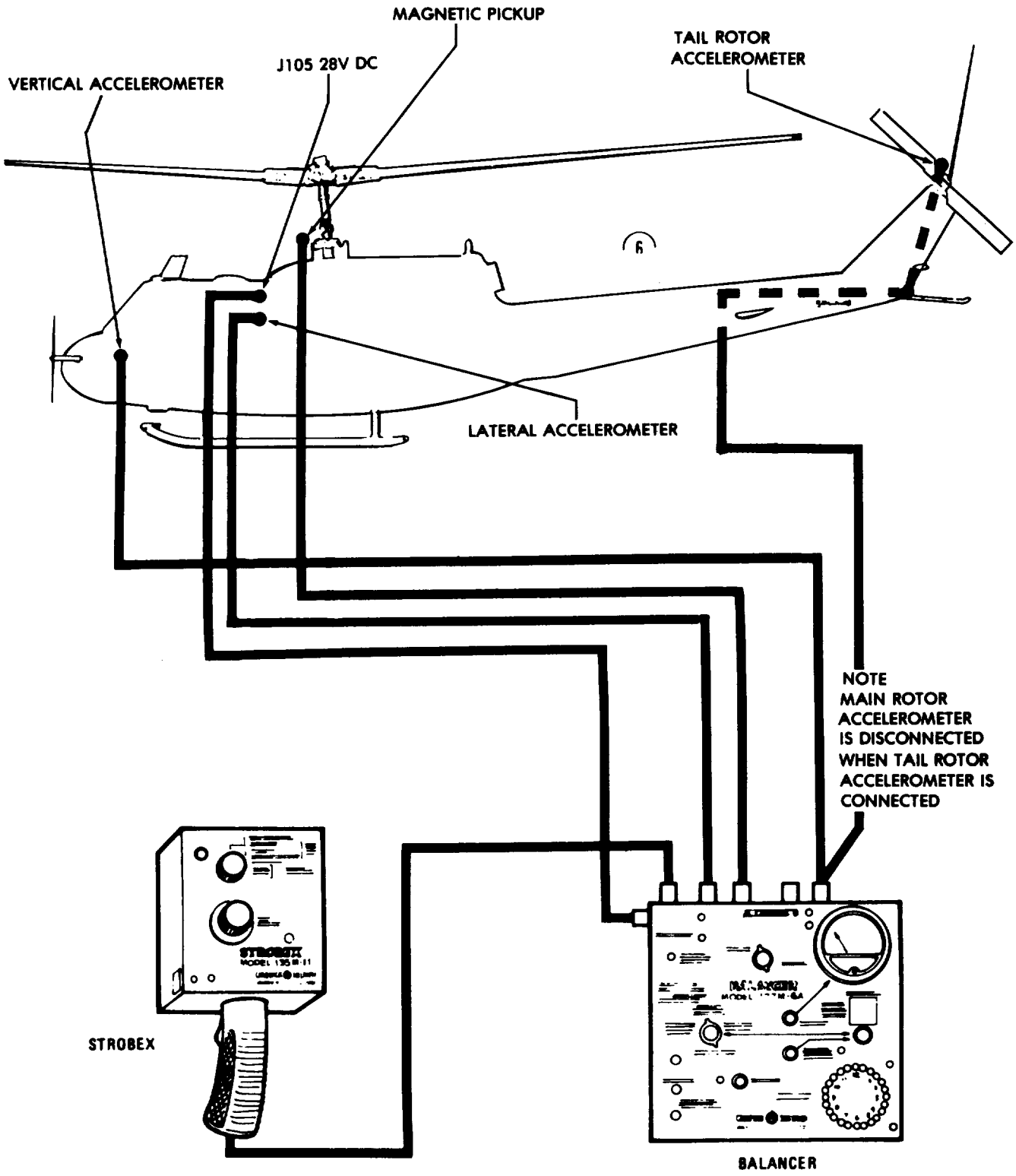


Figure 5-80. Typical VI/BREX to Airframe Interface

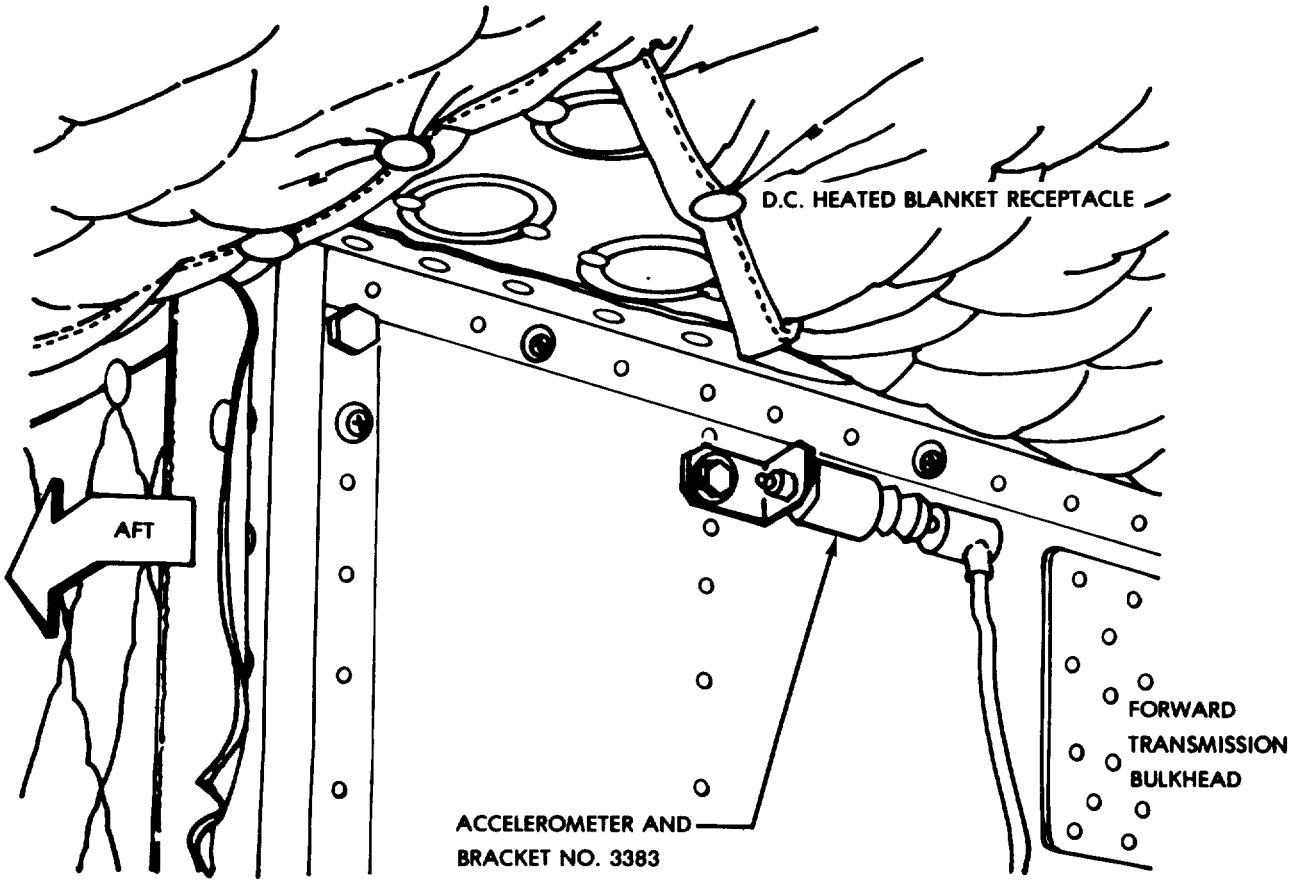


FIGURE 5-81. Lateral Accelerometer

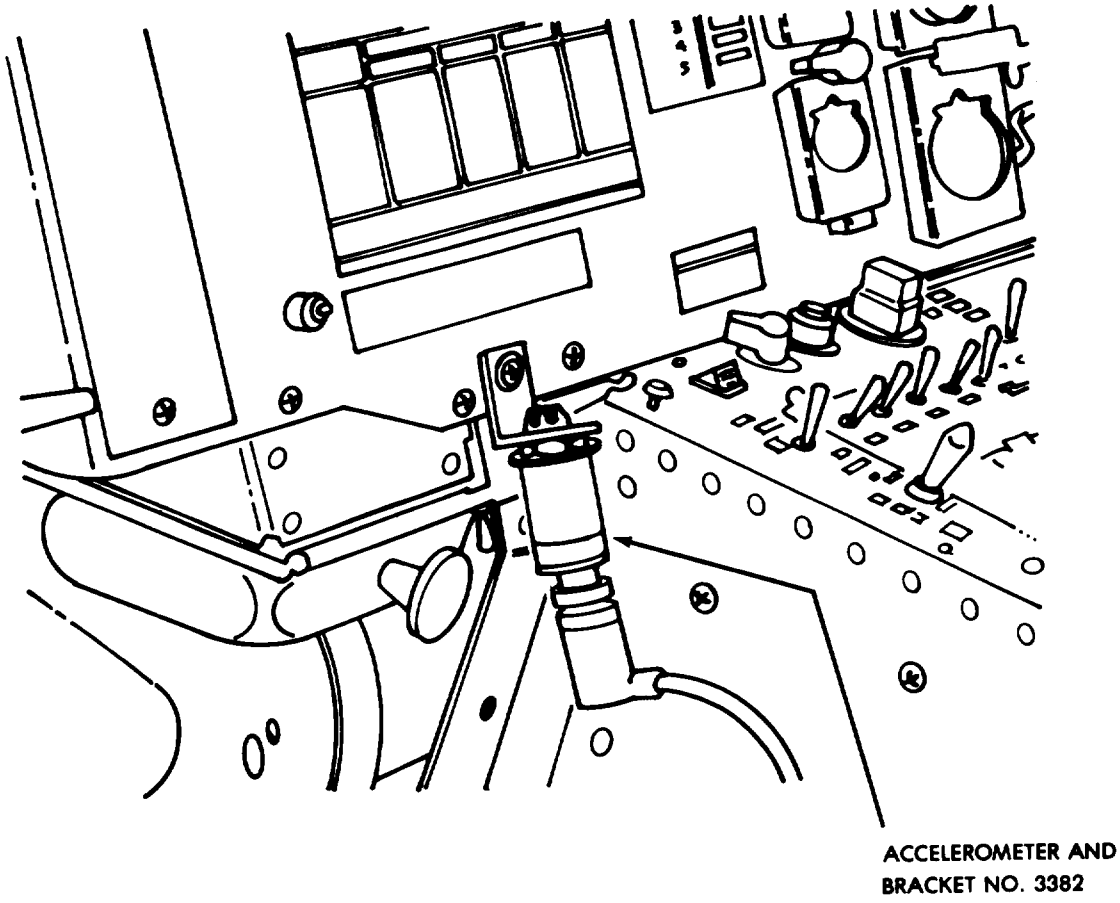


FIGURE 5-82. Vertical Accelerometer

NOTE

TARGET SIZE IS 1/4 X 1 INCH.

MB ONE FLAT ADJUSTMENT OF THE PITCH LINK BARREL WILL CHANGE THE BLADE TRACK APPROXIMATELY 3./8 INCH AT ALL RPMs

CB ONE FLAT ADJUSTMENT OF THE PITCH LINK BARREL WILL CHANGE THE BLADE TRACK APPROXIMATELY 1/2 INCH AT AU RPMs

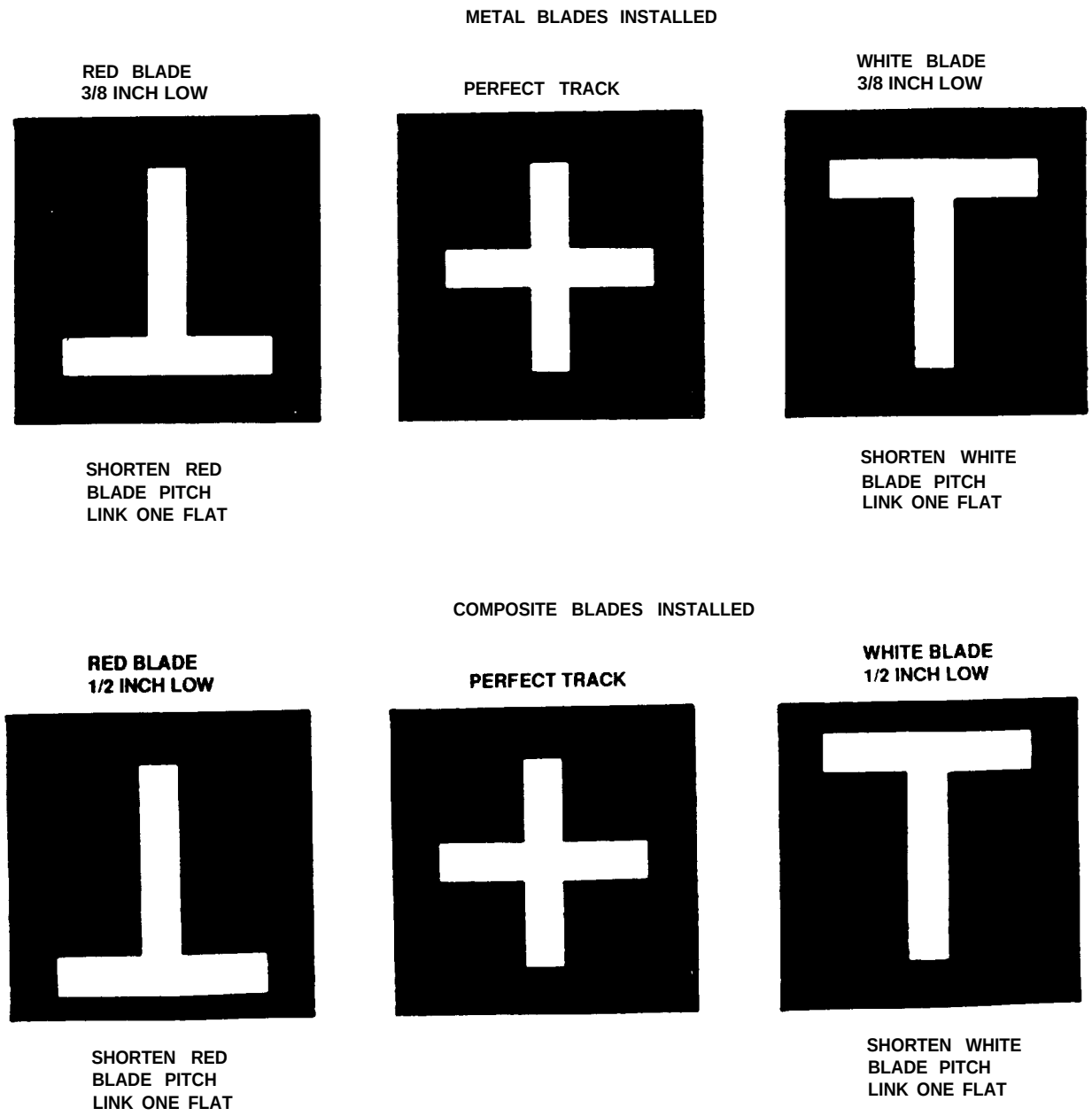


Figure 5-83. Main Rotor Track correction

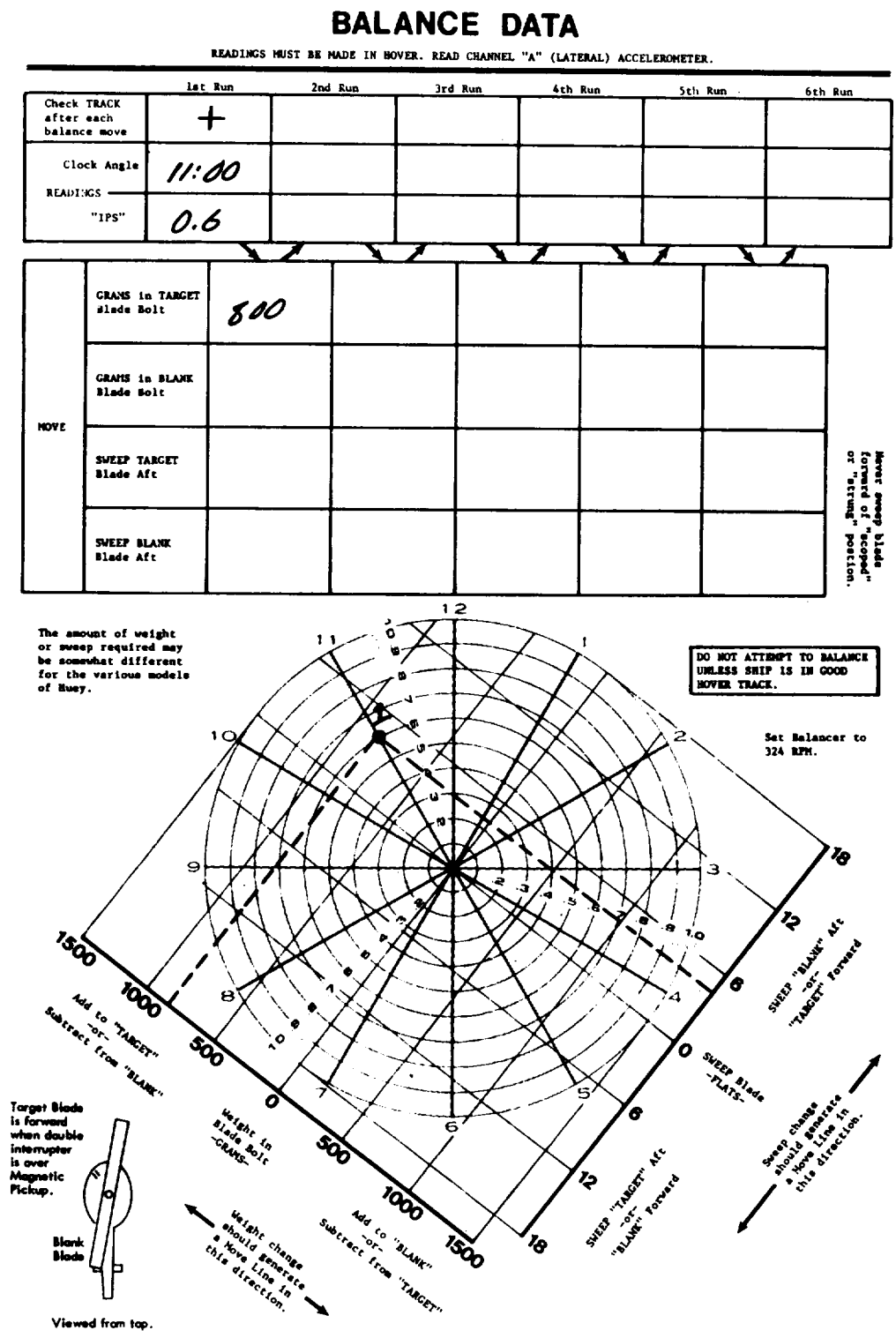


Figure 5-84. Plotting Main Rotor Balance Chart (Sheet 1 of 3)

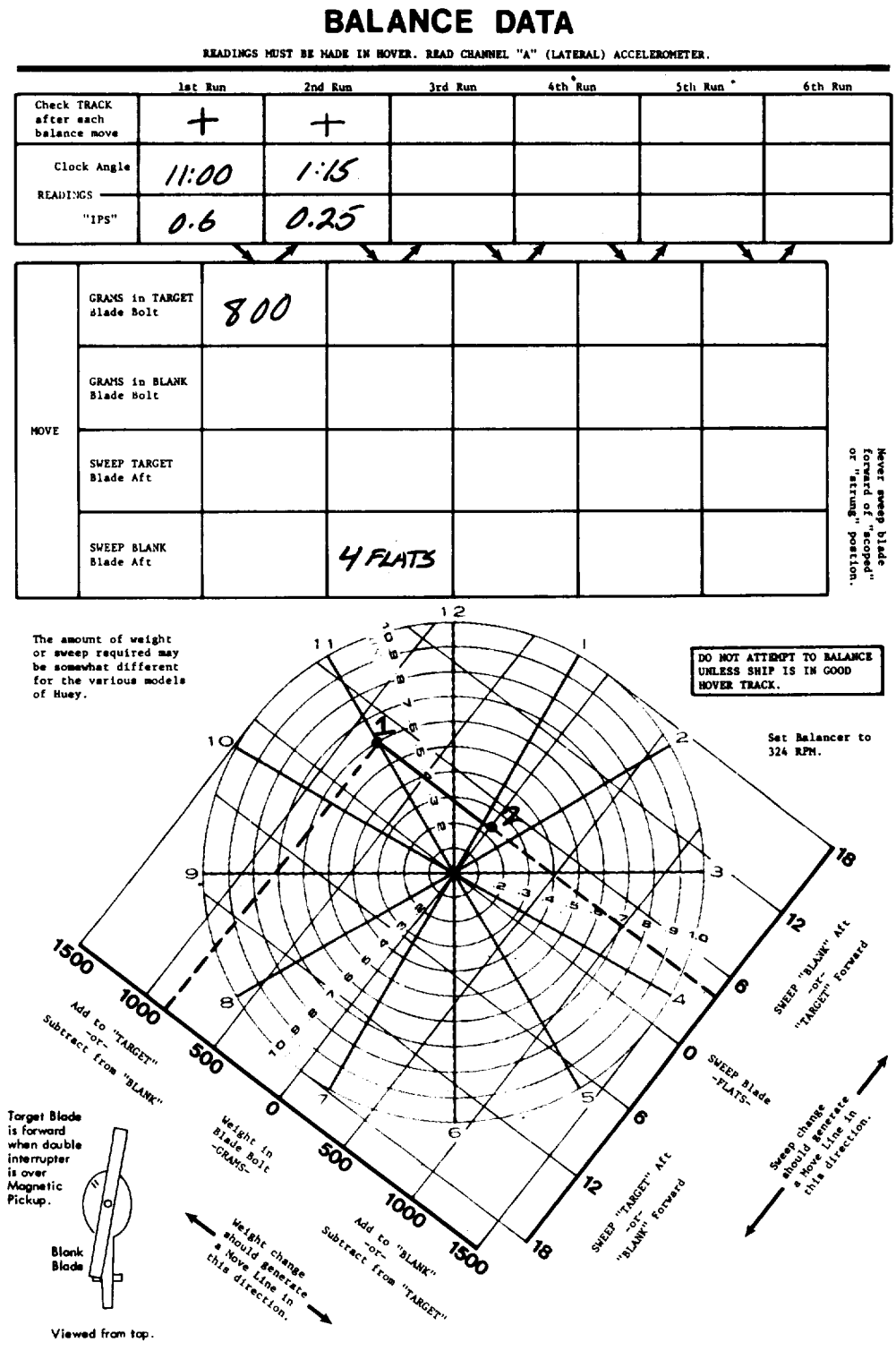


Figure 5-84. Plotting Main Rotor Balance Chart (Sheet 2 of 3)

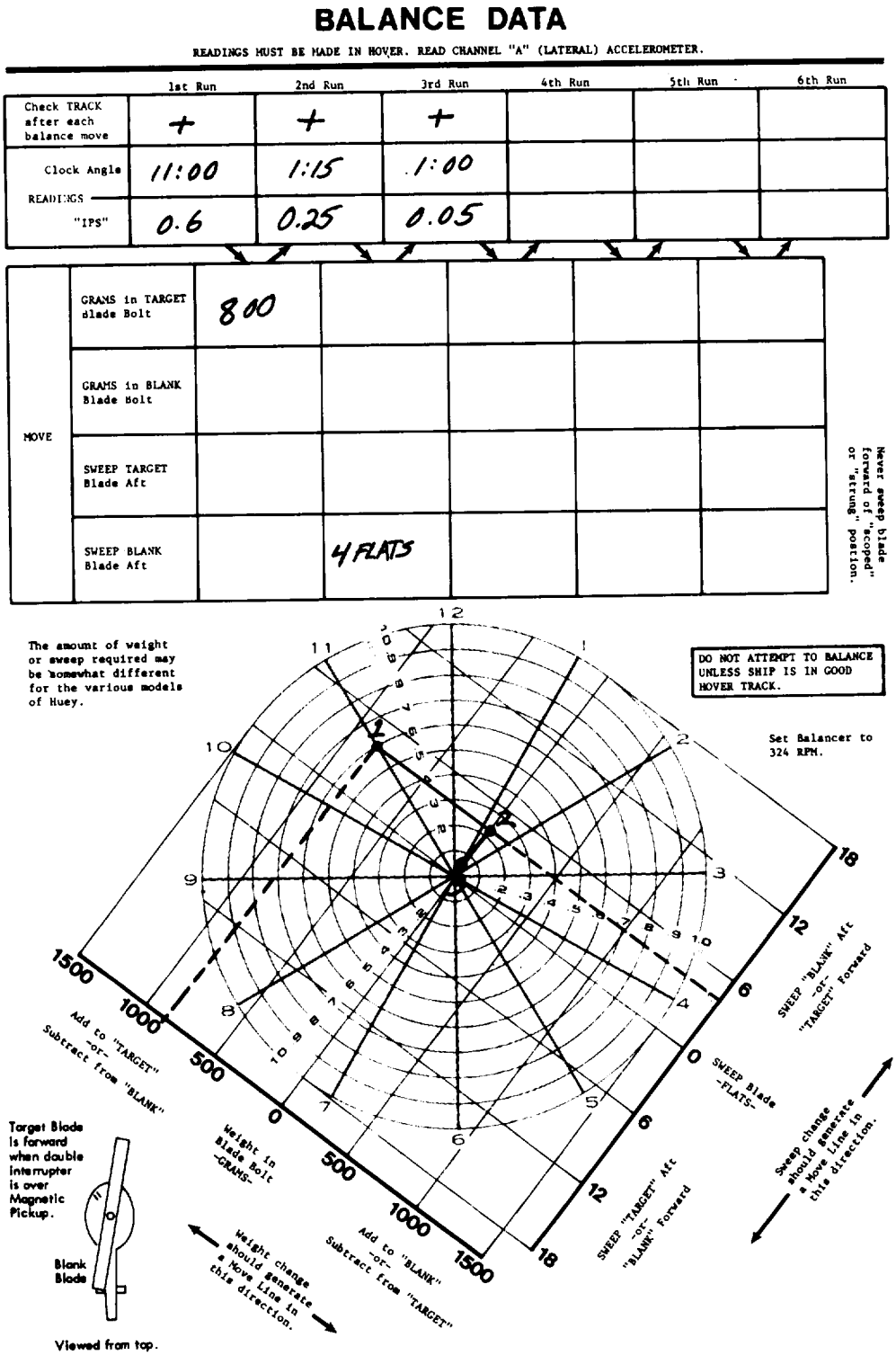


Figure 5-84. Plotting Main Rotor Balance Chart (Sheet 3 of 3)

BALANCE CHART CLOCK ANGLE CORRECTOR, PART #3597

Use this Corrector if "MOVE LINE" is not in the correct direction.

1) Place eyelet "A" over 1st (previous reading of "MOVE LINE".

2) Rotate corrector body so that A-O points in direction "MOVE LINE" should have gone.

3) Holding corrector body firmly, rotate index A-B so that it goes thru 2nd (present) reading

4) Read required correction on scale. Change clock by writing new clock numbers around chart.

5) Replot 2nd reading and proceed as usual, using corrected chart.

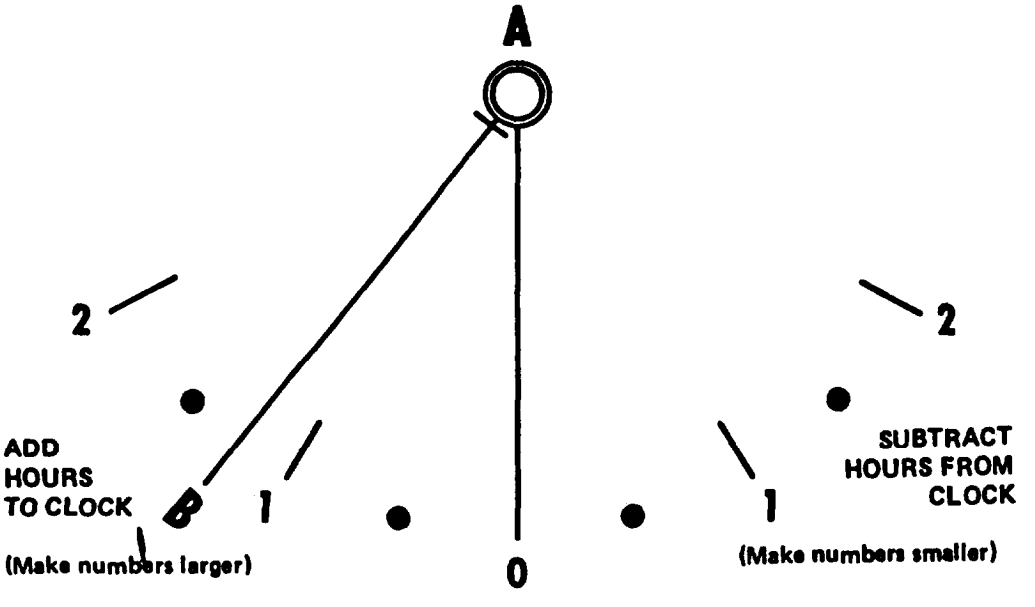


Figure 5-85. Balance Chart Clock Angle Corrector

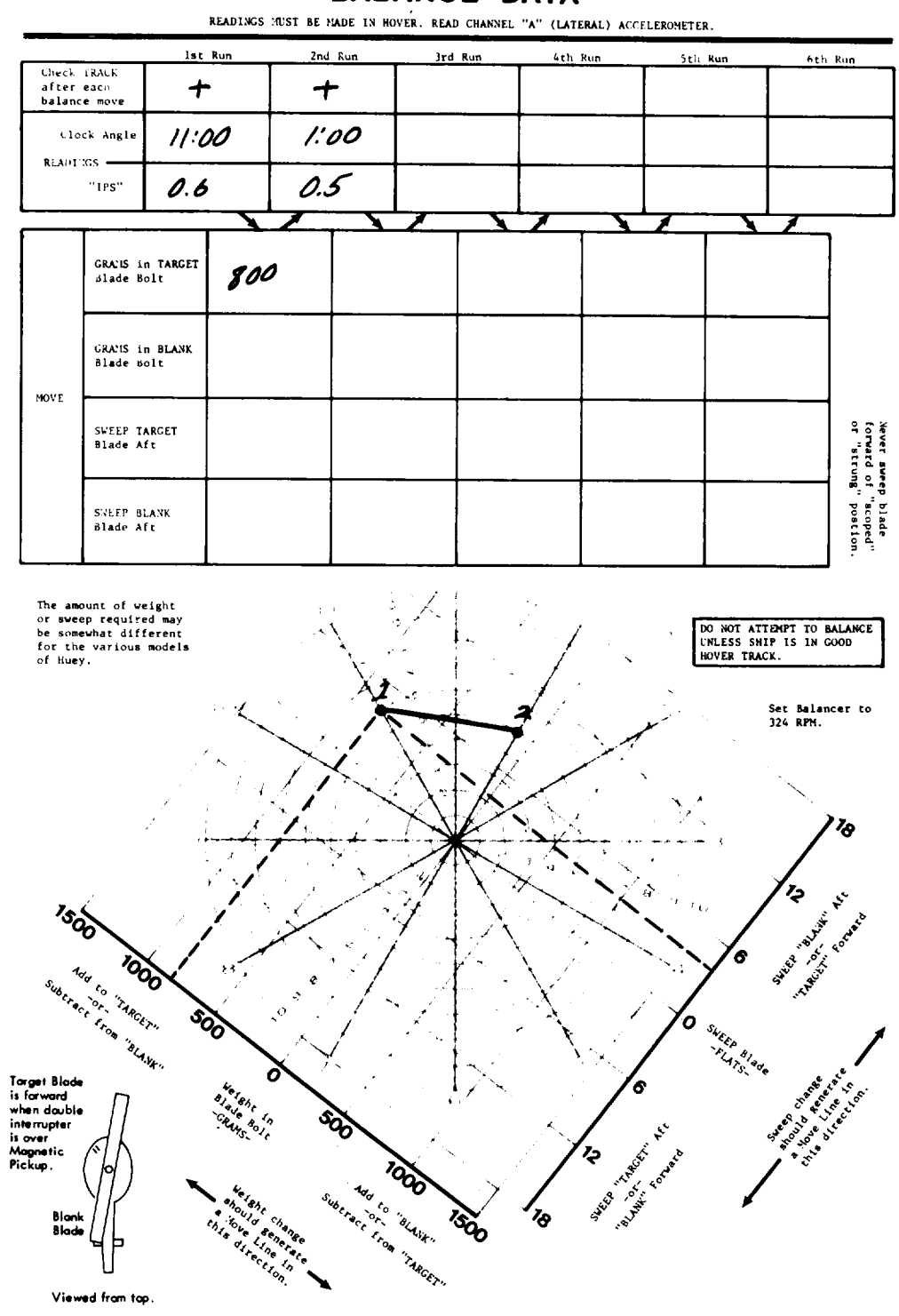


Figure 5-86. Main Rotor Balance Chart Clock Angle Correction (Sheet 1 of 3)

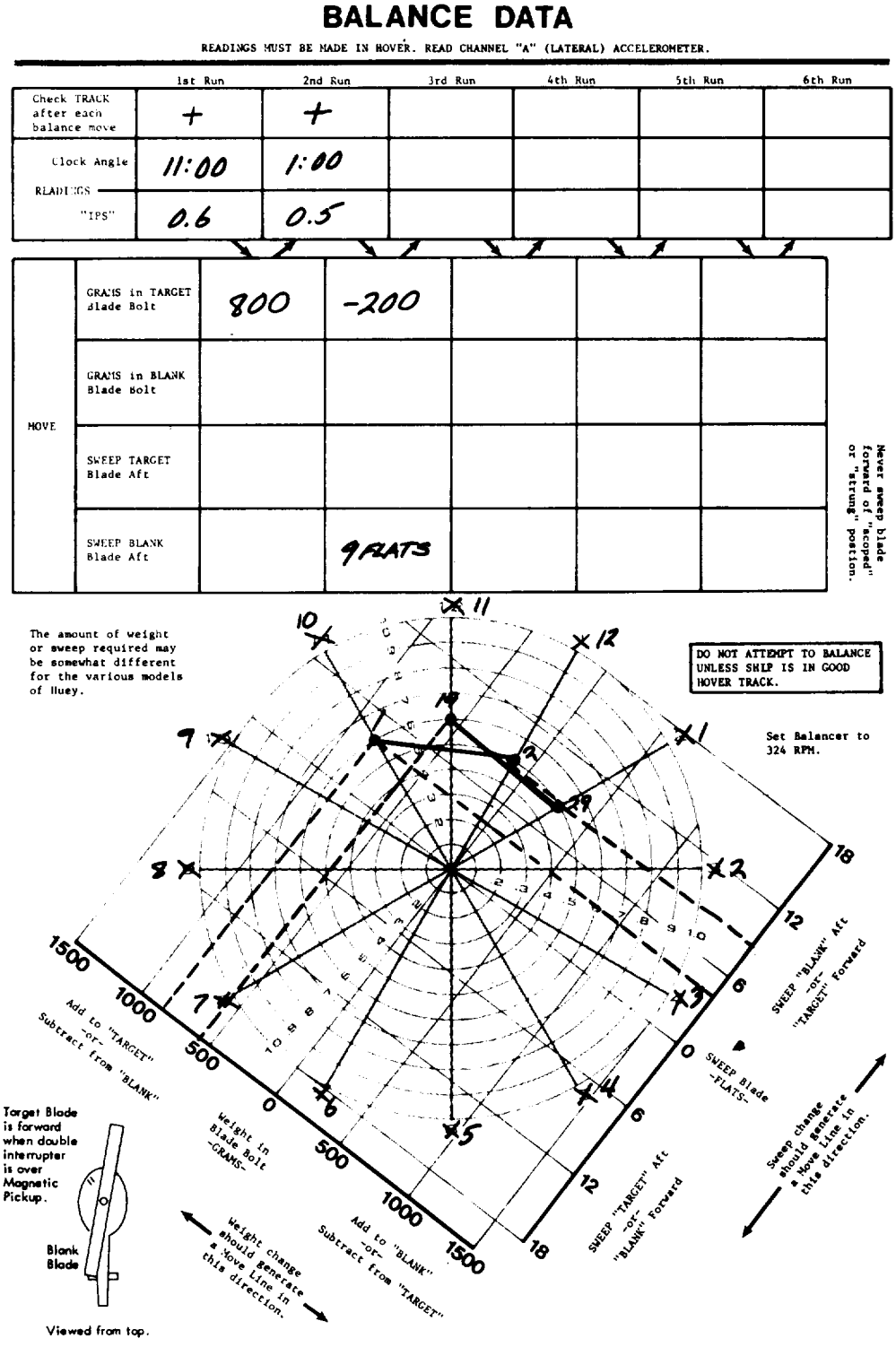


Figure 5-86. Main Rotor Balance Chart Clock Angle Correction (Sheet 2 of 3)

BALANCE DATA

READINGS MUST BE MADE IN HOVER. READ CHANNEL "A" (LATERAL) ACCELEROMETER.

	1st Run	2nd Run	3rd Run	4th Run	5th Run	6th Run
Check TRACK after each balance move	+	+	+			
READINGS — Clock Angle	11:00	1:00	1:00			
READINGS — "IPS"	0.6	0.5	0.05			

MOVE						
	GRAMS in TARGET Blade Bolt	800	-200			
	GRAMS in BLANK Blade Bolt					
	SWEEP TARGET Blade Aft					
	SWEEP BLANK Blade Aft		9 FLATS			

Never sweep blade forward of "scoped" or "strung" position.

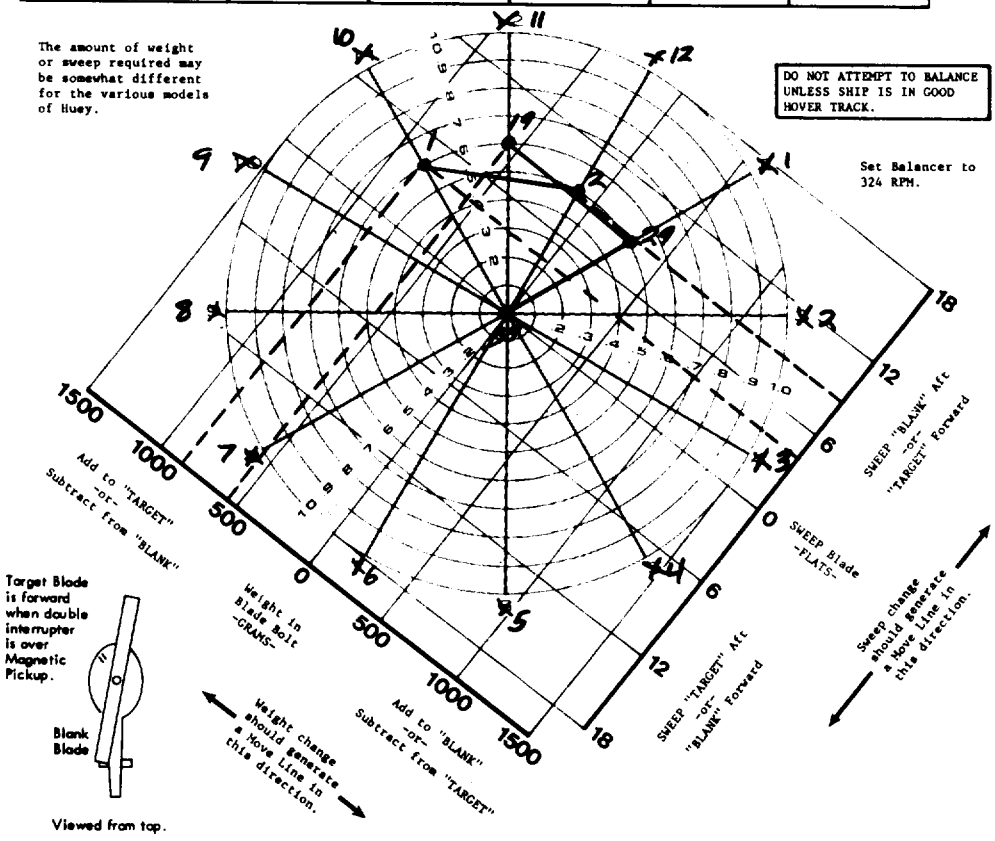


Figure 5-86. Main Rotor Balance Chart Clock Angle Correction (Sheet 3 of 3)

IN-FLIGHT TRACKING DATA

FLIGHT NUMBER		HOVER BALANCE READING (CHANNEL A)	TRACK (CHANNEL B) AT AIRSPEED			CHANGE BEFORE NEXT FLIGHT
			60	90	110	
1	TRACK	+	⊥	⊥	⊥	
	CLOCK ANGLE	1:00	1:00	1:00	1:00	
	"IPS"	0.05	0.1	0.4	0.6	
2	TRACK					
	CLOCK ANGLE					
	"IPS"					
3	TRACK					
	CLOCK ANGLE					
	"IPS"					
4	TRACK					
	CLOCK ANGLE					
	"IPS"					
5	TRACK					
	CLOCK ANGLE					
	"IPS"					
6	TRACK					
	CLOCK ANGLE					
	"IPS"					

Figure 5-87. Example, In-flight Tracking Chart (Sheet 1 of 3)

INSTRUCTIONS
=IN-FLIGHT TRACK=

1) After balancing, switch Balancer "Function" Switch to "Track" and sketch the track observed with the Strobex at 60, 90 and 110 or 120 knots STRAIGHT and LEVEL. Switch Balancer to "B" (vertical) and take "Clock Angle" and "IPS" readings at the same airspeeds. (DON'T EXCEED A COMFORTABLE AIRSPEED.) Tune Balancer as described in 2) and 3) on previous page. Land ship, plot point on "Tracking Chart" (label it #l), and record changes to tab or pitch link in "Data" Section. Plot 120 knot, or fastest airspeed,

=IMPORTANT=

	60	90	110
Use tab if blade "spread" increases greatly with airspeed	T	T	T
Use pitch link if "spread" is fairly uniform with airspeed	T	T	T

=CAUTION=

Use the minimum possible tab to do the .iob. Excessive tab tends to "wash out" and may deteriorate the ride in some flight regimes.

2) Make the indicated changes and fly again to check result. Repeat as required to reduce vertical one-per-rev to .2 or less.

=NOTE=

With some rotors, you will find that the plotted points, ("Move Line") as track is changed, will not go thru the center, but rather will be tangent to some "IPS" circle. This point of tangency is the best track attainable, for tab and pitch link both generate a "Move Line" in generally the same direction. There is no known control to move perpendicular to this.

This may indicate a mis-match of blades and/or loose control linkages. You must be satisfied with this ride . . . .or change blades, and this can be determined in two or three flights.

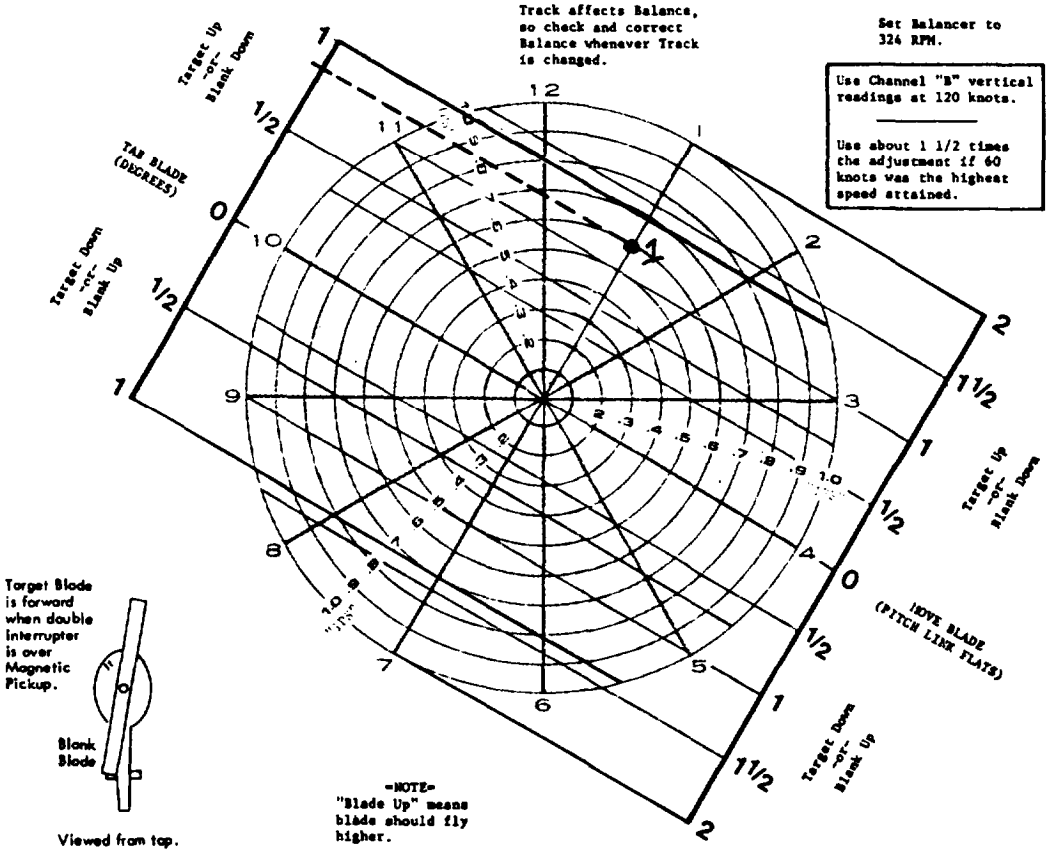


Figure 5-87. Example, in-flight Tracking Chart (Sheet 2 of 3)

IN-FLIGHT TRACKING DATA

FLIGHT NUMBER		HOVER BALANCE READING (CHANNEL A)	TRACK (CHANNEL B) AT AIRSPEED 60	90	110	CHANGE BEFORE NEXT FLIGHT
1	TRACK	+	+	⊥	⊥	BEND TAB UP 7/8 DEGREE ON TARGET BLADE
	CLOCK ANGLE	1:00	1:00	1:00	1:00	
	"IPS"	0.05	0.1	0.4	0.6	
2	TRACK	+	+	+	+	NONE
	CLOCK ANGLE	1:00	1:00	1:00	1:00	
	"IPS"	0.05	0.05	0.05	0.05	
	[illegible]					

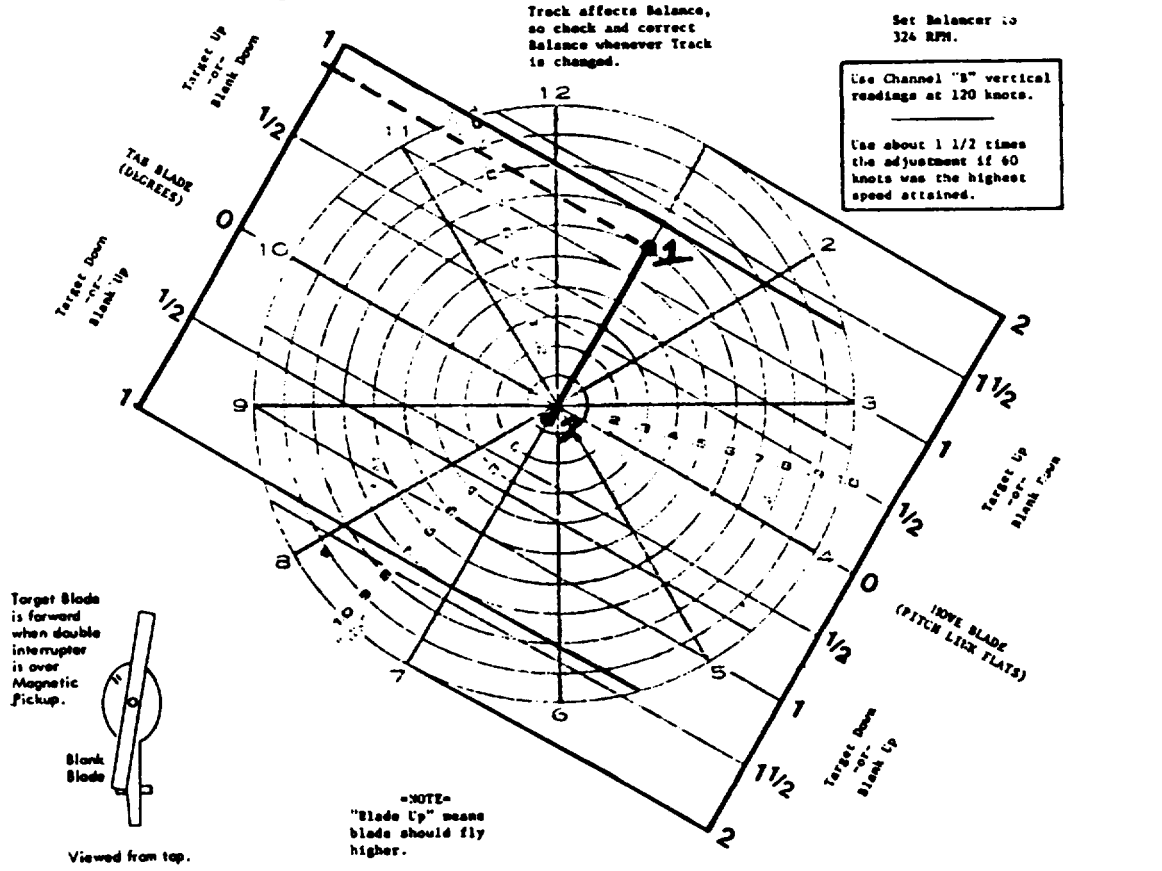
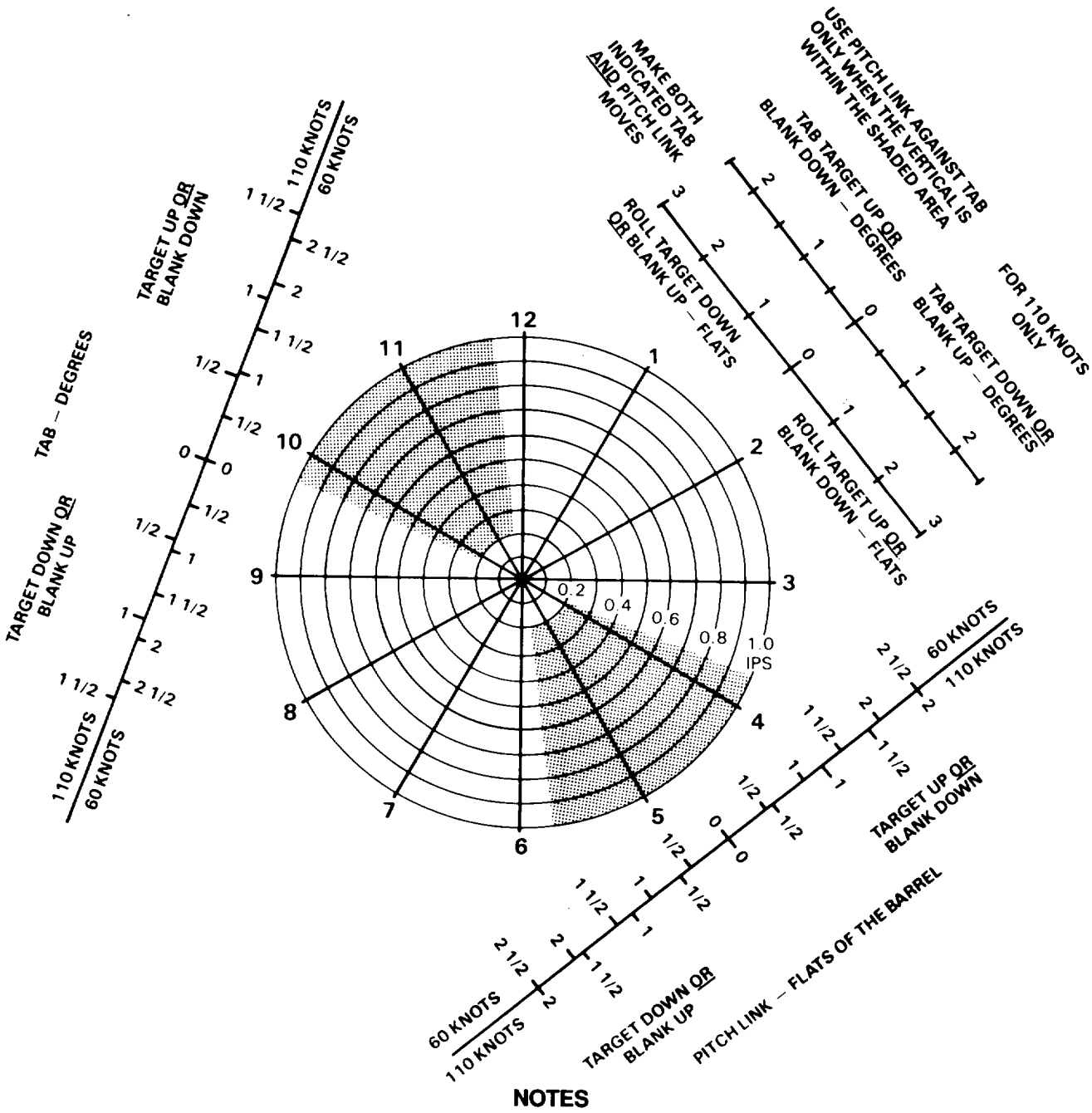


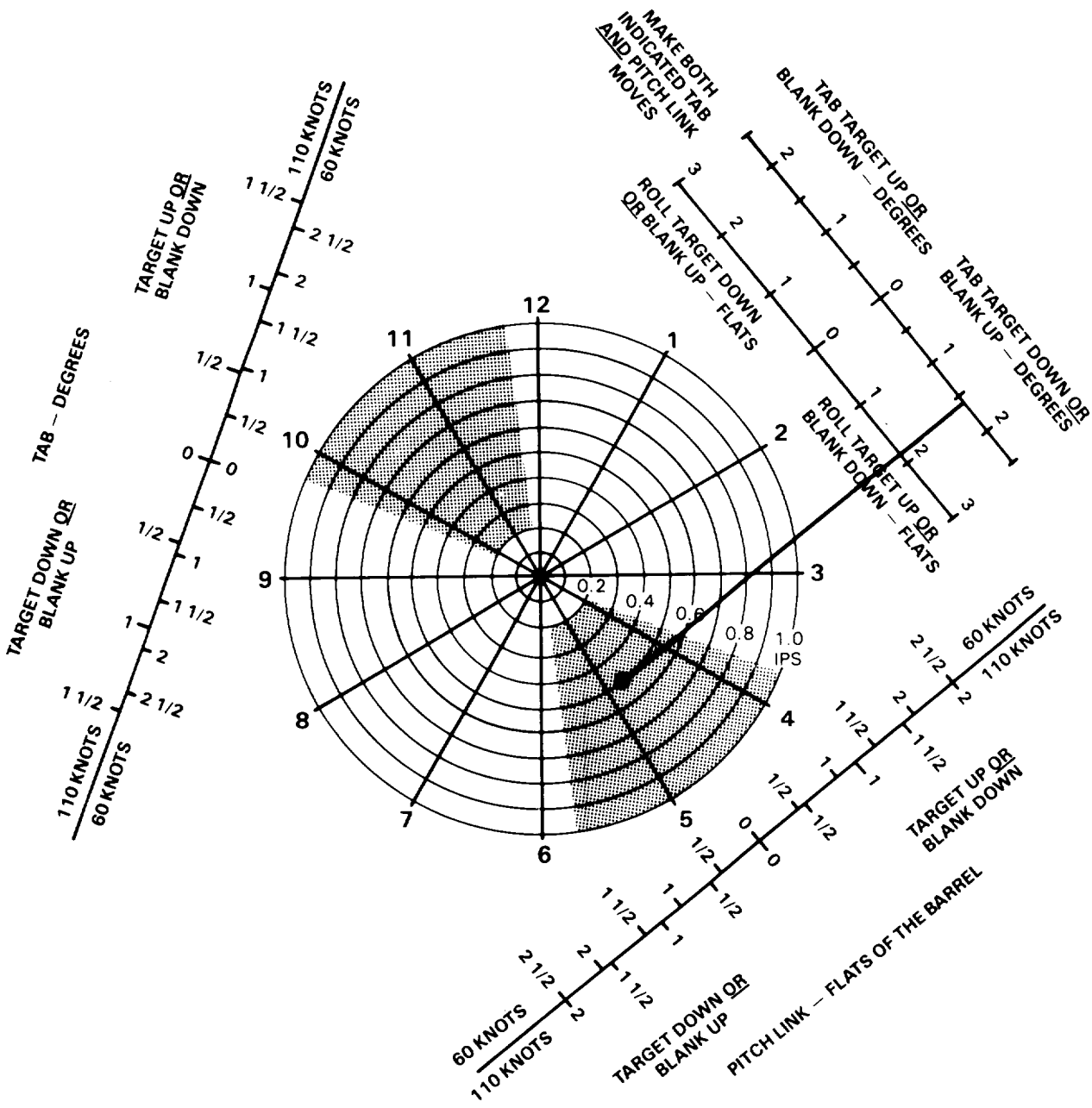
Figure 5-87. Example, In-flight Tracking Chart (Sheet 3 of 3)



NOTES

1. TARGET BLADE IS OVER THE NOSE WHEN THE DOUBLER INTERRUPTER IS OVER THE MAGNETIC PICKUP.
2. CHART HAS SENSITIVITIES FOR BOTH 60 AND 110 KNOTS.
3. ALL VERTICAL DATA IS OBTAINED AT 6400 ENGINE RPM.
4. TUNE VIBREX TO 314 RPM.
5. SHORTENING PC LINK CAUSES BLADE TO CLIMB (ONE FLAT EQUALS 1/2 INCH CHANGE IN TRACK).
6. BENDING TRIM TAB DOWN CORRECTS A CLIMBING BLADE (ONE DEGREE TAB CHANGE EQUALS 1/4 INCH CHANGE IN TRACK).

Figure 5-87.1. CB Vibrex Chart for Vertical 1/Rev on the UH-1 H



NOTES

1. TARGET BLADE IS OVER THE NOSE WHEN THE DOUBLER INTERRUPTER IS OVER THE MAGNETIC PICKUP.
2. CHART HAS SENSITIVITIES FOR BOTH 60 AND 110 KNOTS.
3. ALL VERTICAL DATA IS OBTAINED AT 6400 ENGINE RPM.
4. TUNE VIBREX TO 314 RPM.

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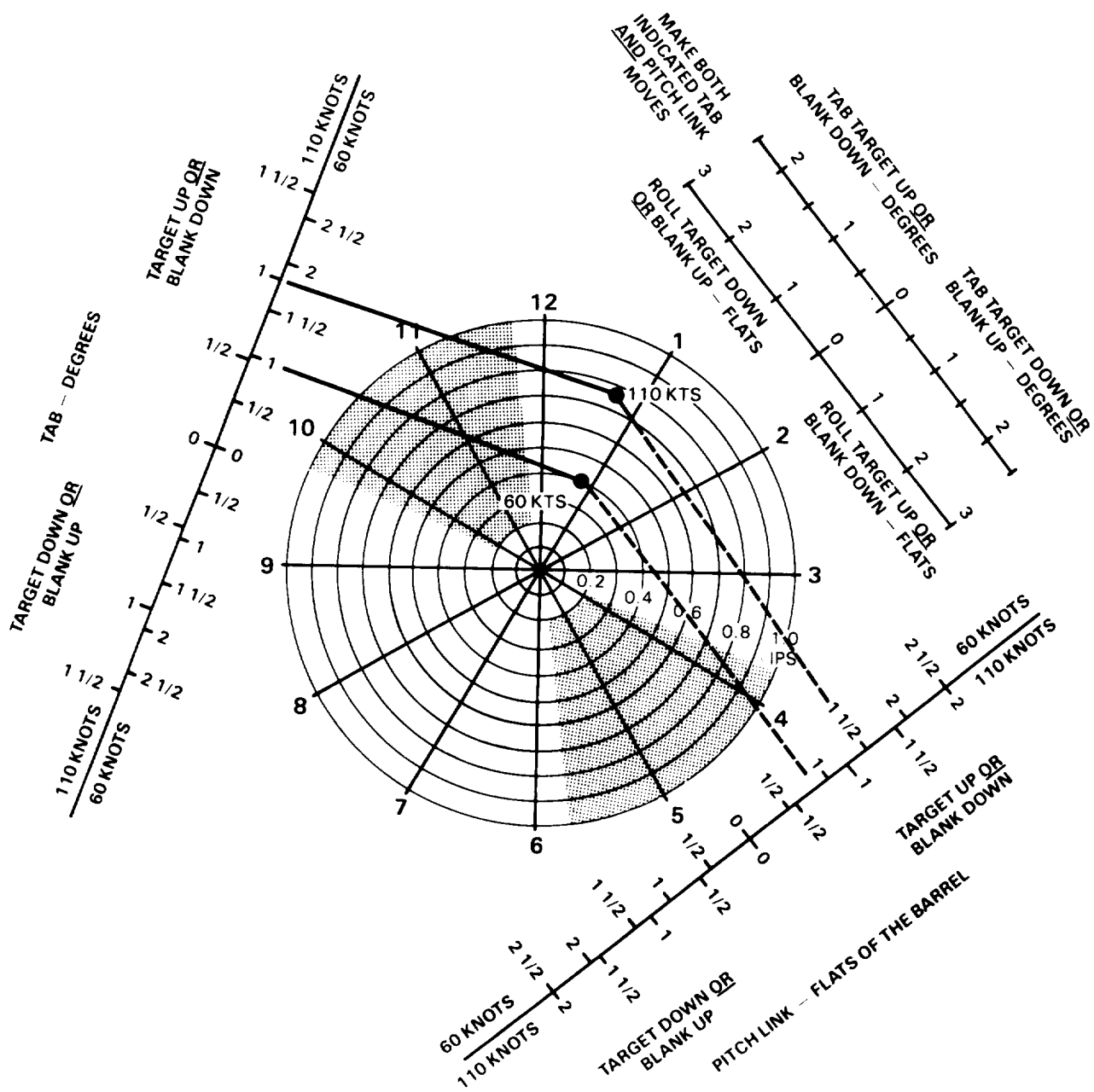
Figure 5-87.2. CB Example of When to Use Pitch Link Versus Tab



NOTES

1. TARGET BLADE IS OVER THE NOSE WHEN THE DOUBLER INTERRUPTER IS OVER THE MAGNETIC PICKUP.
2. CHART HAS SENSITIVITIES FOR BOTH 60 AND 110 KNOTS.
3. ALL VERTICAL DATA IS OBTAINED AT 6400 ENGINE RPM.
4. TUNE VIBREX TO 314 RPM.

205015-2023

Figure 5-87.3. Example of When to Use Tab Alone

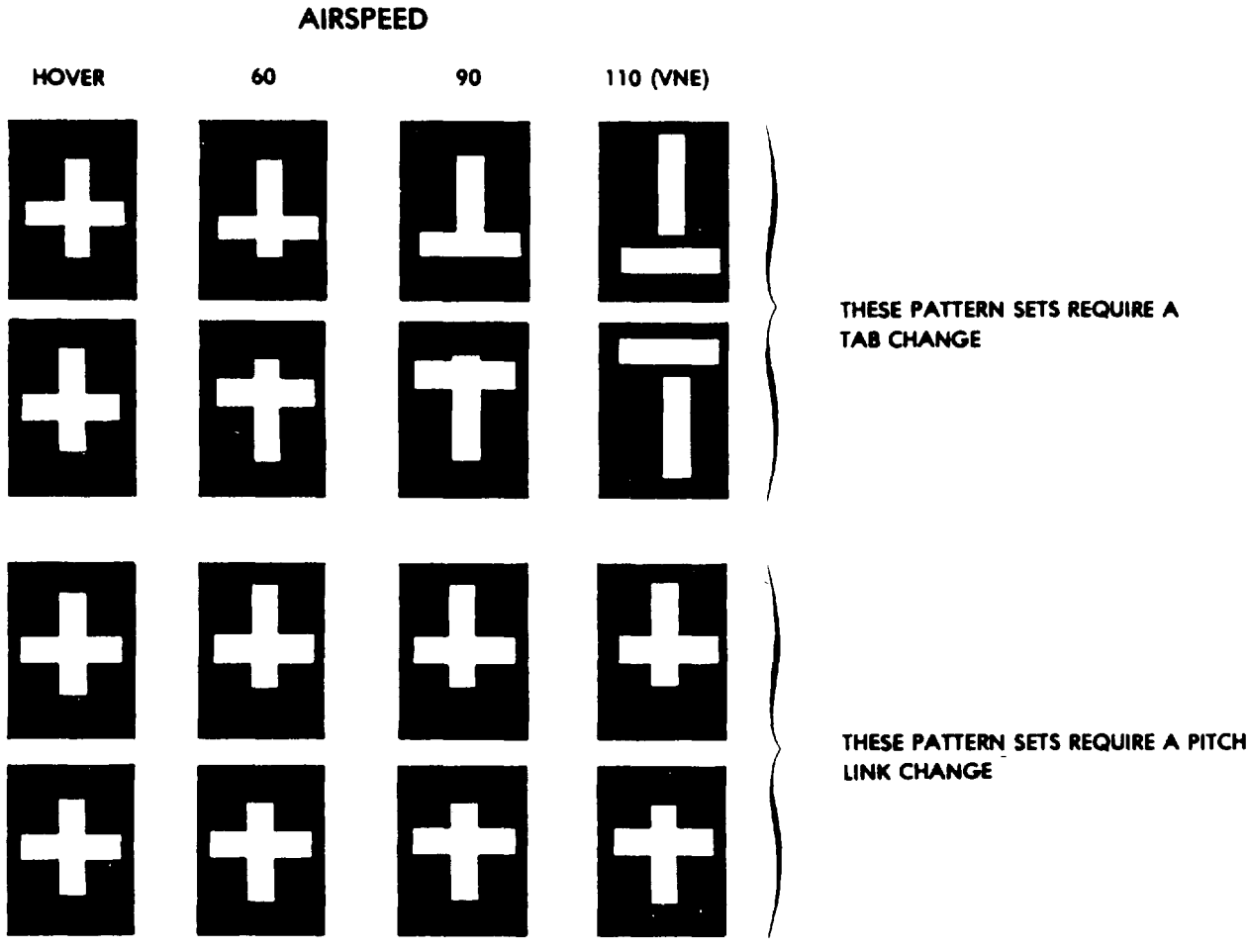


Figure 5-88. Interpreting In-flight Tracking Patterns

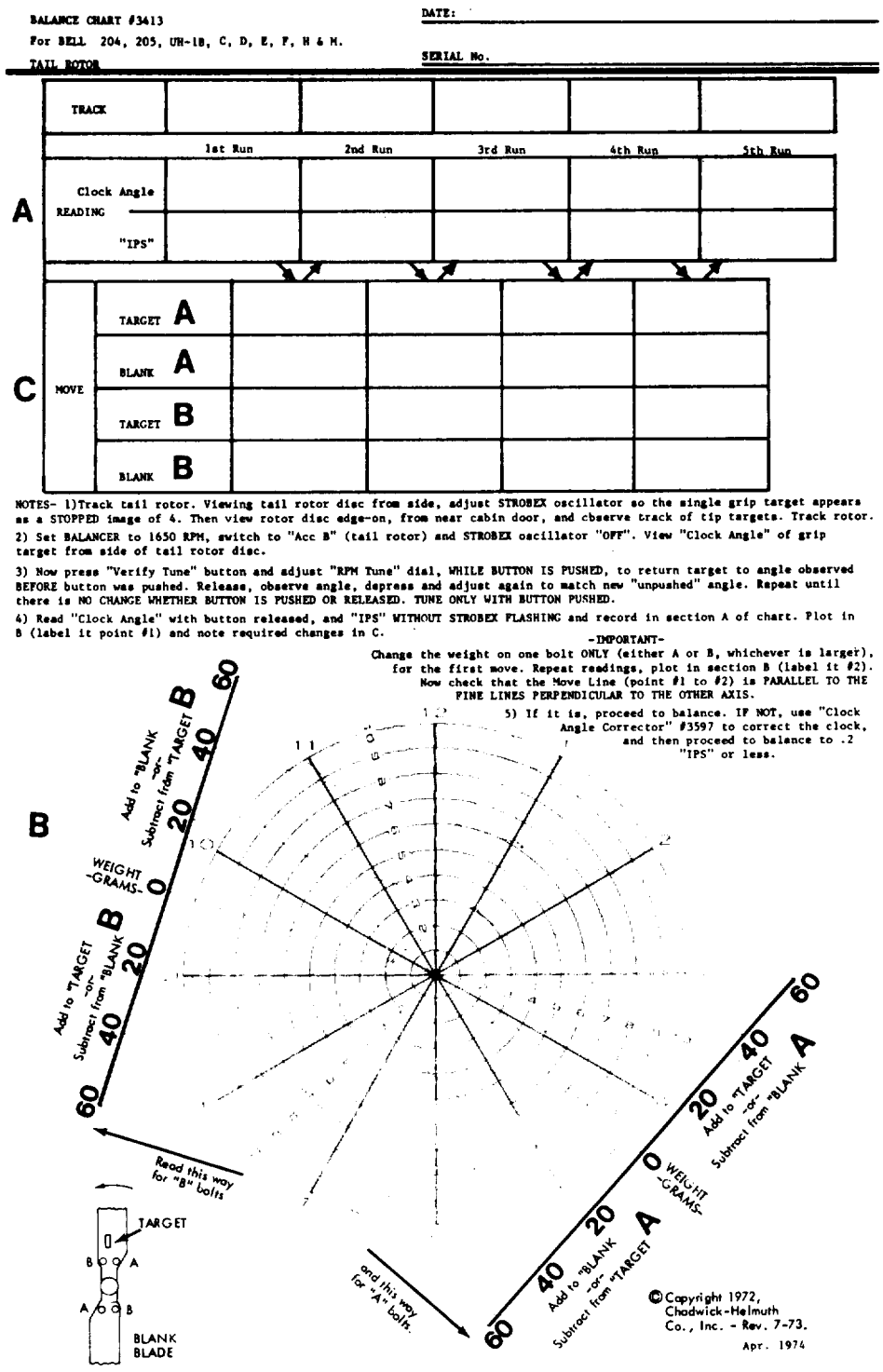


Figure 5-89. Balance Chart No. 3413 – For Tail Rotors Without Balance Arms

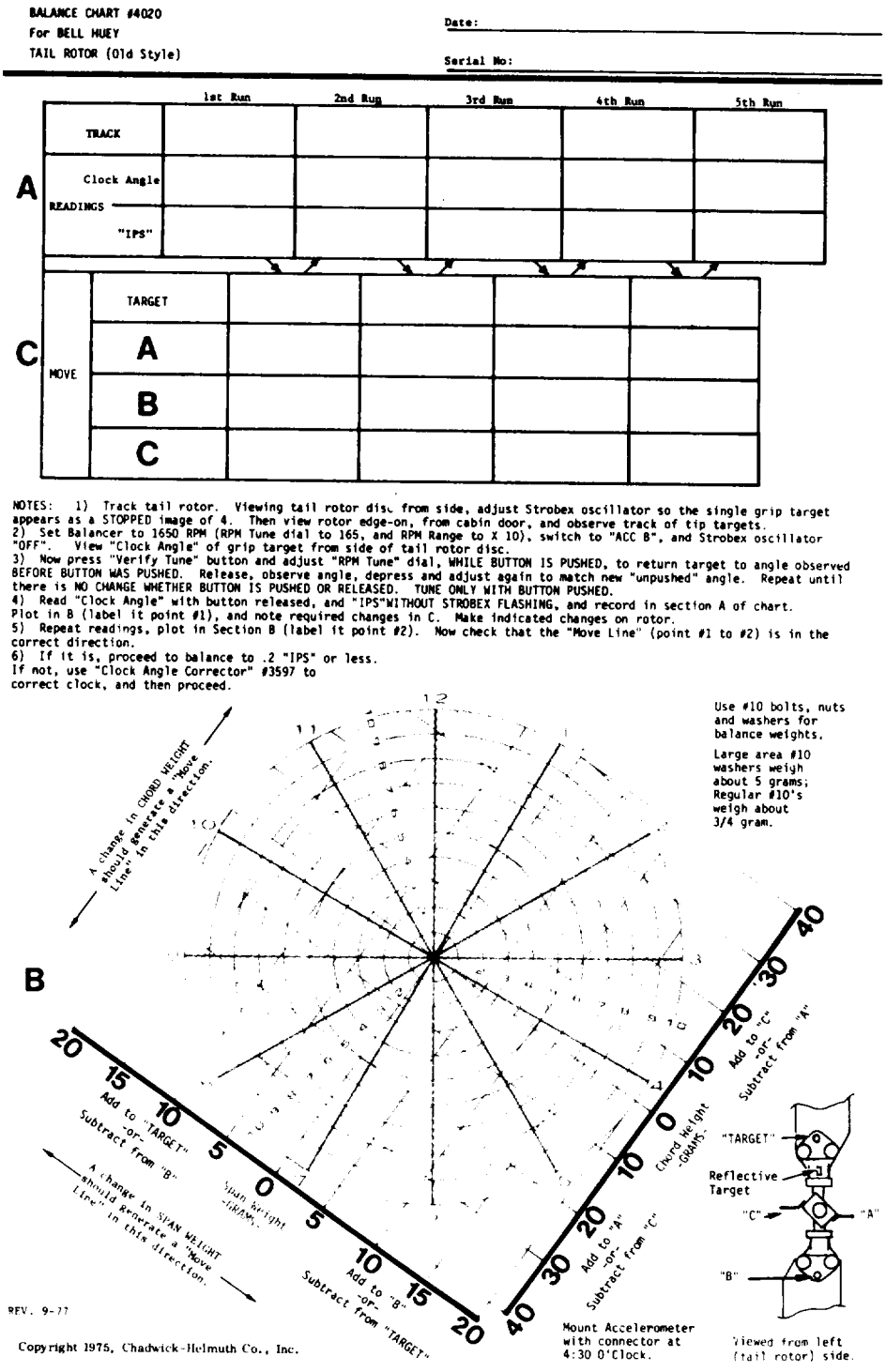


Figure 5-90. Balance Chart No. 4020-For Tail Rotors With Balance Arms No. 4016 Installed.

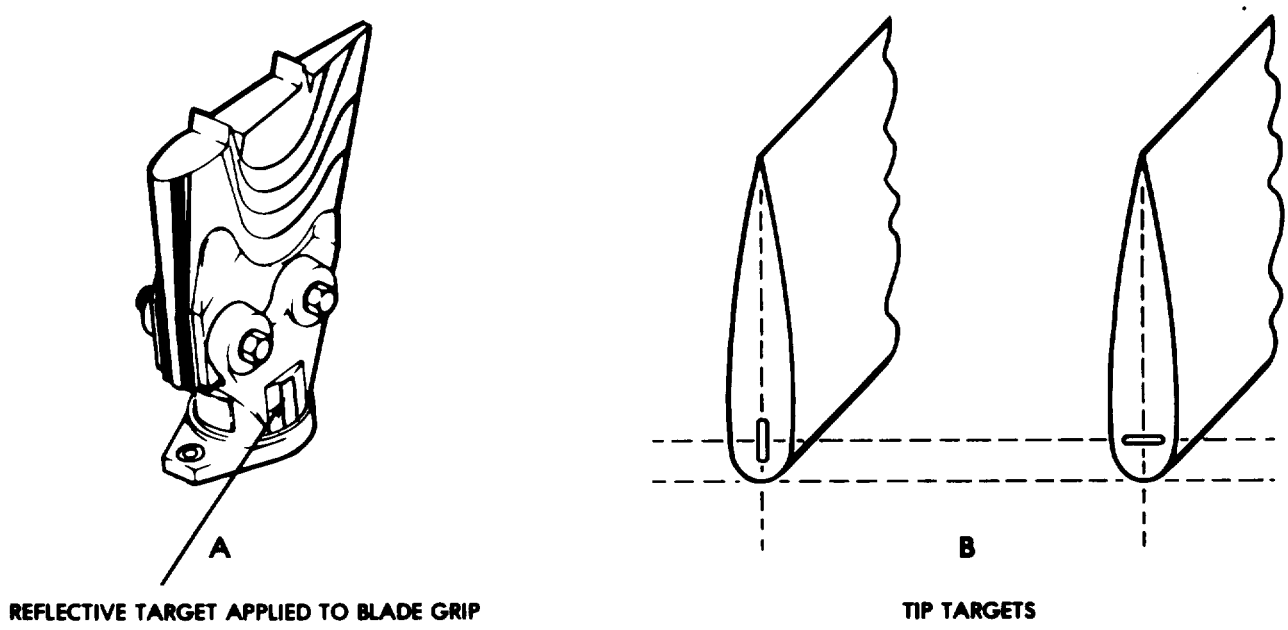


Figure 5-91. Tall Rotor Target Attachment

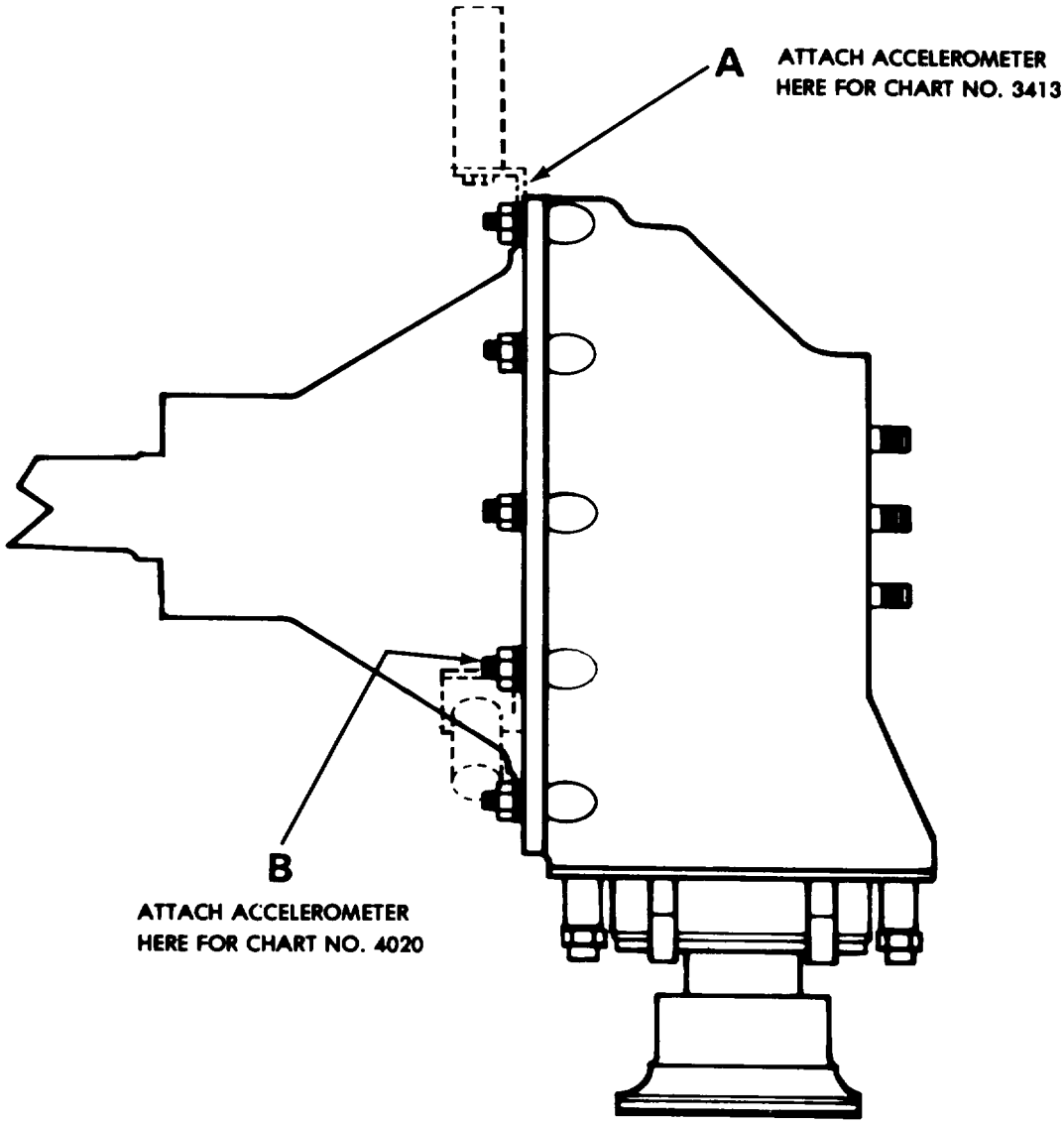


Figure 5-92. Accelerometer Installation

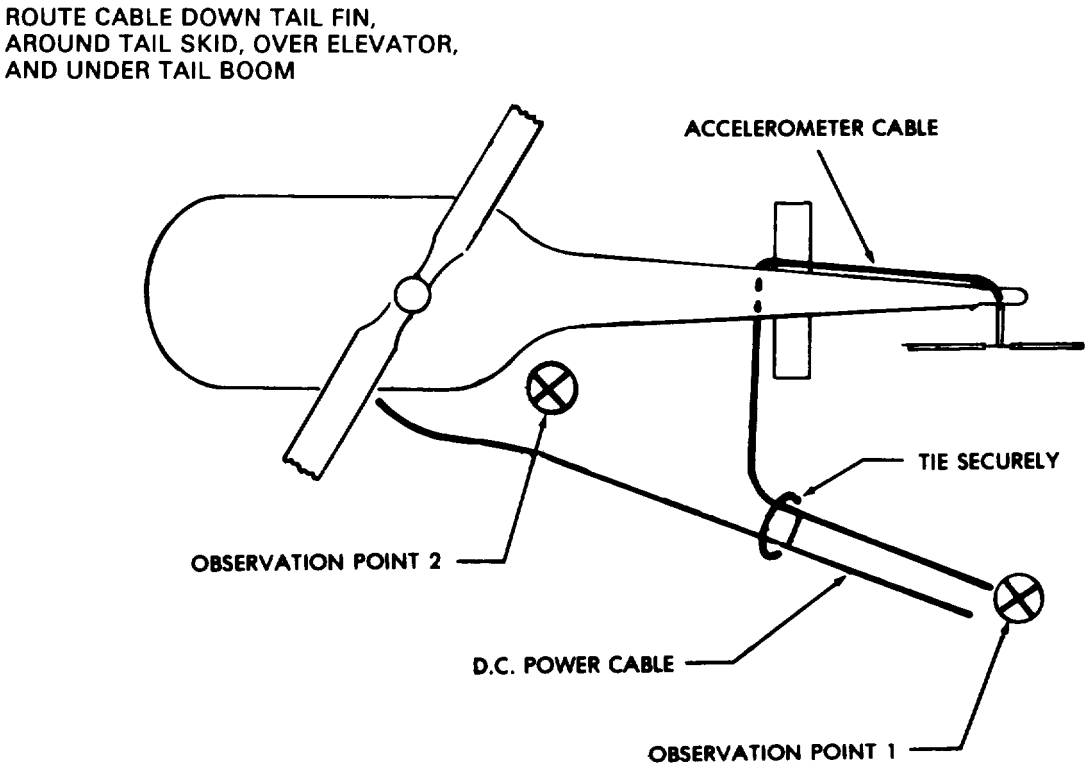


FIGURE 5-93. Tail Rotor Cable Routing and Observation Points

CHAPTER 6

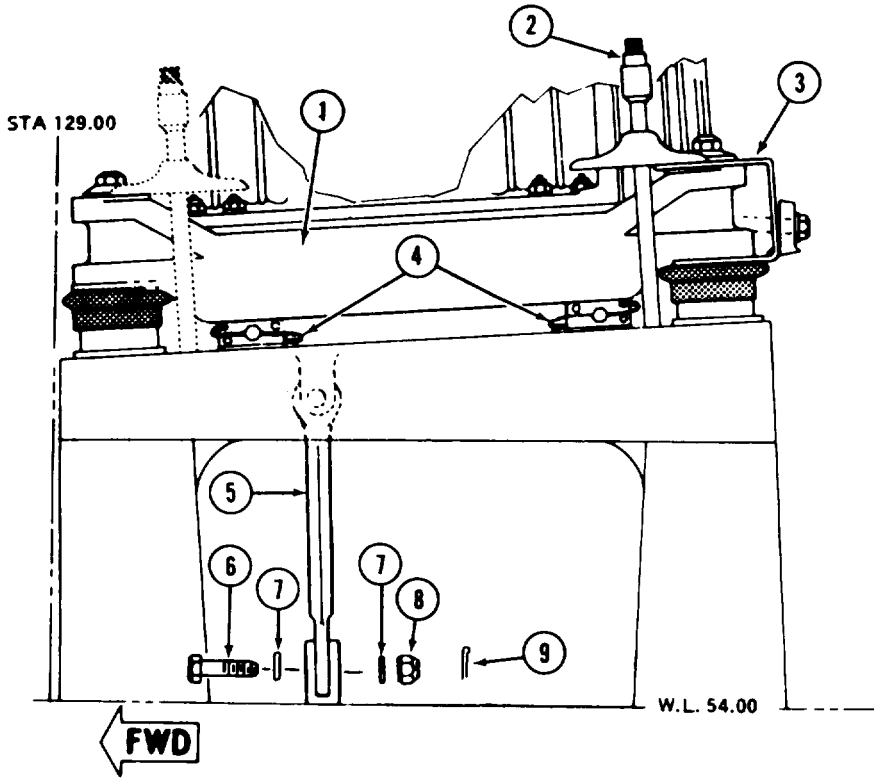
DRIVE TRAIN SYSTEM

SECTION I. MAIN DRIVESHAFT

Figures 6-1 through 6-6 deleted.

6-13. MAIN DRIVESHAFT P/N 205-040-004.

6-14. Description – Main Driveshaft P/N 205-040-004 (figure 6-9). The main driveshaft is installed between an engine adapter on the engine output shaft and the freewheel coupling on transmission input drive quill, The main driveshaft has a flexible splined coupling on each end. Two coupling clamp sets, of split V-band type, hold mating



1. Support case
2. Depth gage
3. Support beam
4. Jacks
5. Lift link
6. Bolt
7. Washer — steel
8. Nut
9. Cotter pin

Figure 6-7. Transmission Positioning for Driveshaft Alignment

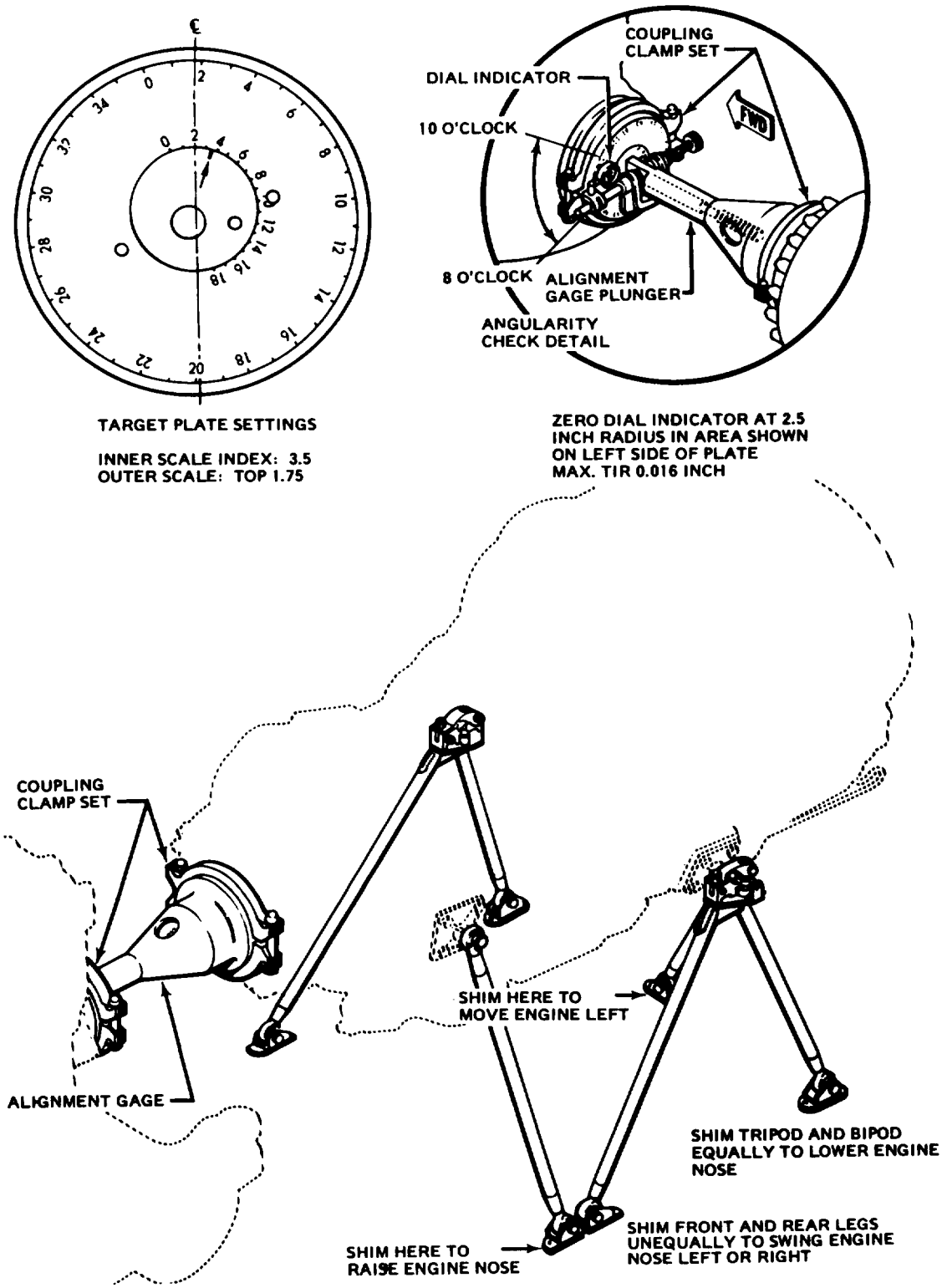


Figure 6-8. Tool Application — Use of Alignment Tool Set (T47)

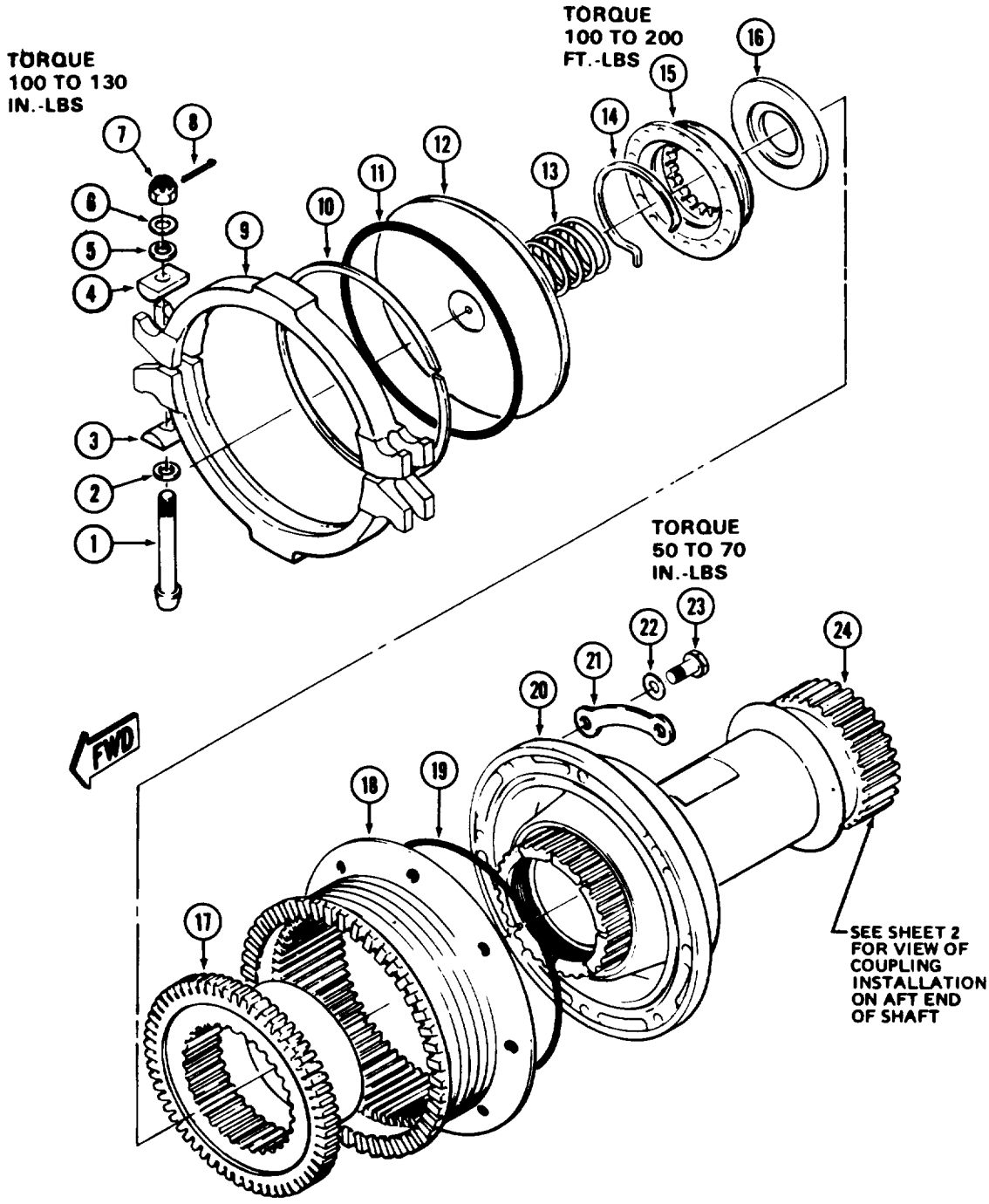


Figure 6-9. Main Driveshaft Assembly and Installation P/N 205-040-004 (Sheet 1 of 3)

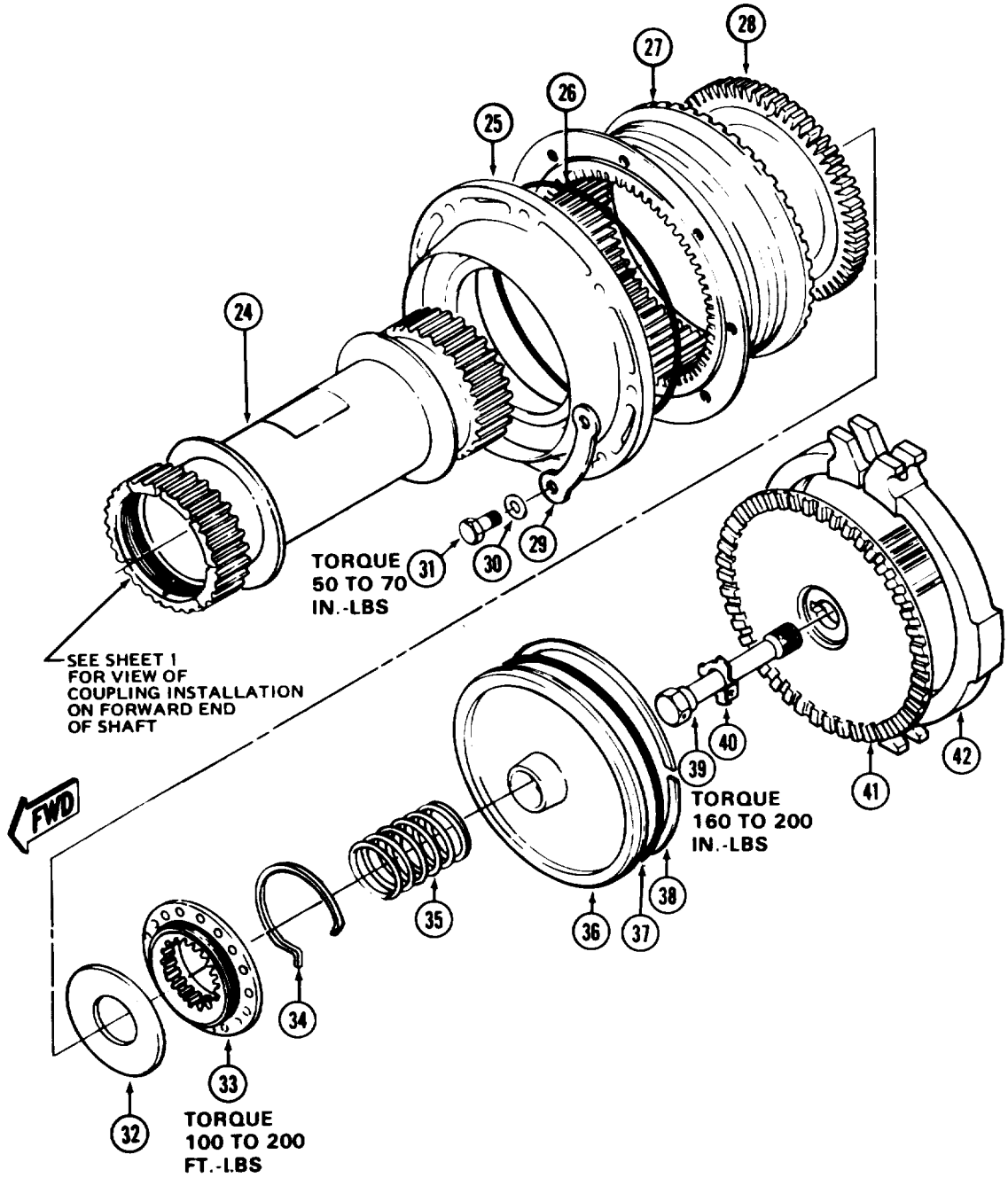
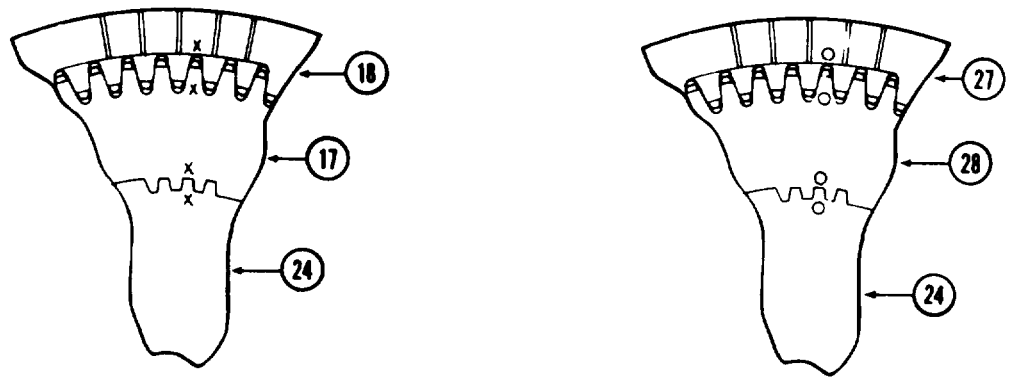


Figure 6-9. Main Driveshaft Assembly and Installation P/N 205-040-004 (Sheet 2 of 3)



DETAIL VIEW ILLUSTRATING INDEXING OF MAIN DRIVE SHAFT PARTS

1. Bolt
2. Special washer
3. Pivot
4. Pivot
5. Steel washer
6. Thin steel washer
7. Nut
8. Cotter pin
9. Clamp set (coupling)
10. Retaining ring
11. Packing
12. Grease retainer
13. Centering spring
14. Locking spring
15. Splined nut
16. Retainer
17. Inner coupling
18. Outer coupling
19. Packing
20. Boot
21. Laminated balance weight
22. Thin aluminum washer
23. Bolt
24. Driveshaft
25. Boot
26. Packing
27. Outer coupling
28. Inner Coupling
29. Laminated balance weight
30. Thin aluminum washer
31. Bolt
32. Retainer
33. Splined Nut
34. Locking spring
35. Centering spring
36. Grease retainer
37. Packing
38. Retaining ring
39. Bolt
40. Locking washer
41. Engine driveshaft adapter
42. Clamp set (coupling)

Figure 6-9. Main Driveshaft Assembly and Installation P/N 205-040-004 (Sheet 3 of 3,

curvic-spline faces of couplings in secure contact. Flexibility of couplings is provided by a floating-spline method of attachment on shaft, to accommodate movement of transmission on pylon mounts. A spring in each coupling assists centering of shaft during operation and tends to hold shaft assembly in place if clamps are removed during maintenance. Some, but not all, main driveshafts have been dynamically balanced. Main driveshafts that have been dynamically balanced may be identified by the presence of balance weights (21 and 29). Also, index marks shown on sheet 3 will be visible when the main driveshaft is disassembled.

6-15. Inspection of Installed Main Driveshaft P/N 205-040-004.

a. Inspect main driveshaft for grease leakage. Refer to paragraph 6-23, step h, for procedure.

b. Inspect main driveshaft for mechanical damage and for discoloration due to overheating. If damage is suspected in the strap fittings, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

c. Inspect main driveshaft for secure installation of clamp sets (9 and 42, figure 6-9).

6-16. Troubleshooting Main Driveshaft P/N 205-040-004.

a. The inspections listed in table 6-2 must be accomplished after disassembly of the main driveshaft.

b. Trouble conditions of main driveshaft can seldom be detected in operation since there are no reliable indications except possibly in an extreme condition. "Suspected vibration" is only partially accurate as a term for such conditions as dynamic out-of-balance or faulty coupling action. Vibration would result as well as abnormal stresses and wear, but would be absorbed in structure and pylon mounts or effectively masked by normal vibrations of the helicopter, providing no distinct indication to pilot. Driveshaft trouble indications are usually those revealed by careful inspection. Principle causes of driveshaft trouble are faulty installation procedures and improper lubrication of spherical tooth couplings.

c. Table 6-2 is a brief summary of troubles which may be encountered. Conditions and possible causes listed have been limited to those reasonably probable though not necessarily frequent in normal service. The troubles could become known through pilot reports or by inspection methods, they would be subject to some evaluation, although final corrective action by a higher maintenance level might be required in some instances. Conditions involving obvious major damage are omitted, as are those caused by accident or an unusual chain of events which would require evaluation by a competent authority.

Table 6-2. Troubleshooting Main Driveshaft P/N 205-040-004

CONDITION	TEST OR INSPECTION	**CORRECTIVE ACTION**
1. Abnormal coupling wear.	STEP 1. Disassemble driveshaft. Check for faulty lubrication or wrong lubricant and inspect for damage. (paragraph 6-20.)	**Clean and lubricate coupling (paragraphs 6-19 and 6-22).** **Replace driveshaft (paragraphs 6-17 and 6-23).**
	STEP 2. Misalignment	**Align engine and transmission (paragraph 6-24).** **Replace driveshaft and associated parts as required (paragraphs 6-17 through 6-23).**

Table 6-2. Troubleshooting Main Driveshaft P/N 205-040-004 (Cont)

CONDITION	TEST OR INSPECTION	CORRECTIVE ACTION
2. Lubricant breakdown in forward coupling.		
	STEP 1. Misalignment, wrong or partial loss of lubricant and inadequate lubricant.	**Align engine and transmission (paragraph 6-24).** **Replace driveshaft and associated parts as required (paragraphs 6-17 through 6-23).**
	STEP 2. Improper cleaning of couplings.	**Clean and lubricate couplings (paragraphs 6-17 through 6-23).**
3. Suspected vibration.		
	STEP 1. Coupling clamps loose or improperly installed or unmatched.	**Install clamp sets properly (paragraph 6-23).**
	STEP 2. Loose engine adapter.	**Replace adapter and any worn associated parts (paragraphs 6-17 and 6-23).**
4. Grease leakage.		
	STEP 1. Cut or torn preformed packing.	**Replace preformed packing, assembly with care (paragraphs 6-17 through 6-23).**
	STEP 2. Misalignment.	**Align engine and transmission (paragraph 6-24).** **Replace driveshaft and associated parts as required (paragraphs 6-17 through 6-23).**
	STEP 3. Cut, torn or wrinkled boot assembly.	**Replace boot assembly (paragraphs 6-17 through 6-23).**

6-17. Removal - Main Driveshaft P/N 205-040-004.

a. Open left side engine cowling.

b. Open transmission cowling. Remove engine air intake screens by releasing fasteners at front and rear edges of top panel and fasteners which secure side louvers or filters to cabin roof.

c. Remove induction baffle upper panel by releasing fasteners.

d. Remove intake screen access section at upper left by releasing fasteners. If particle separator is installed, remove upper half of particle separator.

e. Remove coupling clamps (9 and 42, figure 6-9) at each end of main driveshaft. Keep parts together as sets after removal.

f. Push main driveshaft toward either end to shift one coupling inward and disengage coupling at other end.

g. Remove driveshaft from helicopter.

6-18. Disassembly - Main Driveshaft P/N 205-040-004.

Premaintenance requirements for disassembly - main driveshaft P/N 205-040-004

Conditions	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T29), (T48)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C155), (C261), (C1), (C11), (C62), (C88), (C156), (C206), (C264), (C137), (C138)
Special Environmental Conditions	A covered area not susceptible to blowing sand or dust

WARNING

Complete disassembly is required to perform inspection and relubrication at each 600 hour/one year interval.

NOTE

Refer to figure 6-11 for views of disassembly.

a. Secure holding fixture (T48) to curvic spline of coupling (27, figure 6-9) with clamp set (9) and bolts (1). Secure bar of fixture in a vise.

b. At opposite end, carefully remove retaining ring (10). Remove grease retainer (12) by pressing down on outer coupling (18). Be prepared for retainer (12) to pop loose by holding it with thumbs. Remove packing (11) from retainer (12).

c. Remove centering spring (13) and locking spring (14) from splined nut (15). Loosen splined nut (15) using splined wrench (T29), but do not remove nut.

d. Remove main drive shaft from fixture. Reinstall grease retainer (12) without packing (11). Secure partially disassembled coupling end to fixture.

e. Repeat disassembly on opposite end as outlined in steps b and c. Remove shaft from fixture.

f. Remove splined nuts (15 & 33) and retainers (16 & 32). Remove inner and outer couplings as a unit (see detail I, figure 6-11).

NOTE

If the driveshaft has been dynamically balanced, the outer couplings (18 and 27), inner couplings (17 and 28) and the driveshaft (24) will be indexed as shown on figure 6-9, Sheet 3. Also, one or more lamination weights (21 and 29) will be installed.

g. If driveshaft has been dynamically balanced (at CCAD), use marking ink (C137, and C138) to temporarily index relative positions of laminated balance weights (21 & 29), boots (20 & 25), and outer couplings (18 & 27). Mark each end of shaft with different colors or marks. Disassemble as follows:

(1) Cut lockwire and remove bolts (23 & 31), separate outer couplings (18 & 27) from boots.

(2) Temporarily secure laminated balance weights to boots in original positions using lockwire through bolt holes.

h. If driveshaft has not been dynamically balanced, cut lockwire and remove bolts (23 & 31), separate outer couplings (18 & 27) from boots. Remove outer couplings (18 & 27) and carefully separate boots (20 & 25) from inner couplings (17 & 28).

6-19. Cleaning - Main Driveshaft P/N 205-040-004.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

CAUTION

Do not use solvent to clean boot, solvents may damage boot material.

a. When drive shaft is completely disassembled clean parts, except boot, with solvent (C261) and dry with filtered dry compressed air. Clean boots by wiping with clean dry cloth.

b. Clean corrosion products from parts prior to inspecting. Use wire brush or scotch-brite.

c. Remove fingerprints and coat unprotected surfaces with Corrosion Preventive (C87) when disassembled parts are to remain unassembled beyond the current workday. Degrease/depreserve prior to reassembly.

CAUTION

Bare metal surfaces may corrode rapidly if not protected.

6-20. Inspection "Main Driveshaft P/N 205-040-004. (Disassembled) a. Inspect boots (20 and 25, figure 6-9) for cracks, tears and wrinkles.

b. Inspect inner couplings (17 and 28, figure 6-9) and outer couplings (18 and 27) as follows:

(1) Visually inspect coupling teeth for wear.

NOTE

If any defects are noted on inner coupling teeth, the outer coupling teeth will also be damaged.

(2) Inspect couplings for chipped or burned teeth. Inspect each tooth of inner coupling for wear. Use a white card or tongue depressor at root of teeth to deflect light (figure 6-11, detail K). See figure 6-12 for allowable damage criteria.

(3) Inspect visually for cracks. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM non-destruction inspection procedures for UH-1 helicopter series.

(4) Inspect visually the area on the two outer couplings over which the preformed packings must pass during installation for burrs and sharp edges.

(5) Inspect visually for corrosion and pitting on inner couplings and outer couplings.

c. Inspect driveshaft (24, figure 6-9) as follows:

(1) Inspect splines visually for chipped teeth.

(2) Inspect splines for local damage.

(3) Inspect for mechanical damage and corros ion. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

d. Inspect splined nut (15 and 33, figure 6-9) as follows:

(1) Inspect splines for broken, chipped or worn teeth.

(2) Inspect surface A, figure 6-10, for wear in excess of 0.005 inch.

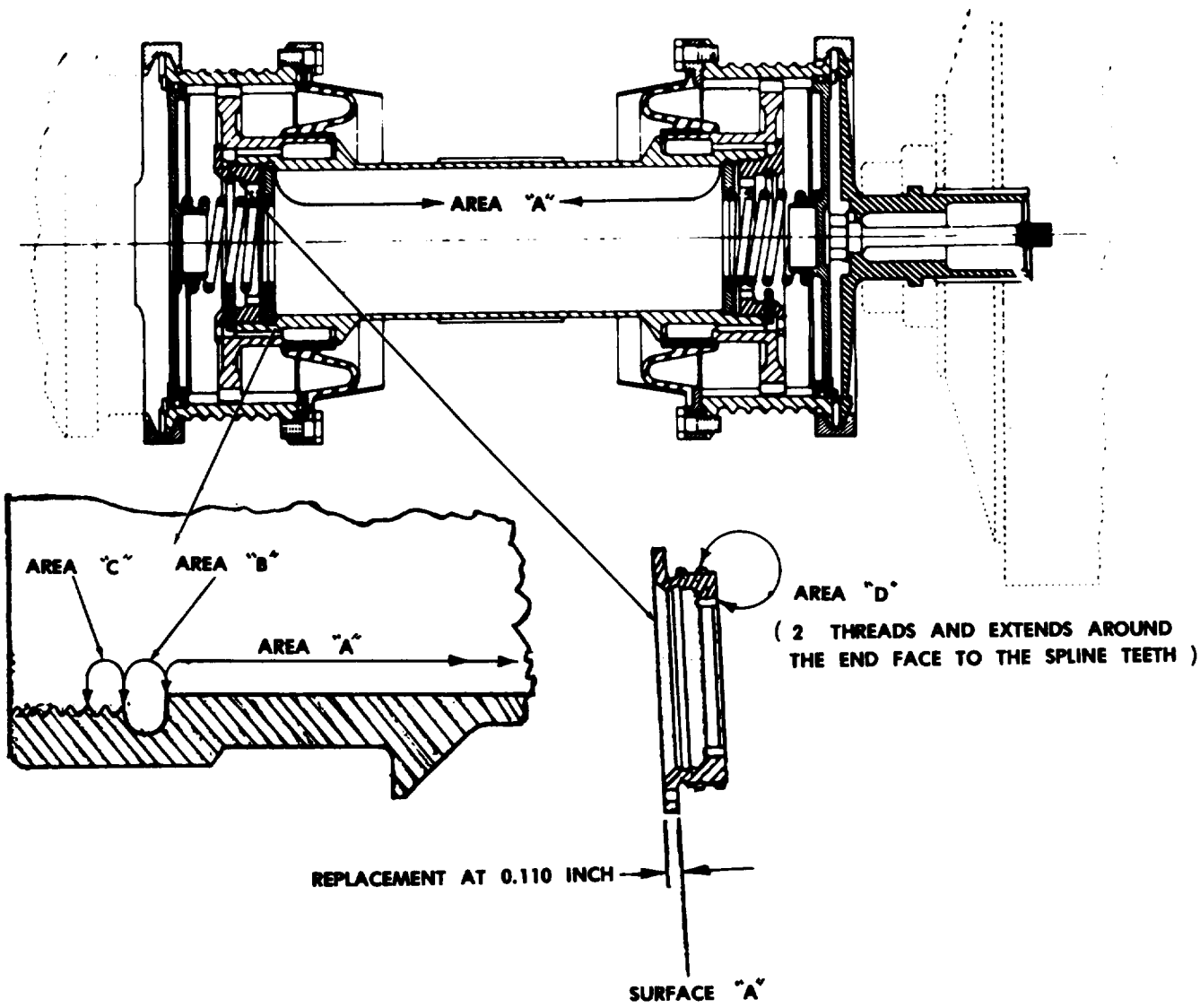
(3) Inspect visually for burrs and scratches.

(4) Inspect visually for cracks and dents. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

(5) Inspect for corrosion and pitting. Pits to a maximum depth of 0.030 inch are acceptable on inboard end face (see Area D, figure 6-10). Apply thin film of coupling lubricant to entire surface of nut.

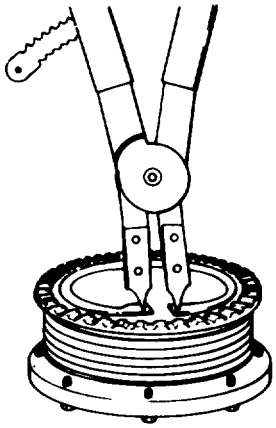
e. Visually inspect spring retainer (16 and 32, figure 6-9) for nicks and corrosion.

f. Visually inspect centering spring (13 and 35) for nicks and corrosion.

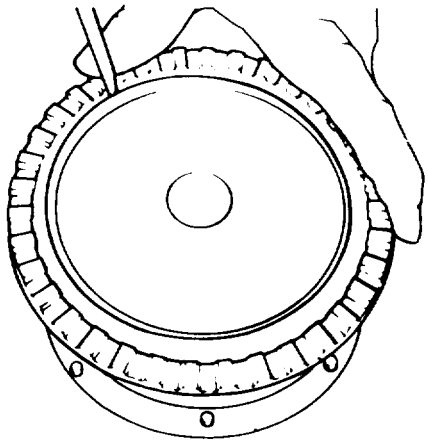


DAMAGE	A (CENTERBORE)	B (THREAD RELIEF)	C (2 INBOARD THREADS)	D (2 INBOARD THREADS AND END FACE)
Allowable Depth W/O Repair	0.005	0.010	0.030	0.030
Max Depth After Repair	0.015	0.025	N/A	N/A
Min Blend Radius	0.500	0.090	N/A	N/A
Max I.D. (If Honed)	2.430	N/A	N/A	N/A
Surface Finish	63 RMS	63 RMS	N/A	N/A

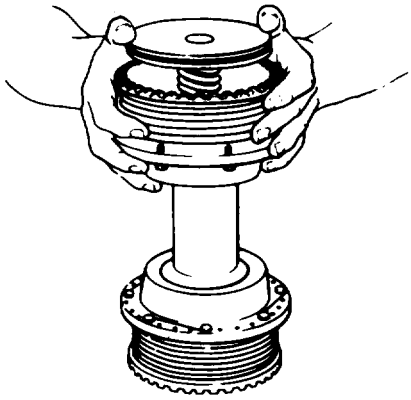
Figure 6-10. Limits Chart – Main Driveshaft Assembly P/N 205-040-004



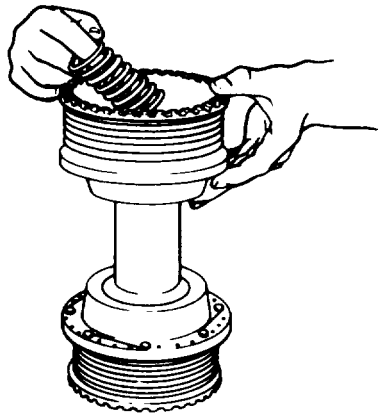
DETAIL A



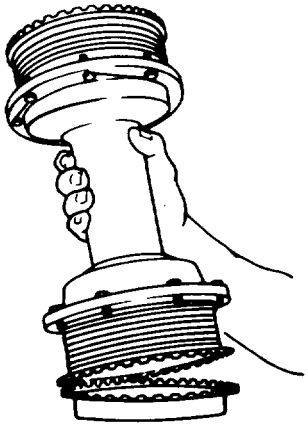
DETAIL B



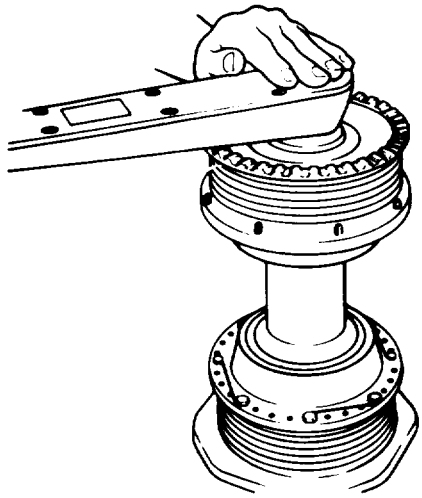
DETAIL C



DETAIL D

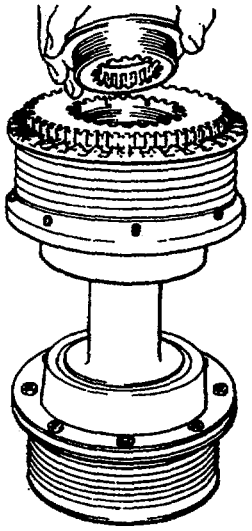


DETAIL E

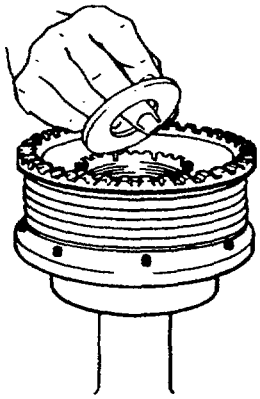


DETAIL F

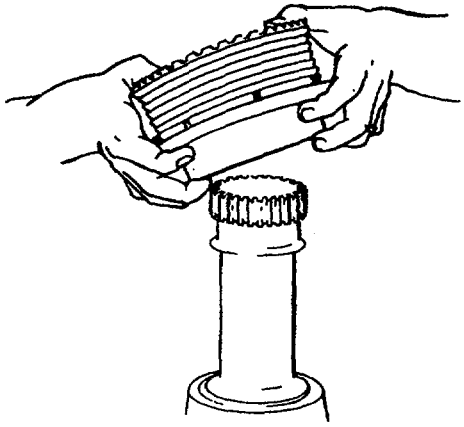
Figure 6-11. Input Drivoshoft-lubrication and Assembly (Shoot 1 of 3)



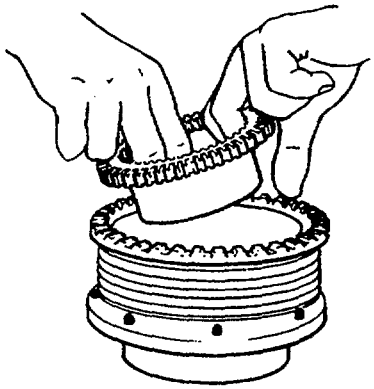
DETAIL G



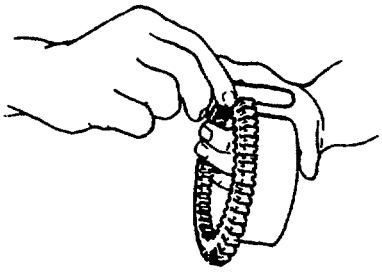
DETAIL H



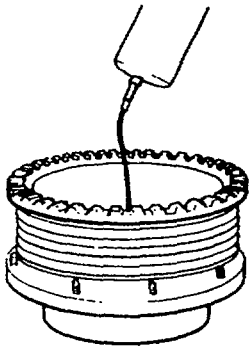
DETAIL I



DETAIL J

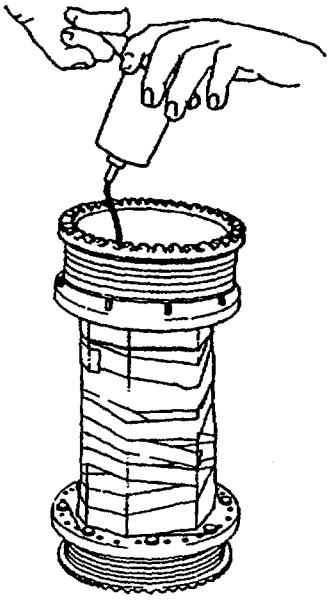


DETAIL K

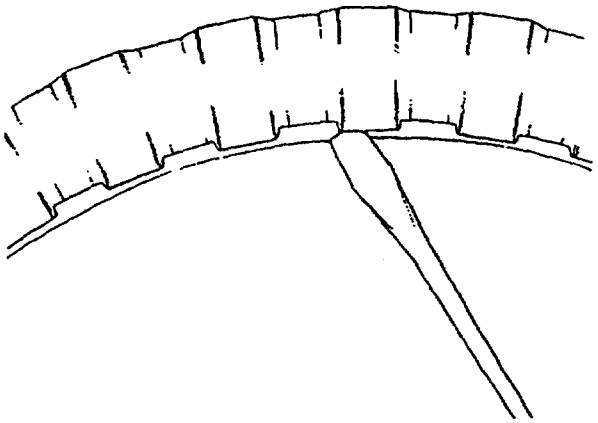


DETAIL L

Figure 6-11. Input Driveshaft-Lubrication and Assembly (Sheet 2 of 3)



DETAIL M



DETAIL N

Figure 6-11. Input Driveshaft-Lubrication and Assembly (Sheet 3 of 3)

g. Visually inspect retaining ring (10 and 38) and locking spring (14 and 34) for distortion and damage.

h. Inspect clamp sets (9 and 42) as follows:

(1) Check for matched sets.

(2) Inspect visually for wear.

(3) Inspect visually for cracks. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

(4) Inspect visually for corrosion and pitting.

i. Visually inspect engine adapter (41, figure 6-9) as follows:

(1) Visually inspect splines for chipped or damaged teeth.

(2) Visually inspect for nicks and burrs.

(3) Visually inspect for corrosion and pitting.

(4) Maximum allowable damage on the adapter flange is 0.010 inch.

j. Visually inspect bolt (39, figure 6-9) for damaged threads and corrosion.

k. Inspect the following parts by magnetic particle method (Code M) of fluorescent particle method (Code F) if cracks are suspected. Refer to TM 43-0103. Alternate inspection method: If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

(1) Check for legibility of stenciled serial number and/or existence of data plate on main driveshaft. If a discrepancy exists, stencil serial number on shaft.

FIGURE 6-9 ITEM	NOMENCLATURE	CODE
9 and 42	Clamp Sets	M
12 and 36	Grease Retainer	F
15 and 33	Splined Nut	M
17 and 28	Inner Coupling	M
18 and 27	Outer Coupling	M
24	Driveshaft	M
39	Bolt	M
41	Engine Adapter	M

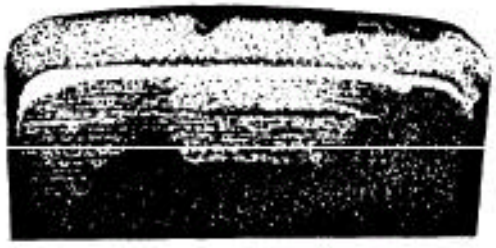
DETAIL A

DETAIL B

Details A and B show typical acceptable patterns of wear on spherical teeth of male coupling. Patterns will vary due to differences in time in service, alignment, and extent of operation at high power.

DETAIL C

Small defects as shown in detail C can occur in either Detail A or B. This type of defect is not detrimental to the coupling.



DETAIL D

Grooves, as shown in detail D, of any length are acceptable on not more than twelve consecutive teeth or twenty four teeth total.

DETAIL E

DETAIL F

Condition as shown in detail E or F are acceptable on not more than five consecutive teeth or twelve teeth total.

Note

When male coupling is replaced for defects like detail E or F, female coupling may require honing to remove any buildup of transferred metal.

DETAIL G

Defects as in detail G which cover over 1/2 the tooth length and 1/2 the tooth depth are to be rejected. Care should be taken in inspection of the female. If metal buildup is not excessive it may be honed down.

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Figure 6-12. inspection Criteria for Spherical inner Couplings on Main Driveshaft (Sheet 1 of 2)

DETAIL H

DETAIL I

Conditions shown in Detail H or I are not acceptable. This type of failure has only been found when an improper lubricant had been used. These photos show that the entire tooth surface has been spalled.

All or at least 30 of the 60 teeth will exhibit this failure. Check for the proper kind of lubricant, and be sure the proper amount of lubricant is installed.

Normally if the male coupling is as shown in Details H, I, or J the surface of the female will be damaged and should be scrapped.

DETAIL J

Detail J shows a group of teeth from a coupling which was run with an improper lubricant. The type of failure as shown in Details H and I.

204040-1175-2

Figure 6-12. Inspection Criteria for Spherical Inner Couplings on Main Driveshaft (Sheet 2 of 2)

6-21. Repair — Main Driveshaft P/N 205-040-004,

a. Replace Main Driveshaft if extensive or excessive corrosion/damage exists.

b. Repair outer couplings (18 & 27, figure 6-9) and inner couplings (17 & 28) as follows:

(1) Replace, without repair, if outer couplings (18 & 27) internal spline wear exceeds 0.005 inch depth (measure from unworn face of tooth).

(2) Replace, without repair, if coupling teeth damage is not within acceptable limits. (See figure 6-12.)

(3) Replace, without repair, if couplings are discolored or blistered due to overheating.

(4) Replace, without repair, if coupling teeth are chipped.

(5) Replace, without repair, if couplings are cracked.

(6) Replace, without repair, if superficial corrosion on spline teeth is in excess of amount removable by using abrasive pad (C11) and hand polishing. Corrosion pits on spline teeth are not allowable.

(7) Polish out burrs and sharp edges on outer couplings in area where packing must pass during installation. Use a fine India Stone (C264).

c. Repair exterior surface of driveshaft (24) as follows:

(1) Replace, without repair, if driveshaft is extensively or excessively corroded.

(2) Replace, without repair, if nicks or scratches exceed 0.010 inch in depth.

(3) Replace, without repair, if driveshaft is cracked.

(4) Replace, without repair, if local damage onsplines exceeds 0.002 inch in depth and/or 10 percent of the total effective spline surface area.

(5) Polish out burrs and scratches on driveshaft (24) exterior surface as follows:

NOTE

Nicks and scratches deep enough to require polishing out must have the repair area finished with a minimum radius of 0.600 inch. All repair areas must be touched-up with two (2) coats of primer (C206).

(a) Nicks and scratches running parallel to or within 15 degrees of shaft axis.

1. Not exceeding 0.005 inch in depth permissible without polishing out.

2. Not exceeding 0.010 inch in depth permissible if polished out using a 0.050 inch radius and provided total polished area does not exceed 25 percent of circumference at any point.

(b) Nicks and scratches not running within 15 degrees of axis must be polished out using fine abrasive cloth (C 1). Finish with a 0.500 inch minimum radius.

1. If not exceeding 0.005 inch in depth, must be polished out using abrasive cloth (Cl 1) by hand. Repair may extend around 100 percent of circumference.

2. If not exceeding 0.010 inch in depth, must be polished out provided total does not exceed 20 percent of circumference at any point. Also, maximum total cumulative rework in this step is 25 percent of circumference at any point.

3. Replace, without repair, if nicks and scratches exceed 0.010 inch depth.

4. Replace, without repair, if rework of area in excess of 5 percent of the plated area is required. If area is less than 5 percent, repair and touch-up with primer (C200) after rework.

d. Repair inner surface of driveshaft (24) as follows: (see figure 6-10 for limits).

(1) Replace, without repair, if driveshaft is extensively or excessively corroded.

(2) Repair inner surface of driveshaft (24) due to corrosion damage as follows:

NOTE

Repairs in Areas A & B must be touched-up with two coats of primer (C206) after removal of all corrosion products. Mask thread area to prevent application of primer.

(a) In Area A, pits to a maximum depth of 0.005 inch are acceptable without polishing out. Pits greater than 0.005 inch in depth must be polished out. Maximum acceptable depth of rework to completely polish out pits is 0.015 inch, or to a maximum inside diameter of 2.430 inch, provided rework is done by honing or other suitable means, such that material removal is uniform around the full inside diameter. Minimum acceptable radius in reworked areas is 0.500 inch and surface finish must be 63 RMS or better.

(b) In Area B, pits to a maximum depth of 0.010 inch are acceptable without polishing out, Pits greater than 0,010 inch in depth must be polished out, Maximum acceptable depth of rework to completely polish out pits is 0.025 inch. Minimum acceptable radius in rework area is 0,090 inch and surface finish must be 63 RMS or better,

(c) In Area C, pits to a maximum depth of 0.030 inch are acceptable without rework. Apply thin film of coupling lubricant to entire thread area.

e. Repair splined nut(15 & 33) as follows: (refer to figure 6-10 for limits).

(1) Replace, without repair, any nut with damage/galled threads or chipped/broken teeth.

(2) Replace, without repair, if evidence of cracks is found.

(3) Replace, without repair, if nut is extensively or excessively corroded.

(4) Polish out nicks, burrs, and scratches (except threads) with fine India Stone (C264).

(5) Pits due to corrosion to a depth of 0.030 inch are acceptable without rework on the two (2) inboard threads and in board end face. Apply thin film of coupling lubricant to entire surface of nut.

f. Repair spring retainer (16 & 32) as follows:

(1) Replace, without repair, if retainer is extensively or excessively corroded.

(2) Pits due to corrosion to a maximum depth of 0.030 inch are acceptable without rework. Treat with brush alodine (C62).

g. Repair centering spring (13 & 25) as follows:

(1) Replace, without repair, if spring is extensively or excessively corroded.

(2) Replace without repair, if spring is nicked, gouged, or deeply scratched,

(3) Remove superficial corrosion by polishing with scotch-brite. Corrosion pits are not acceptable, Apply thin film of coupling lubricant to entire spring.

h. Replace, without repair retaining ring (10 & 38) and locking spring (14 & 34) if bent or distorted.

i. Repair engine driveshaft adapter (41) as follows:

(1) Replace, without repair, if extensively or excessively corroded.

(2) Replace, without repair, if teeth are chipped or excessively worn.

(3) Repair burrs or scratches as follows:

(a) Polish out minor damage covering less than 5 percent of plated area using fine stone (C262). After repair touch-up with primer (C206).

(b) Replace, without repair, if rework exceeds 5 percent of plated area.

(4) Repair splines on engine driveshaft adapter (41) as follows:

(a) Replace, without repair, if crack or dent damage exists.

(b) Replace, without repair, if damage on splines exceeds 0.002 inch depth and/or 10 percent of the effective spine area.

(5) Remove superficial corrosion damage with abrasive pad (Cl 1). Touch-up with primer (C206).

j. Replace bolt (39) if damage or corrosion exists.

k. Repair clamp sets (9 & 42, figure 6-9) as follows:

(1) Replace, without repair, if clamps are not matched set.

(2) Replace, without repair, if worn excessively.

(3) Replace, without repair, if cracked.

(4) inspect for corrosion Remove superficial corrosion with abrasive pad (C11). Replace clamp set, if corrosion is severe.

6-22. Lubrication and Assembly — Main Driveshaft P/N 205-040.004.

NOTE

One six ounce tube of coupling lubricant (P/N 204-040-755-5, Syntech 3913-G1) provides correct amount of grease in one end of driveshaft. If main driveshaft has not been dynamically balanced or if driveshaft (24) or couplings were replaced, disregard use of laminated balance weights and indexing of parts. For ease of assembly, apply a thin coat of lubricant to both the internal and external splines.

a. Lubricate new packing (19) with coupling lubricant and install in groove of boot (20). Install boot on coupling, making sure that large holes in boot mate with the tapped holes in the outer coupling (18). Install, as necessary, balance weights (21) indexed to coupling (18). Install eight bolts (23) with thin aluminum washers (22). Torque bolts evenly 50 to 70 inch-pounds. Lock-wire (Cl 55) bolts in pairs.

b. Assemble opposite outer coupling (27), packing (26), boot (25), and weights (29) in the same manner as in step a.

c. Position each coupling and boot assembly with boot down. Squeeze one-fourth of a tube of lubricant (C 158) into outer coupling splines next to boot. Save remainder of tube for later use. Apply one-fourth of lubricant from a second tube into other coupling splines in the same manner.

d. Carefully place inner couplings into outer couplings. Assure that index parts "X' and "O" are indexed per figure 6-11 (sheet 3 of 3), to maintain a dynamically balanced shaft.

e. Determine the correct end of driveshaft (24), on which to install couplings. Inspect driveshaft (24) and couplings for "X" and "O" index marks.

f. Apply a thin film of coupling lubricant to all internal portions of driveshaft (24), which may not be primed, retainer (16 & 32), splined nut (15 & 33), and centering spring (13 & 35).

g. Place a coupling assembly on end of driveshaft (24), indexing splines as required. Install retainer (16) and splined nut (15) fingertight to hold parts in place. Repeat procedure at opposite end of driveshaft (24).

h. Install grease retainer (12) in outer coupling (18), without packing (11). (Retainer will serve as a spacer to prevent accidental disengagement of coupling splines.) Secure shaft assembly, end with grease retainer (12) on holding fixture (T48), in a vise.

CAUTION

Before applying torque on splined nuts, be sure splines of inner and outer couplings are fully engaged to avoid wrinkling and damaging boots.

i. Torque splined nut (33) 100 to 200 foot-pounds, using splined wrench (T29). Install locking spring (34). Ensure that spring tang is fully engaged with slot in end of driveshaft (24).

j. Repeat steps h and i on opposite end of shaft. Remove tools.

k. Fully extend couplings outward on shaft. A piece of corrugated cardboard approximately 7.25 by 16 inches, wrapped around shaft, may be used to hold coupling position.

1. Apply remaining three-fourths tube of lubricant (C158) evenly over internal splines of outer coupling.

NOTE

One six-ounce tube of coupling lubricant provides correct amount of grease in one end of shaft.

m. Lubricate a new packing (11) with coupling lubricant and install in groove around grease retainer (12). Install centering spring (13) and grease retainer (12) in outer coupling (18). Use caution to prevent damage to packing (11). If there is evidence of damage, such as a sliver of packing being cut off, remove retainer and install new packing.

n. Install retaining ring (10) and ensure that it is seated securely in groove of outer coupling (18).

o. Turn shaft over, with incomplete coupling up, and repeat process in steps l, m, and n on opposite end of shaft.

p. Remove cardboard from shaft and clean all traces of lubricant from exterior of driveshaft assembly with clean dry cloth.

6-23, Installation — Main Driveshaft P/N 205-040-004.

CAUTION

Use 26 spline adapter P/N 204-040-812-3 (41, figure 6-9) retaining bolt P/N 204-040-813 (39) and locking washer P/N 204-040-814 (40),

CAUTION

When hub spring is installed use Drive Shaft PN SKCP 2281-103

a. Select correct engine adapter as described in "Cautions" above and install as follows: Coat adapter (41, figure 6-9) splines with grease (C158) and insert into engine shaft. Install retaining bolt (39) and locking washer (40) with short tab of washer in adapter slot. Torque bolt 160 TO 200 inch-pounds and lockwire bolthead to outer tab of locking washer with lockwire (C155).

b. Refer to paragraph 6-24, step a, prior to installing main driveshaft to determine whether alignment is required. Perform alignment procedure if required

c. Before installing main driveshaft, carefully wipe clean the area surrounding the driveshaft, especially the particle separator, fifth mount beam, synchronized elevator tube, and collective tube.

d. Position driveshaft assembly between engine adapter (41) and transmission input drive coupling.

e. Install clamp set (9) as follows:

(1) Wipe clamp set clean of all traces of lubricant.

(2) Check serial numbers on clamp set. Both halves of clamp set must have the same serial number.

(3) Position clamp set halves around main driveshaft outer coupling (18) and mating adapter on transmission input quill, check to make sure serial numbers on both clamp halves are on the same side.

(4) Install two bolts (1) with heads facing in direction of shaft rotation, and with special washers (2) under bolt head, counter sink of washers toward bolt heads.

(5) Torque nuts (7) evenly to **100 to 130** inch-pounds. Keep gaps at ends of clamp halves even within **0.030** inch of each other. Tap clamp set with a soft faced hammer to ensure proper seating. Recheck torque. Install cotter pins (8).

f. Install clamp set (42) in the same manner outlined in the preceding step and position clamp slots ninety degrees to clamp set (9).

g. Wipe any excess lubricant from main driveshaft.

h. After first ground runup, or first flight, following installation of main driveshaft inspect areas around main driveshaft and in line with couplings for evidence of lubricant slinging. If leakage of lubricant is evident, proceed as follows:

(1) Remove main driveshaft and install new packings (11, 19, 26 and 37, figure 6-9).

(2) Inspect boots for wear and damage.

(3) Reinstall main driveshaft and repeat inspection for lubricant leakage.

6-24. Alignment - Main Driveshaft.

Premaintenance requirements for main driveshaft alignment

Conditions	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T47), (T51), (T53)
Test Equipment	None
Support Equipment	Dial Indicator
Minimum Personnel Required	One
Consumable Materials	None
Special Environmental Conditions	A covered area not susceptible to blowing dust or sand.

a. Check alignment of the main driveshaft installation between the transmission input drive quill coupling and the engine output shaft adapter if any one of the following conditions exist:

(1) Main driveshaft inspection reveals excessive wear of coupling spline or indications of excessive heating during operation.

(2) Major repairs or replacement of structural components has been made to either center fuselage or pylon support structure.

(3) Driveshaft misalignment is suspected for any reason.

(4) Shims under engine mount deck fitting have been changed.

b. Remove the main driveshaft assembly, but leave the engine adapter (41, figure 6-9) installed in the end of the engine output shaft (paragraph 6-17).

c. Position transmission to best position, corresponding to operation as follows:

(1) Release fasteners attaching access doors to pylon support and remove doors. Remove screws attaching upper access doors to pylon support and remove doors.

(2) Remove cotter pin, nut, and washer from bolt (6, figure 6-7) on lower end of link (5). Use hoist (800 pound capacity) to raise pylon to position where lower bolt of lift link can be rotated freely. Replace bolt if binding occurs due to corrosion or galling.

(3) Install four transmission leveling jacks (T51) (4) (two at each side) between transmission support case (1) and top of pylon support.

CAUTION

Do not attempt to raise or lower transmission with jacks only. Use a suitable hoist in conjunction with lacks.

NOTE

Use shim plates with jacks to obtain necessary height.

(4) Operate hoist to raise transmission until bolt (6) can be rotated with fingers. Adjust jacks (4) to hold transmission in this position with hoist slack. Take enough slack from the hoist so that the full weight of the transmission is not resting on the jacks and adjust jacks until all four corners are within 0.020 inch of each other and bolt is free so that it can be rotated with fingers.

NOTE

Ensure that lower lift link bolt (6) moves freely throughout the remaining pylon positioning procedures.

(5) Determine that transmission support pads are symmetrically parallel with pylon support structures as follows:

(a) Use micrometer depth gage (2, figure 6-7) to measure from the top surface of the support beam (3) mounting plates to the top of the pylon support. Take this measurement at each of the four mounts.

NOTE

Lower thickness of the fifth mount support beam (3) channel need not be considered, since it has been compensated for by a difference in the filler plates.

(b) Subtract thickness of support beam (3) from the measurements obtained at the two aft mounts. This action will allow for thickness of the fifth mount support beam channel, which covers the mounting plates at these two points. All four measurements should be equal within 0.020 inch.

(c) When all four points can not be adjusted to the same dimension, take the average of the two front points and adjust the two rear points accordingly.

(d) Upon completion of transmission pylon positioning, recheck bolt (6) to make sure that it can be rotated freely with the fingers.

d. Set the target plate of alignment tool set (T47) with the arrow of the center disk indexed at 3.5 on the inner scale (figure 6-8). Secure by tightening the two washer-head screws at back of plate.

e. Position the target plate of alignment tool set (T47) on the transmission input quill coupling with the 1.75 index of the outer scale at the top vertical centerline (figure 6-8). Secure with coupling clamp set (figure 6-8).

NOTE

Both alignment checks (steps f. and g.) must be accomplished to determine if alignment is correct.

f. Check horizontal and vertical alignment by inserting index finger through access holes in the alignment gage housing and pushing the plunger forward against the retracting spring tension and toward the target plate hole. When plunger enters hole in plate it can be detected by feel.

(1) To indicate correct alignment, largest diameter of plunger must enter hole in target plate.

(2) If misalignment is indicated, observe and note amount and direction of such misalignment.

NOTE

No correction of misalignment should be attempted before completion of angularity check outlined in the following step (g.). Shim requirements can be best determined on a basis of both checks.

g. Perform angularity check as follows:

(1) Mount a dial indicator on the forward end of the alignment gage plunger as shown in figure 6-8.

(2) Position the dial indicator for contact at 2.5 inch radius (just inside the outer scale numbers) on target plate. Rotate the gage through a full turn to determine area of target plate nearest the engine. This area should be found on the left-side of the target plate between the 8 and 10 o'clock positions. Zero the dial indicator in this area. Check run-out through a full turn of the gage. Runout must be

within 0.016 inch maximum total indicator reading.

h. Make correction of engine alignment by use of shims under engine mount deck fittings as required (figure 6-8). Refer to TM 55-2840-229-23 for engine vibe check.

(1) Loosen screws around intake bellmouth in forward firewall, and around attachment ring in rear firewall, to allow engine to shift as necessary during alignment.

(2) Shims under tripod inboard leg fittings P/N 205-060-139-1 must not exceed 0.300 inch shim thickness. Shims under other deck fittings P/N 205-060-135-1 must not exceed 0.300 inch shim thickness.

(3) Torque fitting bolts (through engine deck) to standard torque and repeat alignment and angularity checks after any change of shims.

i. When alignment is correct, remove tool set (T47) and jacks (T51). Retighten screws around bellmouth, and firewalls, and around attaching ring in rear of firewall as necessary.

(1) When installing the fifth-mount bolt, if the bolt inters the transmission support beam at an upward or downward angle, add or subtract shims to the fifth-mount until the bolt enters the transmission support beam on a horizontal plane, this procedure will eliminate a lot of engine movement and shimming to obtain the engine alignment and run-out.

(2) Remove all the shims from the engine deck fittings, (except for .026 from rom the tripod center leg), before installing the engine.

(3) Install the engine.

(4) Install the engine alignment tool to the engine and to the transmission input drive (quill). Each shim equals to .003 in thickness and each .009 of shim thickness equals 1 degree on the run-out. Example: 5 degrees on the run-out equals 15 shims, which equal to .045 of shim thickness.

(5) If shims are added to the monopod, the engine nose will move up. If shims are subtracted from the monopod, the engine nose will move down. If shims are added to the monopod, the engine run-out will increase to the negative at 12 o'clock and the positive at 6 o'clock. If shims are subtracted from the monopod, the engine run-out will increase to the negative at 6 o'clock and the positive at 12 o'clock.

(6) Left front leg of the tripod - if shims are added, the engine moves minutely to the left; however, the run-out will change quite a bit towards 9 o'clock depending on the amount of shims added. There will be more minus towards 9 o'clock and more plus towards 3 o'clock on the run-out.

(7) Left rear leg of the tripod - rolls the engine down and right towards 5 o'clock, if shims are added; however, there is a very minute change on the run-out towards the direction of movement.

(8) Center leg of the tripod - if shims are added the engine moves to the left towards 9 o'clock, if shims are subtracted, the engine moves to the right towards 3 o'clock with a very minute change on the run-out towards either direction.

(9) Front right leg of the bipod - if shims are added, the engine will move minutely towards the right; however the engine alignment will change towards the minus at 3 o'clock and the plus towards 9 o'clock.

(10) Right rear leg of the bipod - if shims are added, the engine rolls down and left towards 7 o'clock with a minute change on the run-out towards the direction of movements.

(11) The left rear leg of the tripod and right rear leg of the bipod together - if shims are added equally to both legs, the engine nose moves straight down towards 6 o'clock. The run-out will change minutely towards the direction of movement to the minus.

j. Install nut (8) and washer (7) on lower bolt (6, Figure 6-7) of lift link (5). Torque nut 480 to 600 inch-pounds (40 to 50 feet-pounds) and secure with cotter pin (9). Install access doors on pylon island structure.

k. Install main driveshaft (paragraph 6-23).

6-24.1. MAIN DRIVESHAFT (Flexible Plate) SKCP2281-103.

6-24.2. Description — Main Driveshaft P/N SKCP2281-103.

a. A main driveshaft (see figure 6-12.1) with flexible plate couplings is installed between an adapter on engine output and the freewheel unit on transmission input drive quill. Two coupling clamp sets, of split v-band type, hold mating curvic-splined faces of end fittings in secure contact,

b. Flexibility of shaft is provided by rectangular plates four in each coupling. Each plate flexes providing both angular misalignment and length changes to accommodate movement of transmission on pylon mounts. Each coupling can be considered a truss-work, in which torque loads are carried as axial loads in straight members of each plate.

c. A fail-safe feature exists which enables uninterrupted drive of the shaft after a failure has occurred in one of the dual load paths provided by the plate couplings. In normal operation a radial clearance exists between center shaft internal diameter and the internal protruding hub of the end fitting (see figure 6.12.1). Upon the unlikely event of a plate failure the center shaft shifts contacting the hub surface which restores the load balance, contains the whirling parts and restores stable operation. The off-center operation of center shaft is sufficient to cause a noticeable unbalance which signals that a partial failure has occurred and fail-safe mode is in operation with last remaining load path.

d. The shaft is dynamically balanced at time of manufacture by the use of washer(s) and screw(s) which are used as balance weights. These weights may be found inside the shaft end fittings. To assure screws are securely fastened a high grade of adhesive is used on the threads. Do not attempt to turn screws as breakage may result due to high lockage force of the adhesive.

6-24.3. Removal — Main Driveshaft P/N SKCP2281-103.

a. Open transmission fairing.

b. Remove air inlet filters (paragraph 4-24).

c. Remove induction baffle upper panel by releasing fasteners.

d. Remove upper half of particle separator.

e. Remove coupling clamps at each end of main drive shaft, keep clamps together as matched sets after removal.

WARNING

Compression of shaft is usually necessary to clear the engine adapter and transmission freewheeling unit.

DO NOT APPLY ANY TOOLS OR CLAMPS TO COUPLING PLATES.

To prevent critical damage to plates and/or shaft, locally obtain and make two installation clamp aids. Refer to figure 6-12.2.

f. Position two installation clamp aids over bolt heads located on the arms of the end fittings (see figure 6-12.3). Tighten clamps to allow removal of shaft. Remove shaft assembly, remove clamp aids.

g. To remove engine shaft adapter, remove lockwire, retaining bolt and key washer. Pull adapter out of engine output shaft.

6-24.4. Cleaning — Main Driveshaft P/N SKCP2281-103.

a. Clean shaft assembly, adapter, and attaching parts with dry cleaning solvent (C261) or Methyl-Ethyl-Ketone (C177).

b. Dry with filtered compressed air or clean cloth.

6-24.5. Inspection and Repair — Main Driveshaft P/N SKCP2281-103.

CAUTION

Do not attempt to loosen or tighten any hardware. Any reason for necessary part removal is cause for shaft replacement.

a. Visually inspect shaft for cracks. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

b. Visually inspect shaft for nicks, dents, scratches and corrosion. Refer to figure 6-12.4 for limits.

(1) Superficial scratches not exceeding **0.002** inch in depth or well rounded dents on part edges not exceeding 0.005 inch in depth do not require repair.

(2) Scratches in the metal deeper than **0.002** inch or with sharp notches shall be smoothly blended into surrounding area so that no sharp indentations or edges remain. Repair must be within the limits specified in figure 6-12.4. Accomplish repair by careful hand filing or stoning, using fine emery cloth for final polishing. Minimize removal of protective coating during repair.

(3) Damage to the protective coating (removal to base metal) which exceeds **0.25** inch in width may be touched up with aluminum colored paint for appearance and minimal protection from corrosion. Smaller areas left bare will not corrode due to sacrificial properties of the original protective coating.

NOTE

Black residue developing around the flex plates is not a cause for rejecting the drive shaft.

c. Check for legibility of stenciled serial number and/or existence of data plate on main driveshaft. If discrepancy exists, stencil serial number on driveshaft.

d. Visually inspect engine adapter (11, figure 6-12.1) as follows:

e. If crack is suspected in main driveshaft engine adapter, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

f. If crack is suspected in adapter bolt, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

(1) Visually inspect splines for chipped or damaged teeth.

(2) Visually inspect for nicks, burrs, corrosion and pitting.

(3) Maximum allowable damage on the adapter flange is **0.010** inch.

6-24.6. Installation - Main Driveshaft P/N SKCP2281-103.

NOTE

If improved particle separator is installed on Aircraft, ensure ring, lip seal, item 13, figure 4-17.1 is installed before the Main driveshaft is installed.

a. If removed, coat adapter (11, figure 6-12.1) splines with grease (C158) and insert into engine shaft. Install retaining bolt (9) and key washer (10) with short tab of washer in adapter slot. Torque bolt **160 TO 200** inch pounds. Lockwire (C155) bolt head to outer tab of key washer.

b. Position two installation clamp aids over bolt heads located on arms of the end fitting (see figure 6-12.3). Tighten clamps to allow installation of shaft between engine adapter and transmission freewheel unit. Install main driveshaft in either direction. Remove both clamps from shaft after installation.

c. Install coupling clamps (2, figure 6-12.1) to secure both ends of shaft as follows:

(1) Check the serial numbers on each clamp set ensuring both halves are alike and on the same side for installation.

(2) Position clamp set so that gap is in line with index mark (circular indentation) on the shaft end fitting. (See figure 6-12.1).

(3) Clamp halves should fit snugly and hold themselves in place without bolts.

(4) Place washer (4, figure 6-12.1) on bolt (3) with chamfer against head. Install bolt, with head in direction of shaft rotation, through pivots (5) and clamp ends. Install washers (6, 7) and nut (8).

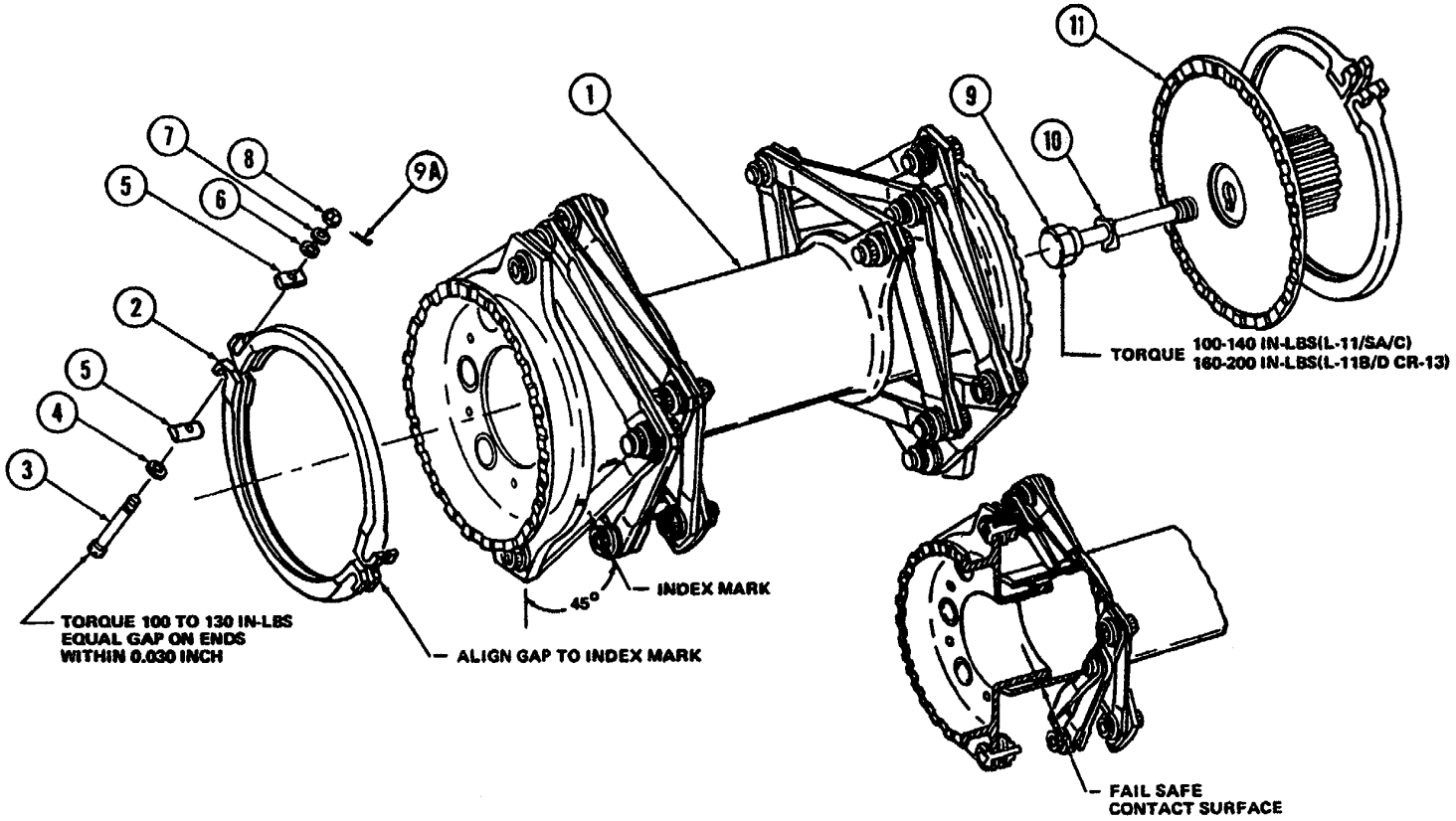
NOTE

Thick or thin steel washers may be added if required under nut; and using like quantity on opposite bolt to maintain balance.

(5) Torque nut **100-130** inch-pounds, keeping equal gaps between ends of clamp set within **0.030** inch. Tap around outside of clamp set with a soft faced mallet to ensure good seating, and recheck torque. Install cotter pin.

(6) Install opposite end clamp set, in the same manner, positioned 90° around shaft in relation to previously installed clamp set.

6-24.7. Alignment Main Driveshaft P/N SKCP2281-103. (See paragraph 6-24 for alignment instructions.)



1. MAIN DRIVE SHAFT ASSEMBLY
2. COUPLING CLAMP SET
3. CLAMP BOLT
4. CHAMFER WASHER
5. PIVOTS
6. STEEL WASHER
7. STEEL WASHER (IF REQD)
8. NUT
9. RETAINING BOLT
9A. COTTER PIN
10. KEY WASHER
11. ADAPTER

Figure 6-12.1. Main Driveshaft SKCP2281

SECTION II. CLUTCH

NOTE

A freewheeling clutch is incorporated in the transmission input drive quill. For description and maintenance procedures refer to paragraph 6-91.

SECTION III. MAIN TRANSMISSION

6-25. TRANSMISSION ASSEMBLY.

6-26. Description — Transmission Assembly. A universal transmission is used. The transmission (figure 6-13) is located directly ahead of the engine and is suspended by pylon-isolating mounts on structural supports. The transmission is coupled to the engine by the main driveshaft and provides drive angle change and speed reduction, through a train of spiral bevel gears and two stage planetary gears, to drive the main rotor mast. Components peculiar to a specific helicopter are excluded on the universal transmission, such as oil lines, generator drive quill, hydraulic pump rod and tachometer generator drive quill, and filler assembly. The transmission conversion requires the installation of serviceable parts removed from the old transmission and universal installation kit (P/N 204-040-018-1).

a. A freewheel clutch in the input drive quill coupling disengages to allow main rotor and gear train to turn freely when engine is stopped or is idling below rotor driving speed, as in auto-rotational descent.

b. Secondary gear trains drive tail rotor shaft, DC generator, rotor tachometer generator, hydraulic pump, and transmission oil pump.

c. Output reduction ratios, expressed as revolutions of each driven unit per engine revolution, are as follows:

Main Rotor Mast	0.0491
DC Generator	1.0
Tail Rotor Drive Shaft	0.6516
Hydraulic Pump	0.6516
Tachometer Generator	0.6516
Oil pump	06274

NOTE

After further reduction in 90-degree gearbox, tail rotor turns at 0.25 engine rpm.

6-27. Lubrication — Transmission Assembly (paragraph 1-6).

6-27.1. Lubrication — Transmission Assembly — Helicopters With MWO 1-1520-242-50-2, Oil Debris Detection System (ODDS).

The primary benefit of the ODDS system is improved filtration of the engine and main transmission lubrication system. The ODDS system is designed to provide early identification of potential component failures. Fine filtration (3 micron) increases system life by removing oil-borne particles which cause wear in the component. Analysis shows that catastrophic failure modes that are detected through spectrometric oil analysis (SOA)/AOAP will be detected by ODDS system chip detectors. The ODDS equipped engine and main transmission do not require routine oil sampling. Spectrometric oil analysis measures concentrations of wear metal debris in the three to ten micron range. Not enough of significant size particles exist to allow an accurate indication of wear metal concentration by spectrometric analysis. Therefore routine oil sampling is not required or authorized.

Although routine oil sampling of the engine and main transmission of ODDS equipped aircraft is not required or authorized, samples may be taken in the event of a chip light, and provided along with chip detector debris to an AOAP lab for analysis using ferrography or similar techniques. The results of this will be used with oil debris classification chart guidelines to determine the serviceability of the component.

Replacement of the ODDS equipped engine and main transmission external oil filters are performed “on condition” as required by maintenance actions (such as bypass buttons or major component change). Since operation of fine filtration cleans the lubricant in the component, do not replace lubricant when replacing filter. Flushing and filtering of lubricant of the ODDS system is not required or authorized. Flushing and filtering of lubricant is only done during replacement of engine and/or transmission.

During the modification of aircraft I.A.W. MWO 1-1520-242-50-2 (ODDS) chip detectors in the 42- and 90-degree gearboxes were changed, they are not part of the ODDS filtering system and still require SOA/AOAP samples and inspections.

6-28. Inspection — Acceptance/Rejection Criteria — Transmission Assembly.

Table 6-3. Inspection Requirements — Transmission Assembly

FIGURE NO.	DEFECTS	METHOD OF INSPECTION	REFERENCE PARAGRAPH	
			INSPECTION	REPAIR
	Metal particles in:			
6-14	Transmission oil filter	Visual	6-45	6-47
6-14	Magnetic plug, electric chip detector (or debris monitor) and pump screen	Visual	6-85	6-87
6-14	External filter (without ODDS)	Visual	6-208	6-209
6-14	External filter (with ODDS)	Visual	6-210.4	6-210.5
6-15	Transmission hardware, loose, missing or damaged	Visual	6-33	6-35
6-17	Transmission case for cracks, nicks dents or scratches	Visual	6-33	6-37
	Oil Leakage:			
6-24, 6-26	Input drive quill	Visual	6-95, 6-104	6-97, 6-106
6-28	Generator drive quill	Visual	6-113	6-115
6-30	Hydraulic pump and tachometer drive quill	Visual	6-121	6-123
6-31	Tail rotor drive quill	Visual	6-129	6-131
6-35	Main rotor mast	Visual	6-137	6-139
6-38	Pylon mounts and lift link security	Visual	6-145	6-147
6-39	Friction damper security	Visual	6-154	6-156

6-29. Troubleshooting —Transmission Assembly.

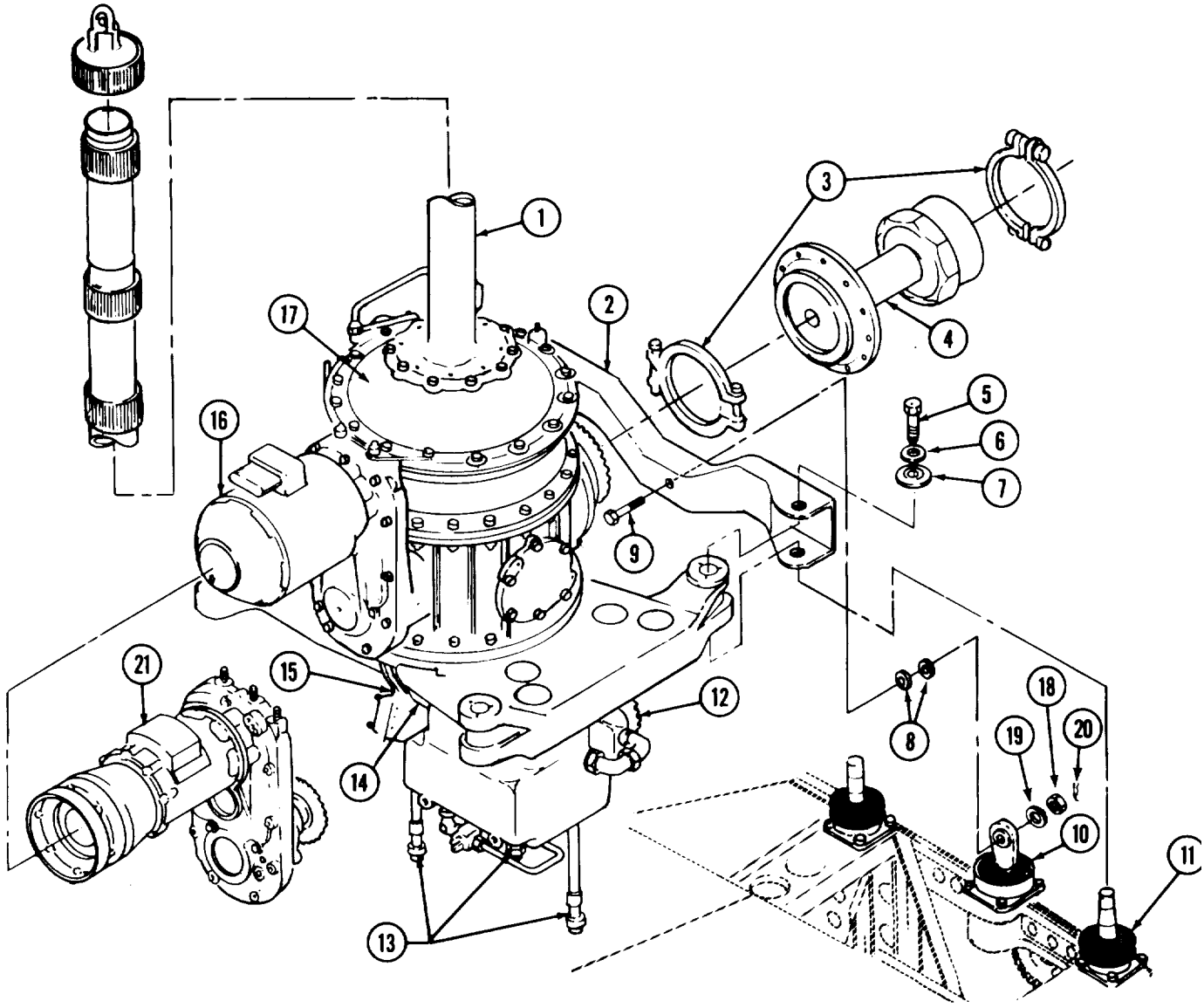
a. The troubleshooting chart (table 6-4) is a brief summary of troubles which may be encountered. Conditions and possible causes listed have been limited to those reasonably probable (though not necessarily frequent in normal service) which could become known through pilot reports or by inspection methods and which would be subject to some evaluation although final corrective action by a higher level might be required in some instances. Conditions involving obvious major damage are omitted, as are those caused by accident or an unusual chain of events which would required evaluation by AVIM.

NOTE

Low oil level will not cause a low oil pressure indication, provided sump contains enough oil to cover pump. Inlet Oil temperature, however, might rise.

b. Effects of an oil leak will depend on its location in system and rate of leakage. An external leak can eventually allow sump to be pumped dry, causing internal failure of transmission. While oil remains to supply pump, the pressure relief valve would tend to maintain normal system pressure, compensating for leakage. This applies especially to leaks located between the pump and relief valve. Leaks occurring beyond relief valve could cause some indication of low oil pressure. Leakage to interior of transmission, while not affecting oil level, could starve lubrication areas beyond the leak and might affect indicated oil pressure and temperature. Cumulative clogging of oil filter screens will not be shown by a gradual drop of indicated oil pressure. Pressure relief valve would maintain normal system pressure even if filter screens became so clogged as to force oil flow through filter bypass valve.

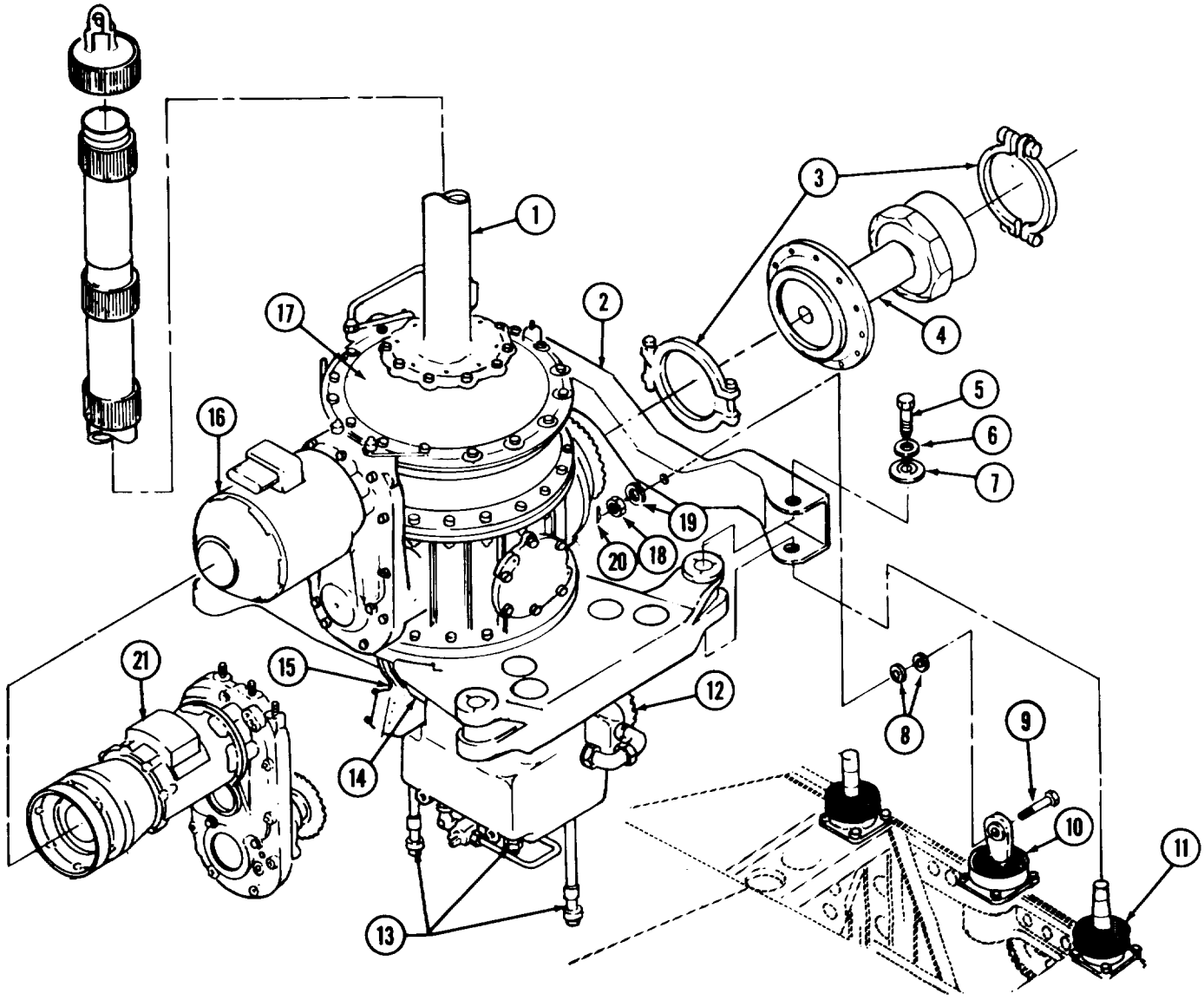
c. Use of wrong oil is omitted from causes of trouble on chart because any such event would be a special problem as to possible damage and corrective action. As to detecting such a condition, little can be said except that most oils which might be available to use by error would tend to cause high oil pressure and high oil temperature indications or excessive seal leakage.



1. Mast
2. Fifth mount support beam
3. Clamp
4. Main driveshaft
5. Bolt - special nylon insert
6. Washer
7. Shouldered washer
8. Washer
* 9. Bolt
10. Pylon fifth mount
11. Typical main mount
12. Tail rotor drive quill
13. Oil hoses and drain coupling
14. Lift link clevis
15. Hydraulic pump drive quill
16. DC generator
17. Transmission
* 18. Nut
* 19. Washer
* 20. Cotter pin
21. AC alternator/alternator drive quill

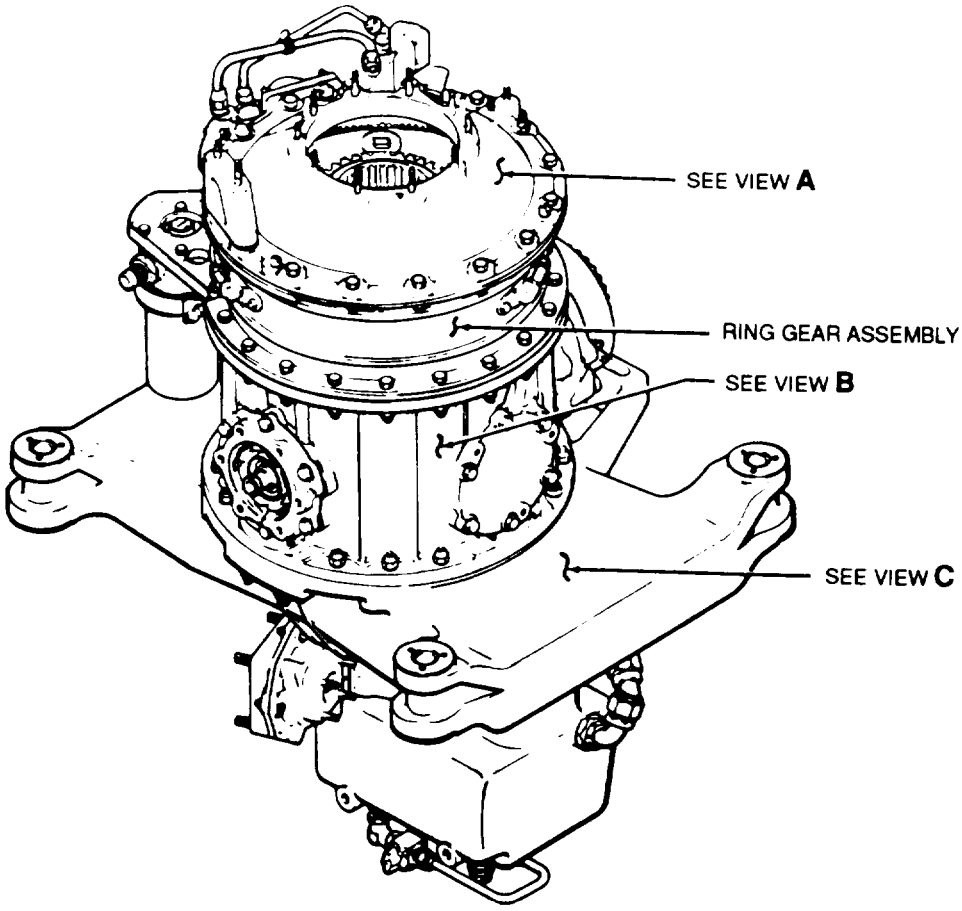
* Location with Improved Particle Separator (IPS) Installed.

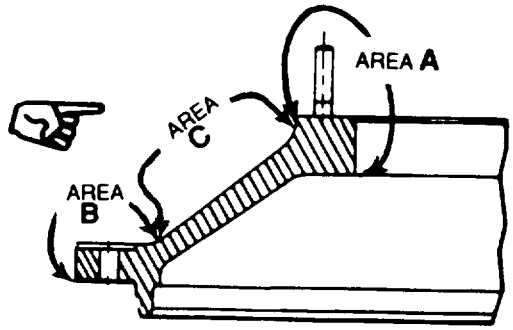
Figure 6-13. Transmission Assembly - Removal and Installation (Sheet 1 of 2)



1. Mast
2. Fifth mount support beam
3. Clamp
4. Main driveshaft
5. Bolt - special nylon insert
6. Washer
7. Shouldered washer
8. Washer
9. Bolt
10. Pylon fifth mount
11. Typical main mount
12. Tail rotor drive quill
13. Oil hoses and drain coupling
14. Lift link clevis
15. Hydraulic pump drive quill
16. DC generator
17. Transmission
18. Nut
19. Washer
20. Cotter pin
21. AC alternator/alternator drive quill

Figure 6-13. Transmission Assembly - Removal and Installation (Sheet 2 of 2)





VIEW A

Figure 6-13.1. Damage Limits, Transmission (Sheet 1 of 6).

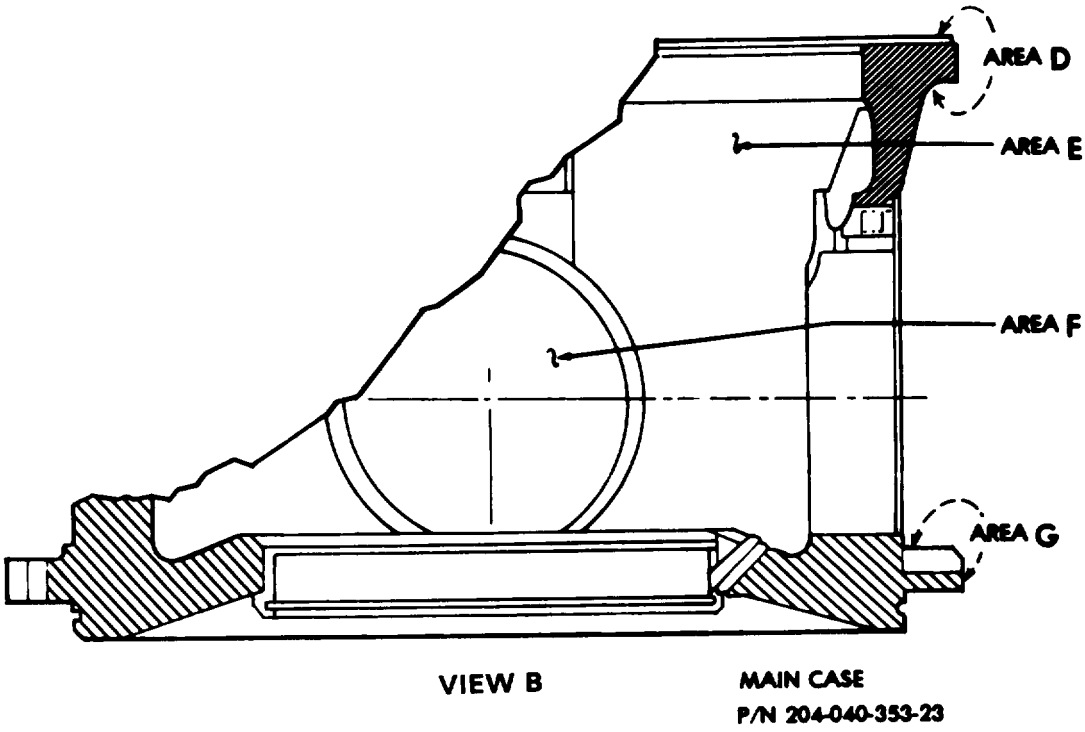


Figure 6-13.1 Damage Limits, Transmission (Sheet 2 of 6)

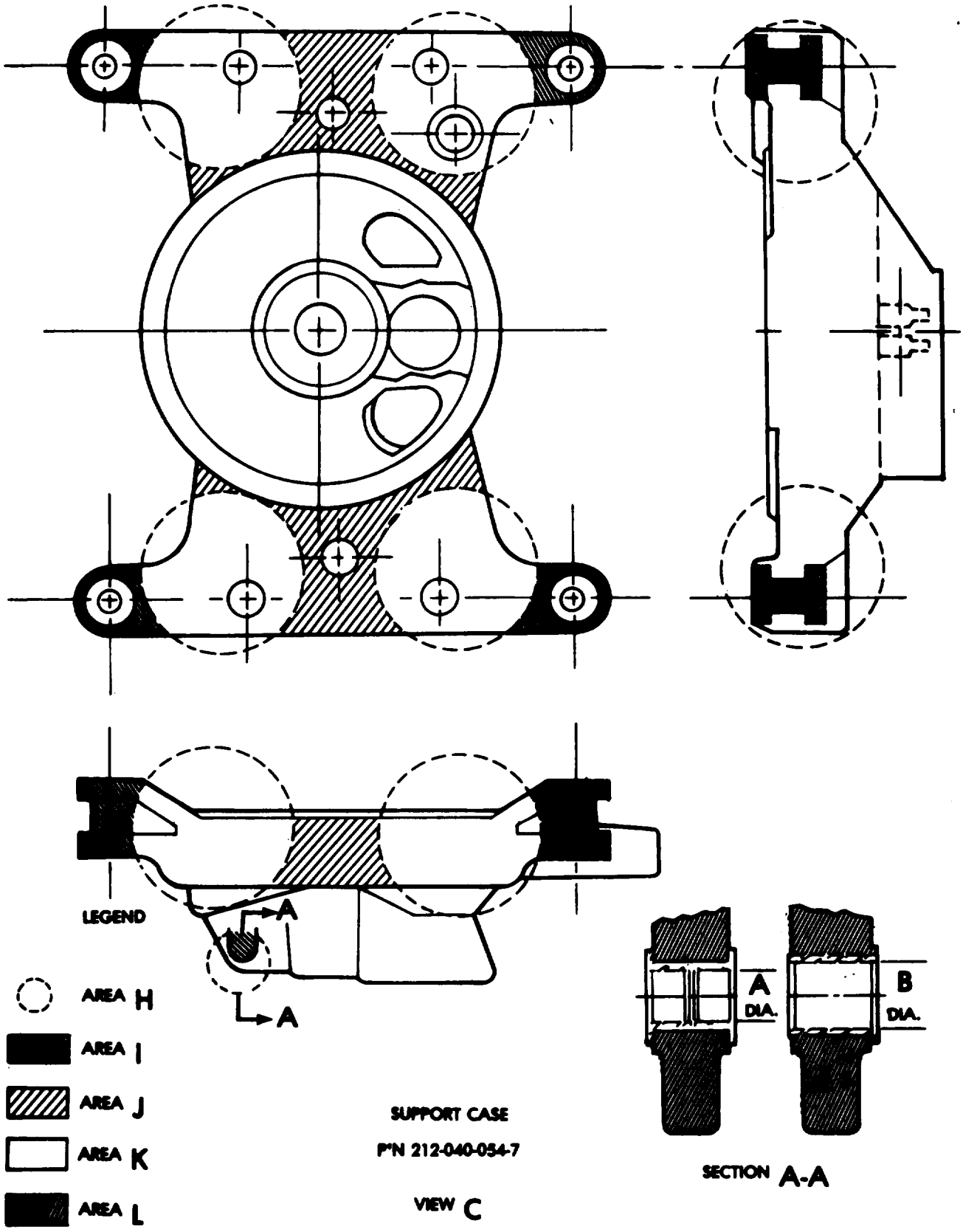
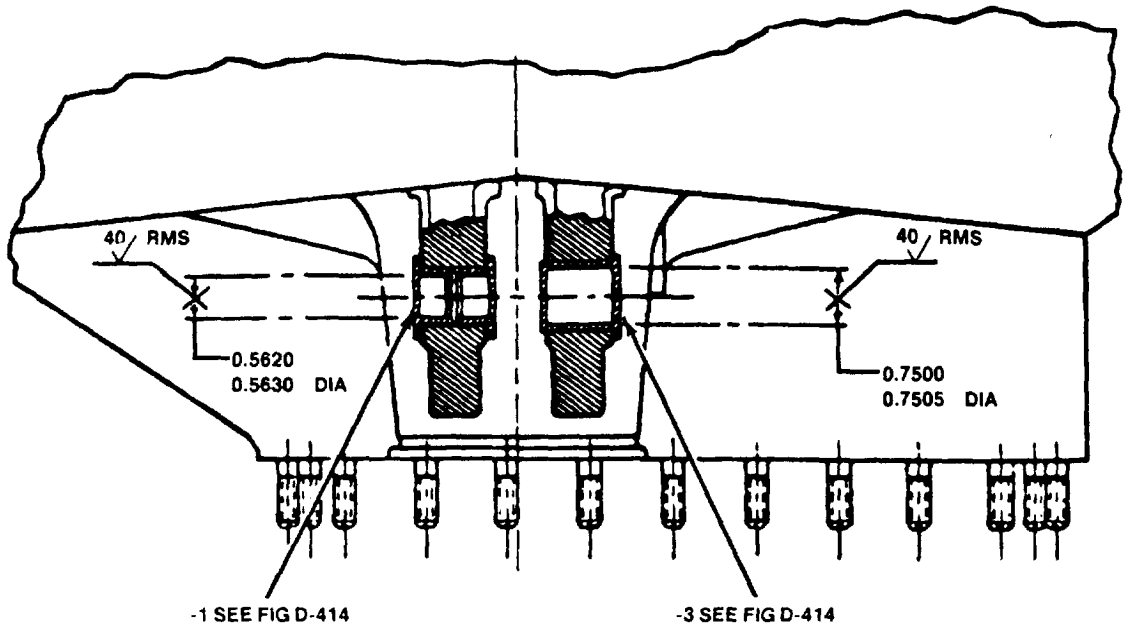


Figure 6-13.1 Damage Limits, Transmission (Sheet 3 of 6)



NOTES

1. Inside diameters of -1 and -3 bushings, to be concentric within 0.001 TIR.
2. -1 bushings to be replaced as a set of two, if worn excessively or loose.
   -3 bushings may be replaced individually.
3. Remove bushings by pressing out. Fluorescent penatrant inspect hole area that was in contact with bushing for evidence of cracks. Any crack is cause for scrapping of case.
4. Line ream old bushing hole to nearest bushing size, indexing from remaining bushing to maintain concentricity. (See Figure D-414.) Hole finish to be 40 RMS.
5. Coat housing area par MIL-M-3171, Type VI.
6. Locally manufacture bushing or bushings to match reamed hole. (See Figure D-414.)
7. Coat bushing with wet zinc chromate primer (C219).
8. Heat case to approximately 200F and press bushing in reamed hole.
9. Line ream bushing ID to dimensions specified in figure above maintaining concentricity requirements of 0.001 T/R.
10. Coat machined area with zinc chromate primer (C219).

Figure 6-13.1. Installation of Lift Link Bushings (Sheet 3.1 of 6)

AREA	LIMITS
All	No cracks allowed.
A and B	Corrosion, pitting or other mechanical damage is cause to replace transmission.
c	Mechanical or corrosion damage is acceptable if the following conditions are met: 1. Maximum depth after polishing damage is 0.020 inch. 2. Damaged area is treated for corrosion protection in accordance with table 2-4. No corrosion, pitting or other mechanical damage is allowed in the machined area around bolt holes. Existence of pitting or damage is cause to replace transmission.
D	Corrosion in Area “D” where main case to ring gear attaching bolts are installed is cause to replace transmission.
E	Mechanical and corrosion damage limits on exterior surface of main case and outside Area “D” and “G” are the same as stated for Area “C”.
F	A loose bearing liner for the bearing that supports the forward end of the input drive quill and/or corrosion between the bearing liner and the case is cause to replace the transmission.
D and G	Corrosion in Area “D” where main case to ring gear attaching bolts are installed is cause to replace transmission. Corrosion in Area “G” where main case to support case attaching studs are installed is cause to replace transmission. Mechanical or corrosion damage in Area “D” and Area “G” that does not extend under nuts and washers is acceptable if following conditions are met: 1. Maximum depth after polishing out damage is 0.020 inch. 2. Maximum area of damage within any one square inch is 20 percent. 3. Maximum area of damage in total area is 10 percent. 4. Damaged area is treated for corrosion protection in accordance with general instructions.
H	Mechanical or corrosion damage in Area “H” is acceptable if following conditions are met: 1. Maximum depth after polishing out damage on flat surfaces is 0.010 inch, and maximum length is 1.0 inch. 2. Maximum depth after polishing out damage on radii is 0.030 inch, and maximum length is two inches.

Figure 6-3.1. Damage Limits, Transmission (Sheet 4 of 6)

AREA	LIMITS
H	3. Damage is polished out and blended smoothly into surrounding surface. 4. Damaged area is treated for corrosion protection in accordance with general instructions. Mechanical or corrosion damage in Area “l” is acceptable if following conditions are met: 1. Maximum depth after polishing out damage on flat surfaces is 0.040 inch. 2. Maximum depth after polishing out damage on radii is 0.060 inch. 3. Damaged area is treated for corrosion protection in accordance with general instructions.
J	Mechanical or corrosion damage in Area “J” is acceptable if following conditions are met: 1. Maximum depth after polishing out damage on flat surfaces and radii is 0.060 inch. 2. Damaged area is treated for corrosion protection in accordance with general instructions.
K	Mechanical or corrosion damage in Area “K, which consists of all areas not covered by Areas “H”, “l”, and “J”, is acceptable if following conditions are met: 1. Maximum depth after polishing out damage is 0.010 inch. 2. Damage area is treated for corrosion protection in accordance with general instructions.
L	Wear and damage to lift link bushings installed in Area “L” is acceptable if following conditions are met: 1. Diameter “A" must not be greater than 0.5630 inch. 2. Diameter “B” must not be greater than 0.7505 inch. 3. Surface finish inside bushings must be 40 RHS (roughness height ratio) or better. 4. Bushings must be securely mounted on case. Signs of yielding, and/or cracks in lift link bushing support lugs is cause to replace transmission. (See Figure 6-13.2)

GENERAL INSTRUCTIONS

1. Evidence of corrosion under shim plates at quill mounting ports is cause to replace the transmission and/or affected quill.

2. Loose or damaged studs at Area “A” and loose studs or inserts at any of the quill mounting ports are cause to replace the transmission.

Figure 6-13.1. Damage Limits, Transmission (Sheet 5 of 6)

GENERAL INSTRUCTIONS (Continued)

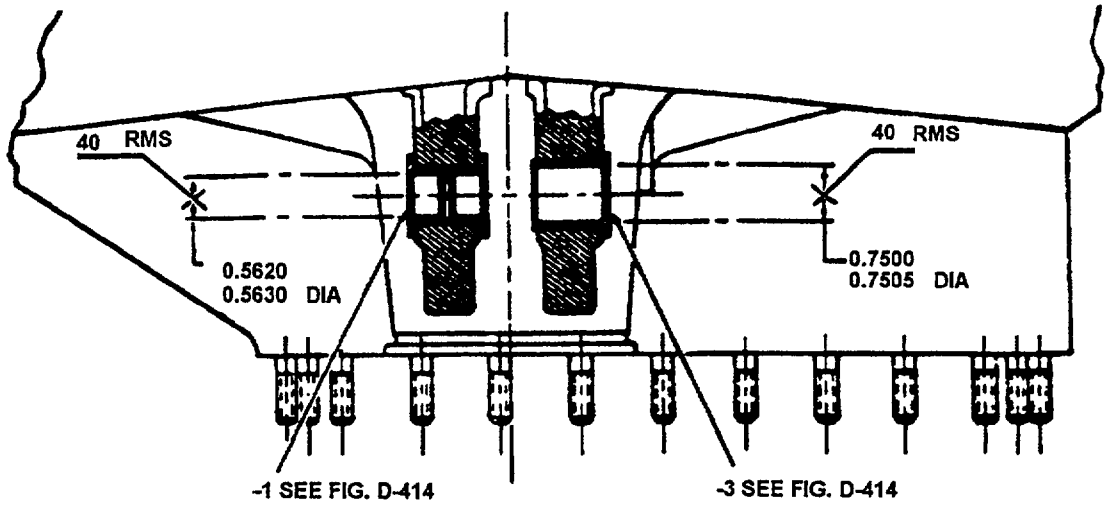
3. Polish out corrosion damage to twice the depth of the corrosion. Finish polishing out with 400 grit abrasive paper to blend repair smoothly into surrounding surface. Ensure that depth and/or area of repair does not exceed acceptable limits specified for the areas designated above. Treat reworked areas for corrosion protection with Dow 7 treatment. Refer to TM 55-1500-34423 for application procedures. Prime all rework areas that were painted prior to repair. Use polyamide epoxy primer. Paint to match existing finish.

4. Polish out mechanical damage to depth to remove all traces of the damage. Ensure that damage does not exceed limits, apply corrosion, prime, and paint in same manner prescribed in preceding step.

NOTE

Do not confuse pitting that has been chemically treated by the overhaul facility with live corrosion.

Figure 6-13.1. Damage Limits, Transmission (Sheet 6 of 6)



NOTES

1. INSIDE DIAMETER OF -1 AND -3 BUSHINGS, TO BE CONCENTRIC WITHIN 0.001 TIR.
2. -1 BUSHING MAY BE REPLACED AS SET OF TWO, IF WORN EXCESSIVELY OR LOOSE. -3 BUSHINGS MAY BE REPLACED INDIVIDUALLY.
3. REMOVE BUSHINGS BY PRESSING OUT. FLUORESCENT PENETRANT INSPECT HOLE AREA THAT WAS IN CONTACT WITH BUSHING FOR CRACKS. ANY CRACK IS CAUSE FOR SCRAPPING OF CASE.
4. LINE REAM OLD BUSHING HOLE TO NEAREST BUSHING SIZE, INDEXING FROM REMAINING BUSHING TO MAINTAIN CONCENTRICITY. (SEE FIG.D-414) HOLE FINISH TO BE 40 RMS.
5. COAT HOUSING AREA PER MIL-M-3171, TYPE VI.
6. LOCAL MANUFACTURE BUSHING OR BUSHINGS TO MATCH REAMED HOLE (SEE FIG.D-414).
7. COAT BUSHING WITH WET ZINC CHROMATE PRIMER (C219).
8. HEAT CASE TO APPROXIMATELY 200 E F AND PRESS BUSHING IN REAMED HOLE, 9. LINE REAM BUSHING ID TO DIMENSIONS SPECIFIED IN FIGURE ABOVE MAINTAINING CONCENTRICITY REQUIREMENTS OF 0.001 TIRE 10. COAT MACHINED AREA WITH ZINC CHROMATE PRIMER (C219).

Figure 6-13.2. Installation of Lift Link Bushings

Table 6-4. Troubleshooting — Transmission Assembly

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

1. Low oil pressure (on caution panel or pressure gage, but not both).

STEP 1. Faulty caution panel or gage circuit or unit,

Repair electrical circuit or replace faulty unit (paragraph 8-268 or 9-171h).

2. Low oil pressure (shown on both caution panel and pressure gage).

STEP 1. Pressure relief valve malfunction.

Adjust or replace valve (paragraph 6-67).

STEP 2. Clogged pump or debris monitor screen.

Clean pump screen and debris monitor screen and cup (paragraph 6-49.4), check oil for chips or contamination (figure 6-14 and paragraph 6-30.1 or 6-81).

STEP 3. Faulty oil pump.

Replace pump (paragraph 6-50).

STEP 4. Leakage or restriction between pressure relief valve ant! transmission.

Repair oil line connections or replace seals (paragraph 6-81).

3. No oil pressure (with normal oil level).

STEP 1. Faulty gage or transmitter or circuit.

Repair circuit or replace faulty unit (paragraph 8-258).

STEP 2. Oil pump failure.

Replace transmission or if transmission is not internally damaged, pump only (paragraph 6-35 or 6-50).

4. No oil pressure (no oil supply).

STEP 1. Leak in system or failure to service.

Replace transmission (paragraph 6-31). Replace oil cooler (paragraph 6-217). Flush and repair external lines (paragraph 6-203).

Table 6-4. Troubleshooting - Transmission Assembly (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

5. High oil pressure (on caution panel or pressure gage).

STEP 1. Faulty gage or transmitter or circuit.

Repair circuit or replace faulty unit (paragraph 8-258).

STEP 2. Pressure relief valve malfunction.

Adjust or replace (paragraph 6-67).

6. High oil temperature (on caution panel or temperature gage, but not both.)

STEP 1. Faulty caution panel or gage circuit or unit.

Repair circuit or replace faulty unit (paragraph 8-258).

7. High oil temperature (shown on both caution panel and gage).

STEP 1. Obstructed air flow around transmission.

Clear cowl opening and sump area.

STEP 2. Oil cooler thermal (bypass) valve malfunction.

Replace thermal valve (paragraph 6-211).

STEP 3. Pressure relief valve malfunction.

Adjust or replace valve (paragraph 6-67).

STEP 4. Clogged oil jets.

Clean or replace jets (paragraph 6-60). Or replace transmission for internal damage (paragraph 6-31). Inspect external oil filter (paragraph 6-208 or 6-210.4).

STEP 5. Seized bearings or other internal transmission failure.

Replace transmission and mast assembly (paragraphs 6-31 and 6-136). Replace oil cooler and flush transmission oil system (paragraph 6-203). Inspect external filter (paragraph 6-204 or 6-210.4).

STEP 6. Oil cooler clogged or obstructed.

Clean cooler core air passages. Replace cooler if internally clogged, and flush oil lines (paragraph 6-203). Inspect transmission filter (paragraph 6-41) or debris monitor (paragraph 6-49.4). Inspect pump screen, magnetic plug and electric chip detector (paragraph 6-81) or debris monitor (paragraph 6-49.4).

Table 6-4. Troubleshooting - Transmission Assembly (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

STEP 7. Oil cooler blower malfunction (if engine oil temperature also high).

Replace blower or repair bleed air connection (paragraph 4-91).

8. Metal chips on generator drive quill magnetic plug, pump screen or transmission sump electric chip detector or debris monitor.

STEP 1. Internal transmission failure of gears or bearings.

If metal limits exceed limits of figure 6-14 or table 6-5 (aircraft equipped with ODDS), replace oil cooler and flush transmission oil system (paragraph 6-203). Inspect external filter (paragraph 6-204 or 6-210.4).

9. Excessive pylon motion.

STEP 1. Pylon mounts worn or improperly installed.

Repair or replace mounts (paragraph 6-142).

STEP 2. Faulty pylon mount friction dampers.

Replace friction dampers (paragraph 6-149).

10. Grease leakage at tail rotor drive couplings.

STEP 1. Damaged seal or grease retainer plate.

Replace seal or grease retainer plate in coupling (paragraph 6-125).

11. Tail rotor driveshaft vibration.

STEP 1. Clamps loose or incorrectly positioned.

Torque clamps and ensure correct positioning (paragraph 6-159).

STEP 2. Clamp halves mismatched.

Replace clamp set (paragraph 6-159).

STEP 3. Hanger bearings or couplings incorrect part number.

Replace hanger assembly (paragraph 6-167).

Table 6-4. Troubleshooting - Transmission Assembly (Cont)

CONDITION

TEST OR INSPECTION

CORRECTIVE ACTION

STEP 4. Driveshaft balance strips bent or missing.

Replace driveshaft section (paragraph 6-159).

STEP 5. Dry or faulty hanger bearing or couplings. Refer to 12. below.

12. Binding or roughness when manually rotating driveshaft.

STEP 1. Check hanger assemblies for dry or faulty bearings. Isolate hanger assemblies by disconnecting driveshafts, as required.

Replace faulty hanger assemblies(paragraph 6-167).

STEP 2. Check flexible couplings for lack of lubricant and roughness. Isolate hanger assemblies by disconnecting driveshafts as required.

Replace faulty hangers, quills or gearbox (paragraphs 6-167, 6-179 or 6-190).

STEP 3. Disconnect gearbox quills. Rotate quills and check for internal binding.

Replace defective gearbox (paragraph 6-179 or 6-190).

6-30. Identification of Metal Particles - Transmission Assembly and Gearboxes.

WARNING

When any particles found are readily identifiable as fragments of transmission or gearbox parts, such as gears, nuts, bearings, oil slingers, thrust washers, snap-rings, safety wire or other components, replace transmission or gearbox.

NOTE

The presence of metal particles does not necessarily indicate that the transmission or gearbox is no longer serviceable. The quantity, source, form and type of metal found, together with the service history or the particular transmission, must be taken into consideration. The time accumulated since the transmission or gearbox was new or overhauled, previous failures and the type of operation are important factors in determining the further serviceability of the unit. The particles found may be steel, tin, lead, aluminum, magnesium, copper (bronze) or phenolic in various shapes and quantities. For a detailed explanation of the action made necessary by the presence of each of the possible types of particles in the transmission or gearboxes, see figure 6-14.

METAL PARTICLES CONTAMINATION -TRANSMISSION OR GEARBOX OIL

KIND OF METAL	QUANTITY AND/OR SIZE	ACTION REQUIRED	NOTES
Magnetic (Steel)	Fuzz - fine hair-like particles.	None	Result of normal wear. May have exaggerated appearance because of oil.
	Particles in granular form. Quantity less than 100.	Drain and flush transmission lube system.	Minor wear - usually not indicative of impending failure.
	Thin flakes, chunks, or splinters not exceeding 1/16 (0.060) inch in thickness and 1/16 (0.060) inch in length. Quantity not to exceed 50 flakes or splinters.	Drain and flush transmission lube system.	Minor wear - usually not indicative of impending failure.
	Thin flakes, chunks, or splinters exceeding 1/16 (0.060) inch in thickness or 1/16 (0.060) inch in length. Quantity exceeding 50 flakes or splinters,	For non-ODDS helicopters, complete serviceability check 6-30.1. For ODDS helicopters, perform serviceability check 6-30.2.	May indicate an impending failure.
	Granular particles, quantity greater than 100.	For non-ODDS helicopters, complete serviceability check 6-30.1 . For ODDS helicopters, perform serviceability check 6-30.2.	May indicate an impending failure.
Non-magnetic (aluminum, magnesium, copper, bronze, etc.)	Granular particles; may appear as miniature lathe turnings.	For non-ODDS helicopters, complete serviceability check 6-30.1. For ODDS helicopters, perform serviceability check 6-30.2.	

Figure 6-14. Gearbox Contamination Particle Classification

NOTE

A visual inspection of color and hardness will occasionally suffice to identify the particles (figure 6-14). When visual inspection does not positively identify the particle, the kind of particle present may be determined by a few simple tests. Equipment to perform tests includes a permanent magnet, electric soldering iron, and concentrated nitric acid.

a. Steel. Steel particles may be isolated using a magnet.

b. Tin and lead. Tin and lead may be distinguished by their low melting points. Clean soldering iron: heat it to about 500 F: then tin it with 50-50 solder (50 percent lead and 50 percent tin). Wipe off excess solder. Tin or lead particles dropped onto hot, soldering iron will melt and fuse with solder. Do not overheat iron.

c. Aluminum. Aluminum particles may be determined by testing their reaction to hydrochloric acid. When a particle of aluminum is dropped into hydrochloric (muriatic) acid it will fizz with a rapid emission of bubbles. The particles will gradually disintegrate and form a black residue.

NOTE

Since magnesium and aluminum react similarly in hydrochloric acid, when in doubt drop particle into nitric acid (C180). Aluminum does not react noticeably in nitric acid.

d. Copper or bronze and magnesium. Copper or bronze and magnesium may be differentiated by their respective reactions to nitric acid (C180). When a particle of copper or bronze is dropped into nitric acid it forms a bright green cloud in the acid. When a particle of magnesium is dropped into nitric acid it fizzes with a rapid emission of bubbles. Phenolic and aluminum do not react noticeably to nitric acid.

e. Decision Aids. Use the following information in reaching a decision to replace a component or continue it in service.

(1) Debris in oil system does not necessarily mean that component is no longer serviceable. Quantity of debris as well as size, type, and composition must be considered. Component time, gage indications, and noise and vibration levels must also be considered.

(2) Metallic debris can be a result of earlier maintenance activity or of wear. Maintenance records should be examined and considered first for history and possible cause. Debris from earlier chip events should be examined for comparison.

(3) Debris from significant failure modes is usually a single type. When several types are present, pay particular attention to identifying significant types.

(4) It is likely that a maintenance generated chip light will occur during the first 25-50 hours of operation following replacement of a component. It is also likely that several maintenance generated chip lights will occur in the first 50 hours of operation following installation of ODDS.

(5) A single chip is rarely significant.

f. Inspect chip detector/debris monitor (non-ODDS helicopters).

NOTE

Chip detector is inspected when CHIP DET caution light comes on.

NOTE

Document the findings of the chip detector inspection on DA Form 2408-20, Block 7.

(1) Remove and inspect transmission sump chip detector. Remove chips, if any, from chip detector and retain for analysis.

NOTE

Although chip detector gap may contain particles in sufficient quantities to have caused a chip light, the light may not remain lit after the chip detector is removed. If unsure about the proper operation of the chip detector, perform a continuity check to insure the chip detector system is functioning properly.

(2) Evaluate chips found and perform required actions per Figure 6-14, Figure 6-14.1 and Table 6-5.

(3) Clean and reinstall chip detector.

g. Inspect chip detector/debris monitor (ODDS-Equipped Helicopters).

NOTE

Debris monitor and transmission sump chip detector are inspected when CHIP DET caution light comes on.

NOTE

Document the findings of the chip detector and debris monitor inspections on DA Form 2408-20, Block 7.

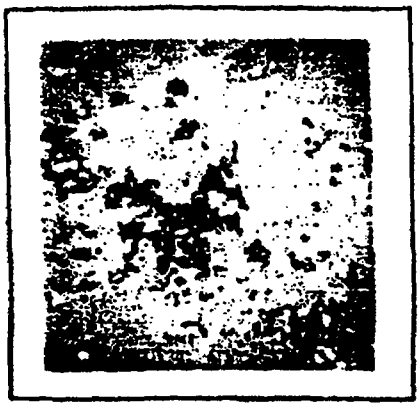
(1) Remove and inspect transmission sump chip detector. Remove and inspect gearbox debris monitor. Remove chips, if any, and retain for analysis.

Table 6-5. Oil Debris Classification

DEBRIS TYPE	DESCRIPTION	QUANTITY/SIZE	CAUSE/ACTION REQUIRED
A. Flake (steel) (significant)	Thin, flat, oblong particles with rounded or scalloped sides. Like corn flakes.	SIZE: Up to 0.040 long and very thin. QUANTITY: Generally more than 10 particles per chip event.	Typically result from spalling of bearings. Usually indicates bearing wear and, sometimes, gear wear. (Note 1.)
B. Chunk/Fragment (steel) (significant)	Sometimes identifiable as fragment from specific component in engine or transmission. Shape varies widely. Sometimes shows distinct fracture surface.	SIZE: Varies greatly. QUANTITY: Usually 1 to 5 per chip event.	Indicates possibility of major failure of part: e.g., gears, bearings or other dynamic elements. Can sometimes be maintenance/induced or residual debris from previous failure. (Note 1.)
C. Granule (steel) (significant)	Fine, powder-like clumps, irregular shaped debris. Like coffee grounds.	SIZE: Length and width are similar and generally 0.010. Thickness varies, but is generally one-half length-width. QUANTITY: Usually more then 50 per chip event.	Usually bearing or gear wear, scoring. Generally associated with fretting or components spinning in housings or on shafts. May be mixed with flakes or fragments. (Note 1.)
D. Bronze (significant)	Granular, chunks, fragment or powder-like golden particles.	To be significant, 25 particles, any size, per chip event.	Bearing cage wear or failure and usually preceded by chip light event with small quantities of magnetic debris. (Note 1.)
E. Wire/hair Splinter/silver (possibly significant)	Long, thin wire or hair-like particles. May have jagged edges and exhibit fracture planes. Like steel wool or wood splinters.	SIZE: Length generally does not exceed 0.080, width and thickness 0.010 to 0.012. QUANTITY: Generally 1 to 20 particles per chip event.	Generally not a significant wear mode. Often associated with maintenance-induced debris. In T-53 engine, may come from torquemeter cylinder. (Note 1.)
F. Cutting/Turning (possibly significant)	Curled, twisted debris of varying length and thickness. Like lathe turnings.	SIZE: Length to 0.08, width 0.10 to 0.08. Thickness varies greatly. QUANTITY: 5 to 20 particles per chip event.	Usually maintenance-induced and not significant. However, recurrence of large quantity usually indicates abrasive wear by bearings or seals rotating in housing. (Note 1.)
G. Chrome/Silver (possibly significant)	Large flat particles. Like shavings, peelings.	To be significant, must be greater than 3 particles which are more than 0.08 long.	Platings or coatings separating from parts: e.g., bearings. (Note 1.)
H. Aluminum/Magnesium (possibly significant)	Granular, powder-like chunk or turning particles. Can be bright silver-white to gray if very fine.	To be significant, 20 to 30 large pieces.	Not usually significant. Wear of housing or failure of shims, spacers, cases. (Note 1.)
I. Carbon (possibly significant)	Black, usually granular, powder, may include chunks or silvers.	Usually requires large quantity to be significant.	Engine only. Generally due to wear of carbon seals. Usually, other operational symptoms occur, such as increased oil consumption, smoking, filter bypass, or leaking. (Note 1.)
J. Epoxy/Phenolic (possibly significant)	Varies in color and can be fibers or peelings or plating-like particles.	Variable	Manufacturing debris or coating peeling. (Note 1.)

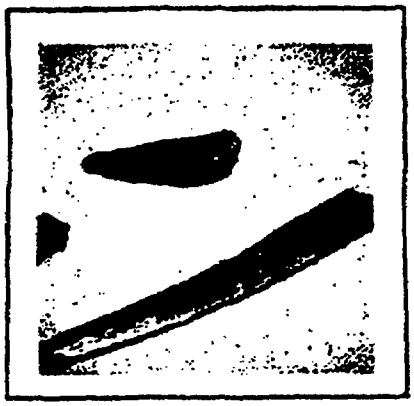
NOTES

1. **Refer to oil contamination troubleshooting for the system.**
2. **Use this table in conjunction with Figure 6-14.1.**
3. **Dimensions are in inches.**



STEEL FLAKES
(SIGNIFICANT)

STEEL GRANULES
(SIGNIFICANT)



STEEL CHUNKS
(SIGNIFICANT)

BRONZE FRAGMENTS
(SIGNIFICANT)

CHUNKS, TURNINGS
(SIGNIFICANT)

Figure 6-14.1. Typical Oil System Debris at 6X Magnification

NOTE

Although chip detector/debris monitor gap may contain particles in sufficient quantities to have caused a chip light, the light may not remain lit after the chip detector is removed. If unsure about the proper operation of the chip detector/debris monitor, perform a continuity check to insure the chip detector system is functioning properly.

WARNING

If fragment can be identified as a piece from a specific internal component, replace the transmission.

(2) Evaluate chips found and perform required actions per Figure 6-14, Figure 6-14.1, and Table 6-5.

(3) Clean and reinstall transmission sump chip detector. Clean and reinstall debris monitor.

6-30.1. Serviceability Check (Chip Light) - Non-ODDS Helicopters

NOTE

If helicopter is at a remote location (away from adequate maintenance facilities), perform serviceability check in paragraph 6-30.3.

a. Remove the transmission mounted oil filter. Visually inspect filter elements for particles. Retain particles for analysis.

b. Check the external oil filter impending bypass button. If extended, do the following:

(1) Replace filter element. Retain any particles for analysis.

(2) Drain all oil from main transmission through clean cheesecloth. Retain particles for analysis. Reservice transmission with new oil.

c. If chips were found in the filter, re-evaluate all chips found per Figure 6-14, Figure 6-14.1 and Table 6-5. If chips exceed removal limits, remove the transmission.

d. Start engine and run at flight idle for 30 minutes.

e. Hover aircraft for 30 minutes. Shut down engine and again inspect transmission chip detector.

f. If no chips are found, return the helicopter to service.

NOTE

In some cases, the 30 minute ground run and 30 minute hover may not completely clean out the lube system. If very small amounts of debris or fuzz remains after the ground run and hover, the serviceability check may be repeated one time. If chips remain after the second serviceability check, remove the transmission.

g. If chips are found, remove transmission. Flush airframe oil system and oil cooler.

6-30.2. Serviceability Check (Chip Light) - ODDS - Equipped Helicopters.

NOTE

DELETED

a. Check the external oil filter impending bypass button. If extended, do the following:

(1) Replace filter element. Retain any particles for analysis.

(2) Drain all oil from main transmission through clean cheesecloth. Retain particles for analysis. Reservice transmission with new oil.

b. If chips were found in the filter, re-evaluate all chips found per Figure 6-14, Figure 6-14.1 and Table 6-5. If chips exceed removal limits, remove the transmission.

c. Start engine and run at flight idle for 30 minutes.

d. Hover aircraft for 30 minutes. Shut down engine and again inspect transmission debris monitor and chip detector.

e. If no chips are found, return the helicopter to service.

NOTE

In some cases, the 30 minute ground run and 30 minute hover may not completely clean out the lube system. If very small amounts of debris or fuzz remains after the ground run and hover, the serviceability check may be repeated one time. If chips remain after the second serviceability check, remove the transmission.

f. If chips are found, remove transmission. Flush airframe oil system and replace oil cooler.

WARNING

If fragment can be identified as a piece from a specific internal part, replace transmission or engine.

(1) Steel. Steel particles can be isolated using a magnet.

(2) Bronze. Bronze is identified by color (gold).

(3) Aluminum or Magnesium. When a particle of aluminum or magnesium is dropped into hydrochloric acid (C134), it fizzes, with rapid emission of bubbles. The particle gradually becomes black residue. Magnesium fizzes in nitric acid (C180); aluminum does not.

c. Decision Aids. Use following information in reaching a decision to replace a component or continue it in service.

(1) Debris in oil system does not necessarily mean that component is no longer serviceable. Quantity of debris as well as size, type, and composition must be considered. Component time, gage indications, and noise and vibration levels must also be considered.

(2) Metallic debris can be result of earlier maintenance activity or of wear. Maintenance records should be examined and considered first for history and possible cause. Debris from earlier chip events should be examined for comparison.

(3) Debris from significant failure modes is usually a single type. When several types are present, pay particular attention to identifying significant types.

(4) It is likely that a maintenance-generated chip light will occur during first 25-50 hours of operation following replacement of a component. It is also likely that several maintenance-generated chip lights will occur in first 50 hours of operation following installation of ODDS.

(5) A single chip is rarely significant.

6-30.3. Decision Criteria for Replacement of Transmission Following Chip Caution Light. (Helicopters With MWO 1-1520 -242-50-2 Oil Debris Detection System) (ODDS).

Collection and analysis of Debris Samples -

In the event of chip light illumination, proceed as follows:

NOTE

It is very difficult to provide procedures for all types of chip light occurrences. Units should take full advantage of all information available, such as DA Form 2408 history, oil debris classification chart, supporting oil labs, CCAD service center, etc...

NOTE

Determine the different types of debris on the chip detector, since it is possible to have more than one type of debris on the chip detector. An example would be the presence of both flakes and granules on the chip detector. More than 10 flakes or more than 50 granules would be cause for component replacement. Any combination of less than 10 flakes and 50 granules would be acceptable.

NOTE

Replacement of external oil filter on ODDS equipped aircraft is "on condition" and only when associated impending bypass indicator button is extended (second reset) or main transmission change. The affected chip detector should also be removed and inspected whenever the impending bypass indicator button is extended. Since fine filtration cleans the lubricant in the component, do not replace lubricant when replacing filter. Flushing and filtering of system (unless there is a component replacement) is not required or authorized as this may mask problems and prevents trend of data.

(1) Remove and inspect debris monitor. Classify debris I.A.W. oil debris classification chart (Figure 6-14.1). Document findings on DA Form 2408-20, Block 7.

NOTE

More frequent chip lights may be encountered in the first 50 hours of operation of a component which has undergone an overhaul or major repair, as well as break in wear debris, being present in lube system. This type of debris is normal and not indicative of a problem with ODDS system.

(2) Clean debris monitor, and screen with solvent (C112) and clean cloth and reinstall.

(3) If evaluation of debris requires component replacement, remove component and forward to overhaul.

(4) If evaluation of debris does not require replacement of component, operate aircraft for one hour (30 minutes flat pitch ground run and 30 minutes hover in ground effect). Re-check chip detector. Classify debris I.A.W. oil debris classification chart (Figure 6-14.1).

(5) If number or size of debris increases, remove defective component and forward to overhaul.

(6) If number or size of debris decreases or remains the same, return aircraft to service.

6-31. Removal — Transmission Assembly.

Premaintenance requirements for removal and disassembly of transmission assembly

Conditions	Requirements
Part No, or Serial No.	205-040-001, 204-040-016
Special Tools	(T19), (T21)
Test Equipment	None
Support Equipment	Hoist -800 pound capacity
Minimum Personnel Required	Two
Consumable Materials	(C11), (C29), (C86), (C105), (C115), (C122), (C129), (C166), (C166A), (C168), (C180), (C206), (C244), (C261), (C279), (C312)
Special Environmental Conditions	None

a. When the transmission is to be replaced, unless conditions prevent operation, perform a 10 minute ground runup and drain operating oil. If runup is not practical, remove mast assembly and spray the interior of the transmission through the top opening with approximately 1 gallon of oil (C 166, C166A, or C168). While spraying, manually rotate internal gears and bearings with input drive quill and drain oil. Attach tag to the transmission stating: TRANSMISSION PRESERVED WITH LUBRICATING OIL (paragraph 6-38).

b. Open transmission fairing and remove engine intake fairing.

c. In cabin remove access panels from both sides of pylon island structure.

d. Disconnect battery and any external power source. Disconnect electrical leads from DC generator. (16, Figure 6-13.)

e. Disconnect transmission electrical harness at connector on right pylon support.

f. Remove, hydraulic pump from drive pad on right side of transmission sump case (paragraph 7-21).

g. Disconnect transmission oil inlet, outlet and drain hoses (13, figure 6-13) at quick-disconnect couplings.

h. Remove upper section of induction baffle, and upper section of engine intake screen.

i. Remove main driveshaft (paragraph 6-17).

j. Remove other sections of induction baffle.

k. Remove bolt (9, figure 6-13) securing eyebolt pylon fifth mount (10) to support beam (2).

NOTE

Aircraft modified with the Improved Particle Separator (IPS) will have bolt (9) installed with head pointing forward. Ensure that bolt (9) does not slide back into eyebolt of support fitting (10) after removal of nut (18) during transmission removal.

l. Disconnect forward section of tail rotor driveshaft by removing coupling clamps at tail rotor drive quill (12) on transmission, and at first bearing hanger (paragraph 6-163). Move driveshaft section aft out of way.

m. Erect maintenance hoist (T53) through left aft side of cabin roof, with end fitting in bearing plate on cabin floor (or any hoist having 800 pound capacity).

n. Remove stabilizer bar (paragraph 5-40).

o. Remove main rotor hub (paragraph 5-12).

p. Disconnect lower control linkage from swashplate horns, from collective pitch lever on swashplate support, and from elevator control bellcrank on transmission. Stow linkage out of way.

q. Reinstall mast nut on top of mast (1, figure 6-13). Attach hoist to lifting eye on mast nut and take up cable slack.

NOTE

If mast is not installed, cover with lifting eye can be used to remove the transmission.

r. Disconnect lift link from clevis (14) on forward underside of transmission support case by removing retaining bolt assembly (bolt-spacer-washer), nut and washer. Keep attaching parts with link.

s. Remove bolt (5) washer (6), and shouldered washer (7) from top of the two forward and two aft mounts (11) at four ears of transmission support case.

t. Remove eight bolts and washers attaching fifth mount support fitting (47, figure 6-38) to aft side of pylon support and remove fitting and shims (6, figure 6-38) if shims are installed.

NOTE

Ensure that all electrical leads and clamps have been disconnected from transmission to fuselage structure before beginning hoisting operations.

u. Carefully hoist mast and transmission assembly clear of fuselage structure. Remove fifth mount support beam (2) from aft side of transmission support case.

v. Place transmission on stand (T21), adapter (T19). Secure with bolts through transmission support case ears.

w. Remove remaining control assemblies from mast, as required (paragraphs 5-61, 5-71, and 5-79). Leave mast as part of assembly; or remove if necessary (paragraph 6-136).

x. If transmission is to be replaced, disassemble in accordance with paragraph 6-32.

6-32. Disassembly — Universal Transmission Assembly Build-Up.

NOTE

The parts required to convert the universal transmission are shown in figure 6-15. Disassemble parts only to the extent necessary for removal.

a. Install transmission to be replaced on stand (T21) with adapter (T19).

b. Disconnect and remove electrical harness from transmission, retaining clamps and hardware on harness.

c. Disconnect hose assembly (1, figure 6-15) from No. 8 oil jet, and at tee fitting, disconnect clamp (46) and retain with hose.

d. Disconnect hose assembly (28) from elbow (32) and remove bracket (30) from transmission sump. Retain bracket and clamps (27) with hose. Reinstall small angle bracket (30) on sump with washers (31) and nuts (26) and screws (29).

e. Remove elbow (32) and nut (33) from pressure manifold. Discard preformed packing (34).

f. Remove tube (24) from elbow (22) and filler assembly (25).

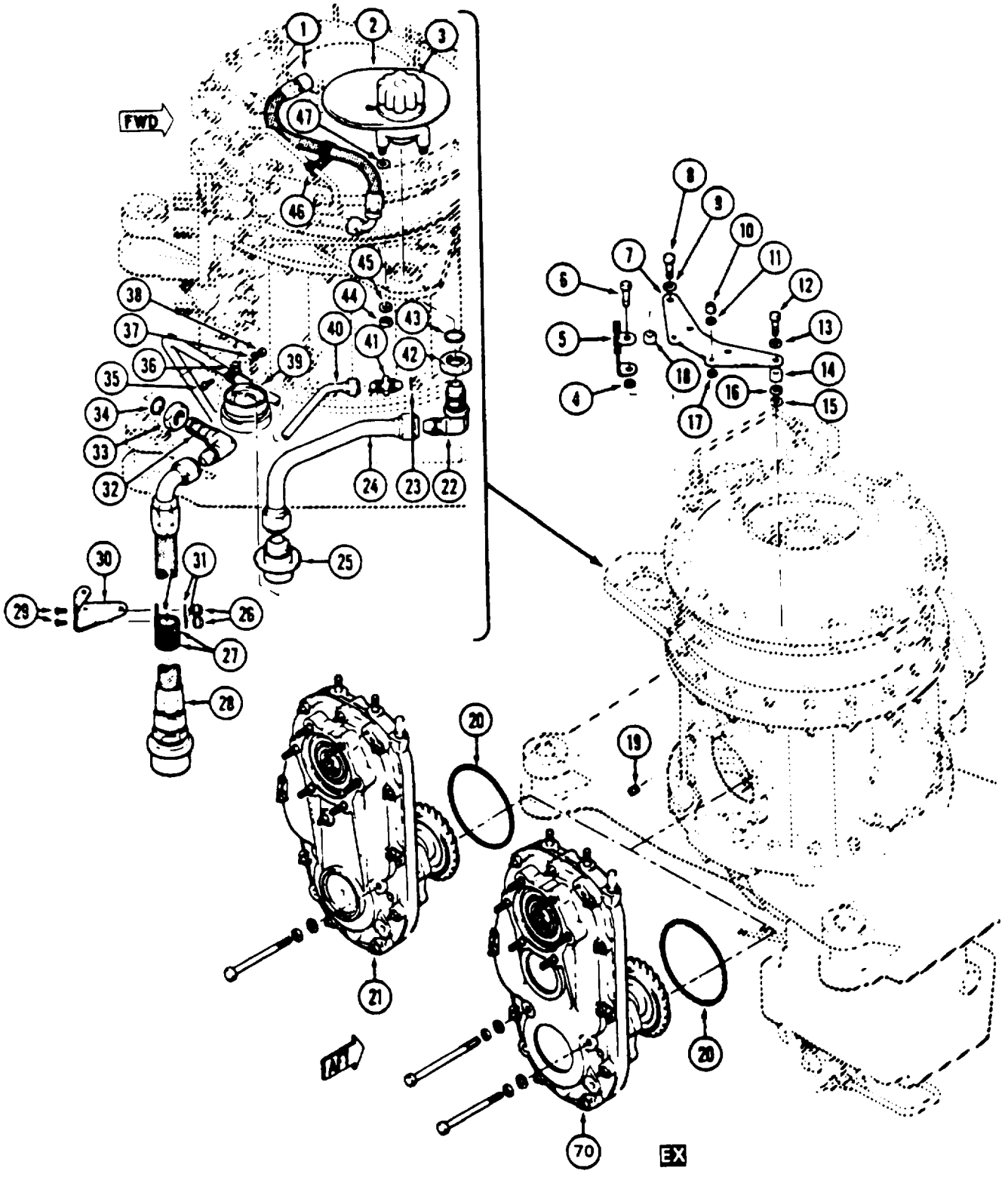


Figure 6-15. Universal Transmission Assembly - Build-up (Sheet 1 of 3)

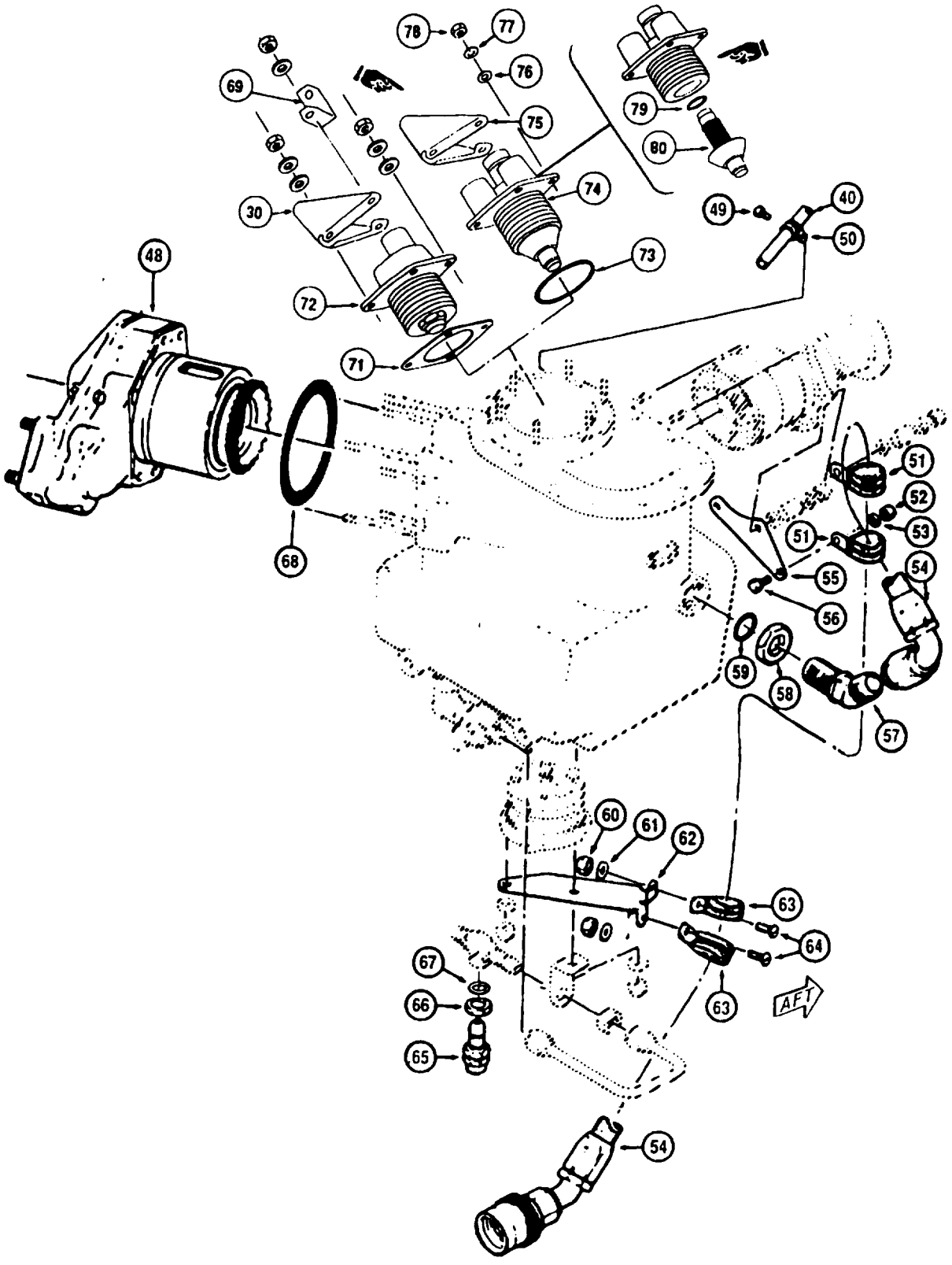


Figure 6-15. Universal Transmission Assembly-Buildup (Sheet 2 of 3)

1. Hose assembly
2. Neck and scupper assembly
3. Filler cap
4. Washer
5. Cyclic spring bracket
6. Bolt
7. Support bracket
8. Bolt
9. Washer
10. Nut
11. Washer
12. Bolt
13. Washer
14. Spacer
15. Washer
16. Washer
17. Shim
18. Spacer
19. Set screw
20. Preformed packing
21. Quill, generator drive
22. Elbow
23. Preformed packing
24. Tube
25. Filler assembly
26. Nut
27. Clamp
28. Hose assembly
29. Screw
30. Bracket
31. Washer
32. Elbow
33. Nut
34. Preformed packing
35. Screw
36. Clamp
37. Washer
38. Nut
39. Case assembly port
40. Tube assembly
41. Union
42. Nut
43. Preformed packing
44. Nut
45. Washer
46. Clamp
47. Washer
48. Quill, hydraulic pump and tachometer drive
49. Screw
50. Clamp
51. Clamp
52. Nut
53. Washer
54. Hose assembly
55. Bracket
56. Bolt
57. Elbow, 45 degrees
58. Nut
59. Preformed packing
60. Nut
61. Washer
62. Bracket
63. Clamp
64. Screw
65. Drain coupling half
66. Nut
67. Preformed packing
68. Preformed packing
69. Bracket
70. Quill, alternator drive
71. Gasket
72. Filter
73. Packing (ODDS)
74. Debris monitor (ODDS)
75. Bracket (mod) (ODDS)
76. Washer (ODDS)
77. Washer (ODDS)
78. Nut (ODDS)
79. Packing
80. Cup and Screen

Figure 6-15. Universal Transmission Assembly - Build-up (Sheet 3 of 3)

g. Disconnect tube (40) from union (41), clamps (36 and 50) and move from transmission. Retain clamps on tube.

h. Remove neck and scupper assembly (2) from transmission bracket by removing nuts (44) and washers (45 and 47). Discard aluminum washers.

i. Remove filler assembly (25) from case assembly part (39). Install filler cap (3) over port.

j. Remove support bracket (7) and cyclic spring bracket (5) from top case by removing bolts (6,8 and 12), washers (9,11,13,15, and 16), spacers (14 and 18), and shims (4 and 17). Retain hardware.

k. Remove generator drive quill (21) from forward side of transmission (paragraph 6-111). Discard preformed packing (20, figure 6-15).

NOTE

Remove and retain setscrew (19, figure 6-15) for reinstallation in assembly.

l. Remove hydraulic pump and tachometer drive quill (48) from right side of sump case, (paragraph 6-120). Discard preformed packing (68, figure 6-15). Clean quill pad to remove sealant and install covers.

m. Disconnect hose assembly (54) from elbow (57) and brackets (55 and 62). Retain clamps (51 and 63) on hose.

n. Remove bracket (55) from tail rotor drive quill by removing attaching nuts, washers and spacers. Reinstall aluminum washers (new), steel washers, spacers, steel washers, and nuts (in that order) on quill studs.

o. Remove bracket (62) from oil pump in sump case by removing nuts and washers, Reinstall aluminum washers (new), steel washers and nuts (in that order) on pump studs.

p. Remove elbow (57) and nut (58) from sump case. Discard preformed packing (59).

q. Remove drain coupling half (65) and nut (66) from sump case. Discard preformed packing (67).

r. Remove pressure transmitter (2, figure 6-16) from pressure tap manifold (1) and discard preformed packing.

s. Remove pressure switch (3) from pressure tap manifold (1) and discard preformed packing.

t. Remove main rotor mast (paragraph 6-136).

u. If transmission was removed from helicopter with ODDS, remove debris monitor (74) and hose clamp bracket (75). Install gasket (71), filter (72) and bracket (30), using washers (76 and 77) and nuts (78).

v. Install protective caps, covers and plugs on all transmission openings and removed parts. Prepare

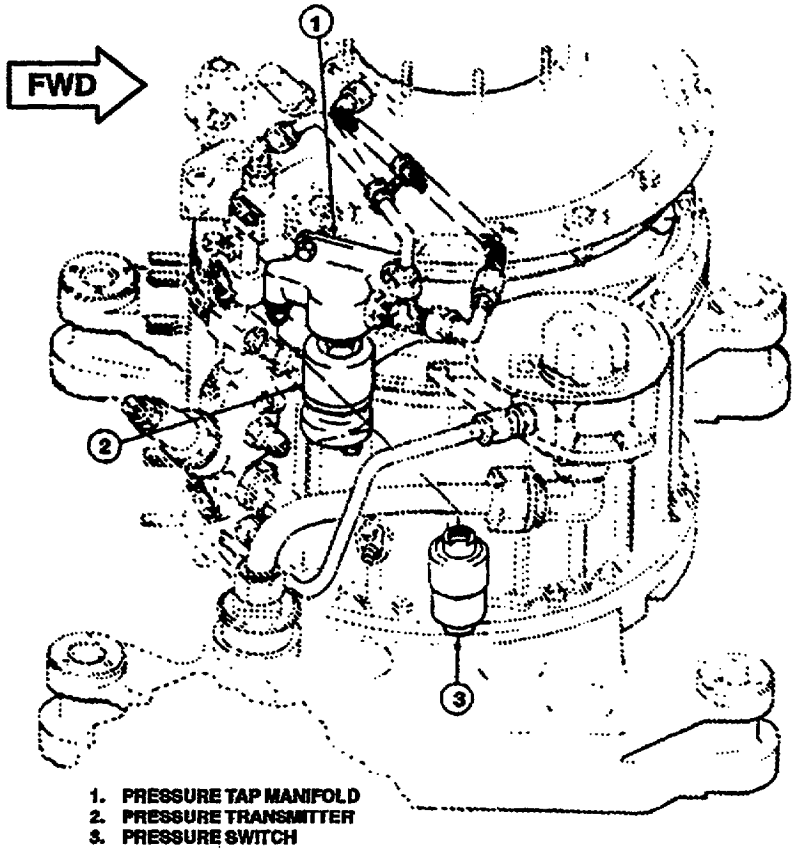


Figure 6-16. Transmission Pressure Transmitter and Switch

transmission assembly for return and overhaul (paragraph 6-38).

6-33. Inspection - Transmission Assembly.

a. Inspect the following transmission parts for metal particles or other contaminants in accordance with paragraph 6-30 and figure 6-14.

(1) External oil filter (paragraph 6-208 or 6-210.3).

(2) Transmission oil filter (paragraph 6-45) or debris monitor (paragraph 6-49.4).

(3) Transmission screen (paragraph 6-85).

(4) Magnetic plug (paragraph 6-113).

(5) Chip detector plug (paragraph 6-85).

b. Inspect for loose, missing or damaged bolts or studs.

c. Check for damaged locked-in studs or inserts.

d. Inspect transmission case for damage. General pitting throughout the case is acceptable, when the pitting depth does not exceed **0.030** inch. Pitting in machined areas not exceeding **0.010** inch is acceptable, provided that it does not allow seals to leak. Pitting in the mounting flange of **0.020** inch is permitted provided it does not extend through the bolt/stud hole. The standard wear criterion (high side of dimension **+0.005** inch) would apply. Treat all corrosion in accordance with TM 1-1500-344-23. If crack in main transmission case, ring gear case, or the transmission support case is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

e. Visually inspect all threaded fittings for thread damage and cracks. No cracks allowed. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

f. Inspect drive quills for condition, leakage and security of mounting. If removed, inspect for rough, or binding bearings, gear wear pattern, nicks, cracks, or galling. No cracks allowed. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

(1) Input drive quill (paragraph 6-95 or 6-104).

(2) Generator drive quill (paragraph 6-113).

(3) Hydraulic pump and tachometer drive quill (paragraph 6-121).

(4) Tail rotor drive quill (paragraph 6-129).

g. Inspect pylon mounts and lift link for condition (paragraph 6-145).

h. Inspect friction dampers for condition (paragraph 6-153).

i. Inspect main rotor mast for condition (paragraph 6-137).

j. inspect transmission oil thermal (bypass) valve, oil cooler, and connecting lines for condition (paragraphs 6-214 and 6-221).

k. Inspect cowl opening and sump area for obstruction.

i. Check oil level and service transmission (paragraph 1-6).

m. Inspect transmission vent cap for clogged condition (30, Figure 6-19).

(1) Remove and clean with (C261) and dry, compressed air.

(2) Reinstall vent cap (30) using new gasket (31). Torque 80 TO 120 inch-pounds. Lock wire (C155) to drilled hole in case.

6-34. Cleaning — Transmission Assembly.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

a. Clean transmission assembly and attaching parts with dry cleaning solvent (C261). Do not allow solvent to enter transmission openings.

b. Use soft bristle brush (C52) to aid in removing heavy deposits of grease and oil.

c. Dry parts with filtered compressed air.

6-35. Repair or Replacement — Transmission.

CAUTION

All parts removed from the transmission shall be inspected to determine serviceability. If the transmission was removed prior to normal overhaul life for metal particles in the oil system, the input drive quill, generator drive quill, hydraulic pump and tachometer drive quill and mast assembly shall not be used on the replacement transmission. in addition, the transmission oil cooler shall be replaced and all oil hoses, tubes and fittings shall be flushed.

NOTE

The transmission and mast assemblies must be returned to depot at the same time when the above caution condition exists.

a. if generator drive quill (21, figure 6-15) was removed for installation on a universal transmission accomplish the following:

(1) Replace (without repair) if metal particles were found in oil system.

(2) Replace (without repair) if quill sleeve OD is less than 4.9989 inches or is corroded and pitted.

(3) Replace (without repair) if quill bearings are rough or binding.

(4) Replace (without repair) if quill gear pattern shows excessive nicks, scratches or galling.

(5) For repair of quill leakage or damage refer to paragraph 6-115.

b. If hydraulic pump and tachometer drive quill (48, figure 6-15) was removed for installation on a universal transmission accomplish the following:

(1) Replace (without repair) if metal particles were found in oil system.

(2) Replace (without repair) if bearings are rough or binding.

(3) Replace (without repair) if gear patterns show excessive nicks, scratches or galling.

(4) Replace (without repair) if quill sleeve OD la less than 3.6247 inches.

(5) For repair of quill leakage or damage refer to paragraph 6-123.

c. Replace oil system fittings. hoses or tube assemblies that are crushed or damaged.

d. Replace (without repair) pylon mounts (10 and 11, figure 6-13) and lift link if damaged or deteriorated (paragraph 6-144).

e. Replace (without repair) friction dampers if damaged or deteriorated (paragraph 6-151).

f. Replace (without repair) main rotor mast (1, figure 13) if damaged or corroded. For replacement of seal refer to paragraph 6-139.

g. Replace loose or damaged transmission case studs (paragraph 6-36).

h. Repair nicks, scratches and gouges at transmission lower case (paragraph 6-37).

I. Replace damaged clamps and hardware. Replace aluminum washers, shims and preformed packings that have been disturbed.

6-36. Replacement — Damaged Studs — Transmission Assembly.

NOTE

These instructions are for standard type studs; threaded directly into transmission case.

a. Measure stud height, if possible, before removal. Using a stud extractor, turn stud out slowly and evenly to avoid seizure and breakage. If broken off, drill hole in stud on center and using stud extractor screw stud out.

b. Determine diameter of removed stud. Select replacement stud (TM 55-1520-210-23P) by reference which provides an undersize and four oversizes (by 0.003 inch increments) to each standard stud. Generally, next larger oversize will be required for proper installation torque. Start new stud into tapped hole with fingers. If it turns freely beyond two turns, select next oversize which will become tight in one or two turns with fingers.

CAUTION

Clear vent hole in transmission case stud port prior to installing new stud.

c. Remove replacement stud, and coat coarse end with unreduced primer (C312) to prevent contact of dissimilar metals. Start stud into tapped hole.

d. Use a stud driving tool to turn stud slowly and evenly into hole, and check stud for squareness with machined surface of case. As stud is driven to proper depth, check that torque is within following limits.

STUD SIZE	INCH-POUNDS TORQUE
1/4	50 to 95
5/16	100 to 225
3/8	175 to 375

e. Replace any loose or damaged locked-in studs or inserts as follows:

NOTE

These instructions are for those studs and thread inserts which have a serrated locking ring, with inner teeth engaged on a serrated collar of stud or insert and outer teeth broached into material of transmission case. Tools for installation and removal are made by manufacturer of these parts. When such tools are not available, replacement can be accomplished with other tools, provided careful workmanship is applied.

(1) To remove a thread insert, select a drill equal in diameter to that of serrations between locking ring and insert. Drill to depth equal to ring thickness. Remove insert with an extracting tool. If lockring fails to come out, collapse remaining portion of ring with punch.

(2) To remove a stud, use a hollow mill with outside diameter 0.0156 inch less than root diameter of outer serrations of lockring. Mill to depth equal to ring thickness, Remove stud and any remaining portion of ring. If hollow mill IS not available, saw stud off, use drill as in step (1) and remove stud with an easy-out extractor.

(3) Check condition of tapped hole and counterbore. Holes are tapped with standard Class 3 tap and counterbore has 90 degree shoulder and can be cleaned up as necessary. Avoid enlargement of holes, since this would require oversize parts.

CAUTION

Clear vent hole in transmission case stud port prior to installing new stud.

NOTE

In the following steps, coat surface of parts which will be in contact with material of case with unthinned primer (C312).

(4) Turn new stud or insert into tapped hole until stop surface of serrated collar is 0.010 TO 0.020 inch below surface of parent material, using wrench tool.

(5) Place lockring over stud (or on insert) and line up teeth of ring with teeth of serrated collar. Drive ring into material flush with top of insert or stud collar.

f. Installation of studs, P/N 204-040-308, in transmission input drive quill opening. Modify studs at drive quill opening as follows:

NOTE

Modification of main case by installing three special studs at input quill mounting port will allow pusher eat (T59.1) to be used when installing input quill.

(1) Inspect input quill mounting studs at the one, five and nine o'clock position to determine if special studs, 205-040-308, are installed. Special studs will be internally threaded on outboard end and will have a set screw installed.

(2) Remove standard studs at the one, five and nine o'clock positions.

(3) Select stud, 205-040-308, of size to achieve proper stud height, when stud is installed and torqued.

(4) Coat coarse threads of studs with unthinned primer (C253). Start studs into holes in case.

(5) Use a suitable stud driving tool and torque studs 175 TO 250 inch-pounds, maintaining a projected stud height of 1.56 TO 1.60 inches.

(6) Install set screws, NAS1081-4A4, into internal threaded end of studs.

6-37. Repair Lower Case — Transmission Assembly.

NOTE

Damage to lower case exceeding the following limits shall require replacement of transmission.

a. Scratches or gouges shall be dressed out using abrasive pad (C11) provided the maximum depth of rework to completely remove the scratch or gouge does not exceed 0.070 inch in figure 6-17, area A or 0.030 inch in area B; and provided the total reworked area does not exceed 2.0 square inches.

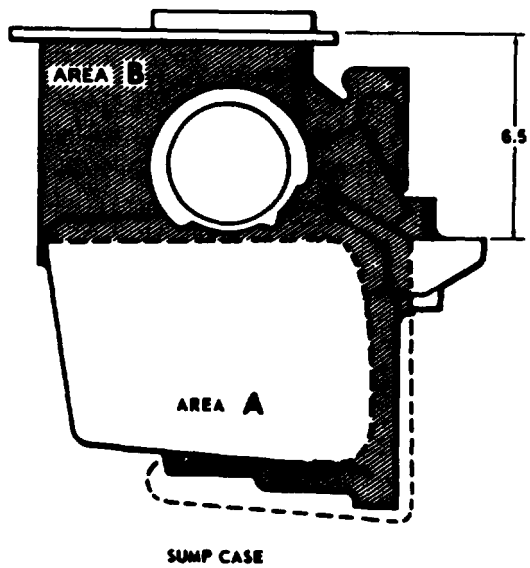


Figure 6-17. Lower Transmmission Case – Repair

NOTE

Area B is defined as all of the unmachined exterior surface within 6.5 inches of the parting surface at the top flange, and the exterior surface over cored pressure passages as shown in figure 6-17. Area A is all other unmachined exterior surfaces.

b. Scratches or gouges shall be reworked to blend with the original surface and to have a minimum bottom radius of 0.5 inch.

c. Clean in accordance with TM 55-1500-243-23.

d. Apply one coat of epoxy polyamide primer (C206), allow primer to dry a minimum of 30 minutes and a maximum of 4 hours. Apply two coats of paint to match existing finish allowing a minimum of 30 minutes and maximum of 4 hours between coats.

NOTE

If epoxy primer is allowed to dry more than 4 hours, paint will not adhere properly.

638. Return to Overhaul Transmission Assembly. The following procedures provide instructions for the preservation and packaging of a reparable transmission for shipment to an overhaul facility.

a. Preserve the transmission by spraying the interior through the top opening with oil (C166 or C168). While spraying, manually rotate the input drive quill to ensure that the gears and bearings are thoroughly wetted.

NOTE

Install transmission cover assembly (T64.1) immediately after the mast has been removed from the transmission assembly and the interior preservation has been completed. Keep rubber portions of the transmission pylon mounts (if installed) free of all oil, grease, or solvents to prevent deterioration weakening of bonds between rubber and metal.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

b. Clean the exterior of the transmission including splines and the threaded areas with solvent (C261). Air dry or wipe with a clean lint free cloth.

c. Cap or plug all lines, as applicable, in accordance with TM 1-1500-204-23 series. Cover breather holes and all other openings with flexible barrier material (C115) and secure with tape (C279). Secure all loose items, as required, to prevent damage during shipment.

CAUTION

Do not allow corrosion preventive compound to contact rubber parts.

d. Apply corrosion preventive compound (C86) to all exterior bare metal surfaces including spines, studs, and threaded areas.

e. Cover input drive spline and generator drive spline areas with flexible barrier material (C115) and secure with tape (C279).

f. Deleted.

g. Attach directly to the transmission a completed DD Form 1577-2 Unservicable (Reparable) Tag. A tag or label (DD Form 1577-3) will be securely attached to the exterior of the container in such a manner that will afford maximum protection from handling or weather. (Refer to DA PAM 738-751).

h. Prepare DA Form 2410 (Component Removal and Repair/Overhaul Record) in accordance with DA PAM 738751.

i. If a transmission metal storage and shipping container (NSN 8115-00-701-9867) is available, the preferred method of shipment is in this container.

(1) Carefully lower transmission into the container, align mounting points with bolts on the shock mounted frame, and install washers and nuts. Torque nuts 700 TO 900 inch-pounds.

CAUTION

Care must be taken to prevent desiccant from coming in contact with the transmission or corrosion of transmission will take place.

(2) Insert 56 units of dry desiccant (C105) into the transmission container in such a manner as to prevent desiccant from coming into contact with the transmission during shipment (use of desiccant basket may be disregarded).

(3) Position top of container in place, secure with bolts, washers, and nuts. Torque nuts 265 TO 285 inch-pounds.

j. Obliterate old markings from container that do not coincide with the item to be returned. Mark container in accordance with MIL-STD-129.

k. As a field expedient only, prepare the transmission as stated below.

NOTE

This procedure is based on the assumption that the provisions of step i cannot be compiled with, that the work will be done under less than Ideal conditions with limited equipment, and that on some occasions by personnel who are not experts In the field of preservation. This procedure will be used only at locations where facilities for the application of normal preservation procedures do not exist.

(1) Comply with steps a through h above to the extent possible with available materials and equipment.

(2) If caps or plugs specified are not available, openings may be closed with flexible barrier material (C98) and secured with any type of tape that is available (other barrier material may be substituted).

(3) Coat the entire exterior metal surfaces of the transmission with any grease type corrosion preventive compound (CPC) or if CPC is not available, apply a light coat of aircraft grease (C122 or C129). Cover the transmission with flexible barrier material (C115) and secure with any tape that is available.

(4) Mount the transmission in the best available container (instructed if necessary) of wood or metal. Cushion, block and brace as necessary.

NOTE

If the field expedient procedures were used, mark the outside of the container as follows: THIS TRANSMISSION IS NOT PRESERVED FOR STORAGE. OVERHAUL OR PREPARE FOR STORAGE AS SOON AS PRACTICABLE.

(5) Mark the main transmission in accordance with step j.

6-39. Assembly — Universal Transmission Assembly Build-Up.

a. Install lift plate cover (10, figure 6-18) on new universal transmission and remove from shipping container. Mount transmission in stand (T21) with adapter (T19).

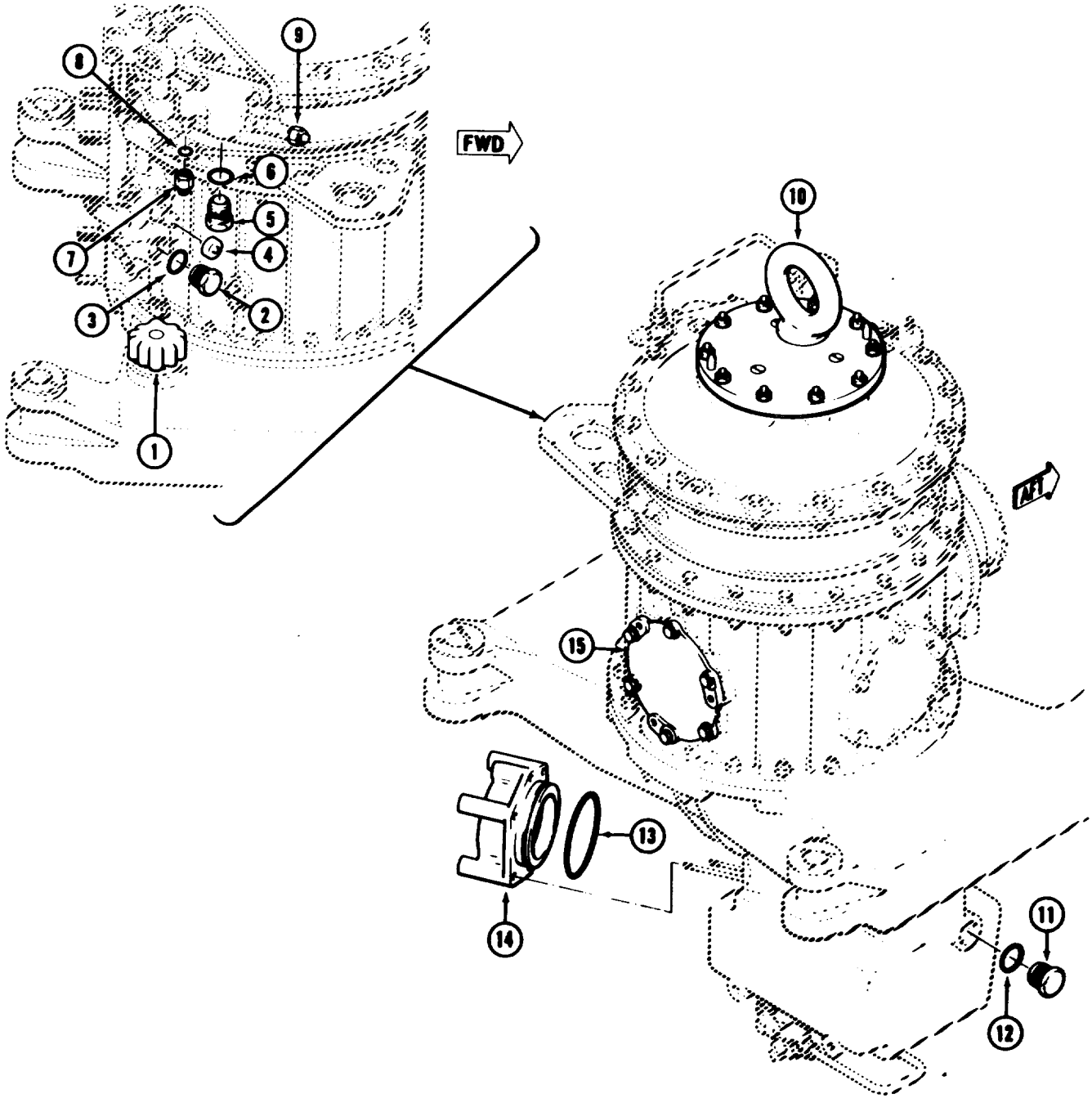
b. Remove hydraulic pump pad cover (14), preformed packing (13) and generator pad cover (15) from new transmission. Clean drive quill pads to remove sealant.

c. Install hydraulic pump and tachometer drive quill (46, figure 6-15) with new preformed packing (68) (paragraph 6-124).

d. Coat set screw (19, figure 6-15) with class B-2 sealing compound (C244). Install set screw in bolt hole at 12 o'clock position of pad for generator drive quill (21) with outboard end of screw below pad surface.

e. Install generator drive quill (21) with new packing (20) (paragraph 6-117).

f. Apply a bead of class B-2 sealing compound (C244) around perimeter of drive quills (21 and 48, figure 6-15) and transmission case pads.



1. Cap, oil filler
2. Plug, inlet manifold
3. Preformed packing
4. Cover, temperature bulb
5. Plug, pressure transmitter
6. Preformed packing
7. Cap, pressure switch
8. Preformed packing
9. Cap, No. 8 oil jet
10. Cover, lift plate (T64.1)
11. Plug, sump outlet
12. Preformed packing
13. Preformed packing
14. Cover, hydraulic pump pad
15. Cover, generator pad

Figure 6-18. Universal Transmission Assembly — Basic Configuration

g. Install rotor tachometer generator on hydraulic pump and tachometer drive quill (48) (paragraph 8-39).

h. From new transmission, remove temp bulb cover (4, figure 6-18), pressure switch cap (7), No. 8 oil jet cap (9), inlet manifold plug (2). Pressure transmitter plug (5), and packings (3, 6, and 8).

(1) Install hose assembly (1, figure 6-15) to tee fitting and to No. 8 oil jet, secure with clamp (46).

(2) Install pressure switch (3, figure 8-16) with new performed packing in manifold (1).

(3) Install pressure transmitter (2) with new preformed packing to manifold (1).

i. Install elbow (32, figure 6-15), nut (33) and new preformed packing (34) into inlet manifold. Secure elbow 90 degrees from horizontal position.

(1) If transmission will be installed in helicopter without ODDS, connect hose assembly (28) to elbow (32) and install bracket (30) on sump with nuts and washers.

(2) If transmission will be installed on helicopter with ODDS, remove nuts and washers and remove bracket (30), bracket (69), filter (72), and gasket (71). Install packing (73), debris monitor (74) (connector up, inboard), bracket (75) (flanges outboard and aft). Secure with washers (76, next to monitor or bracket), washers (77, under nut), and nut (78). Torque nuts in sequence at 30 inch-pound increments until 90 inch-pound torque is obtained.

(3) Secure hose assembly (28) to bracket with two clamps (27).

CAUTION

When installing filler assembly Insert drift through center of the assembly and depress plate and spring while turning the assembly into locked position. This is to prevent damage to the adapter and the resulting dropping of metal particles into the transmission.

j. Remove cap (1, figure 6-18) from oil filler port of support case and install filler assembly (25, figure 6-15) in case filler port (39). Apply bead class B-2 sealing compound (C244) around the perimeter of filler assembly (25) and filler port (39).

k. install neck and scupper assembly (2) on support bracket with aluminum washers (47) between scupper and bracket. Install cap (3) on scupper.

(1) Connect tube (24) to elbow (22) and filler assembly (25).

(2) Connect tube (40) to union (41) located on neck of scupper.

(3) Connect clamp (36) to bracket on lower flange of main case. Route tube (40) to drain scupper on sump.

(4) Connect clamp (50) on tube to bracket located on upper flange of sump case.

1. install brackets (5 and 7) se follows

(1) Remove five bolts, washers, and nuts from top case. Counting counter-clockwise from No. 1 oil jet, remove the fourth through the eighth bolts. Install removed bolts, steel washers, new aluminum washers, and nuts in transmission being replaced.

CAUTION

When Installing brackets (5 and 7), use bolts removed from the replaced transmission to ensure proper grip length.

(2) Install brackets (5 and 7) with hardware removed during disassembly. Install new shims (4 and 17) between bracket (7) and quill (21). Shims to be equal height of spacers (14 and 18) within 0.003 inch. Torque bolts 160 to 190 inch-pounds.

m. From new transmission remove sump outlet plug (11, figure 6-18) with preformed packing (12).

(1) Install 45 degree elbow (57, figure 6-15), nut (58) and new packing (59). Secure elbow aft and 22 degrees from up position.

(2) Secure hose assembly (54) to elbow (57).

(3) Remove nuts, washers and spacers from tail rotor drive quill at the 5, 7 and 9 o'clock positions. Install bracket (55) on the 5 and 7 o'clock studs and damps (51) on the 9 o'clock stud. Secure with nuts (52), washers (53), and spacer, omitting the aluminum washers at damp end bracket attaching points.

(4) Install bracket (62) on oil pump with existing nuts (60) and washers (61) and spacer, omitting the aluminum washers at bracket attaching points. Check for hose clearance with sump assembly end droop cam control rod.

aluminum washers at clamp and bracket attaching points.

(4) Install bracket (62) on oil pump with existing nuts (60) and washers (61) and spacer, omitting the aluminum washers at bracket attaching points. Check for hose clearance with sump assembly and droop cam control rod.

n. Install new packing (67) on coupling half (65) and install coupling in tee at bottom of sump. Secure with nut (66).

o. Install electrical harness onto transmission and secure with clamps.

p. If transmission is for helicopter with ODDS, connect cable plug to debris monitor (74).

q. Remove lift plate cover (10, figure 6-18) from transmission and install main rotor mast (paragraph 6-141).

6-40. Installation - Transmission Assembly.

a. Use any hoist of 800 pound capacity, attach hoist to mast nut on top of mast, lift transmission (17, figure 6-13), and lower to just above main mounts (11). Work aid (Figure 6-18.1) may be used to guide mounts (11) into transmission main mount holes.

b. Place fifth mount support beam (2) on two rear ears of transmission support case.

c. Lower transmission (17) carefully to position on four main mount (11), guiding lift link into lift link clevis (14) at forward underside of support case.

CAUTION

Before installing lift link attaching bolt assembly (P/N 204-040-815-1), make sure bushing is bonded to bolt. If bushing is not on bolt when installed, lift link clevis will be damaged and the transmission will require replacement.

d. Maintain tension on hoist and install lift link attaching bolt assembly (34, figure 6-38) in lift link clevis (35) from left side. Install washer (36) and nut (38). Torque 480 to 600 inch pounds and install cotter pin (37).

e. Remove hoist and using a 0.0015 inch feeler gage, check gap between washer on lift link attaching bolt and bushing sleeve on left side of lift link clevis.

(1) if feeler gauge does not slide freely between washer and bushing, remove bolt and inspect bolt and lift link clevis for proper buildup of hardware.

(2) if bushings are improperly installed in lift link clevis or bushing flanges are cracked or broken, the transmission will require replacement.

NOTE

Bolt (5, figure 6-13) can be reused. Minimum breakaway torque is the same for new and used bolts.

f. install four special nylon insert retaining bolts (5, figure 6-13) with plan washer (6), and should washer (7), into the top of each main mount (11). Check the breakaway torque for the four bolts (5) which must be a minimum of 24 inch-pounds.

NOTE

The minimum breakaway torque is the minimum torque required to start removal of the bolt from the completely installed untorqued position. This is to ensure that the self-locking feature of the nylon insert bolt is serviceable. If lift link will not self-center on bearing, center lift link on bearing to prevent chafing on lift link and clevis. Minimum free running torque is that torque required to continue installation of the bolt just prior to bolthead contracting washer.

g. Torque retaining bolts (5) 70 TO 90 foot-pounds.

h. Install swashplate, scissors and sleeve, and collective levers (paragraphs 5-67, 5-84, and 5-73).

i. install main rotor hub and connect mast controls (paragraph 5-3). Install stabilizer bar (paragraph 5-35).

j. Install forward section of tail rotor driveshaft, with clamps at coupling of drive quill (12, figure 6-13) on sump case and at coupling on No. 1 bearing hanger (paragraph 6-159).

NOTE

Aircraft modified with IPS will have the fifth mount bolt (9) reversed (head pointing forward) to ease removals of the transmission. No more than 2 1/2 threads are allowed in the bearing area of the fifth mount eyebolt (10) (this includes thread run-out).

NOTE

If more than two washers are required for proper alignment of eyebolt and support beam, install AN179-43 bolt and four washers. If only three washers are required to eliminate gap, install a fourth washer under bolt head. Do not exceed a maximum of four washers.

k. Install fifth mount support fitting across rear of pylon supped structure, aligning eyebolt of fifth mount (10, figure 6-13), with hole in support beam (2). If vertically misaligned, remove support fitting and peel or replace laminated filler plates under mount as required for alinment (paragraph 6-148). Install support fitting, and connect mount eyebolt to support beam with retaining bolt (9), using washers (8), between beam end eyebolt if required to eliminate any gap. Install washer (19), nut (18) torque 480 TO 800 inch pounds, and cotter pin (20).

l. Install lower sections of induction baffle.

m. When required, level transmission and check alignment between transmission input drive quill coupling and engine shaft adapter.

n. Install main driveshaft (paragraph 6-13) and sections of induction baffle and intake screen.

o. Install hydraulic pump on drive pad at right side of transmission sump case (paragraph 7-19).

p. Connect electrical leads to DC generator (Appendix 9. Connect transmission electrical harness cable at connector on right pylon support.

q. Connect oil drain hose at coupling (13, figure 6-13) under sump, sump outlet hose at coupling on left inner wall of compartment below transmission, and oil manifold inlet hose at outlet coupling of filter on right wall of same compartment.

r. Perform maintenance operational check. Inspect for leaks, chafing lines and proper oil level. Check for proper instrument reading, refer to TM 55-1520-210-10.

6-41. TRANSMISSION OIL FILTER. (Helicopters without ODDS)

6-42. Description - Transmission Oil Filter. The transmission oil filter (11, figure 6-19) is mounted in a pocket in upper right aft corner of sump case, with inlet and outlet ports through internal passages. Filter consists of a stack of wafer-disc screens assembled with spacers on a perforated tube, attached on a body incorporating a bypass valve for continued oil flow if screens become dogged. A cast scupper on sump case is located below filter mounting pad, and is connected to an overboard drain line to dispose of spilled oil during filter removal.

6-43. Removal - Transmission Oil Fitter.

a. Obtain access through right-hand side of pylon island in cabin by peeling down soundproofing from top and removing access door marked TRANSMISSION OIL LEVEL ACCESS.

b. Remove four nuts, washers and brackets from mounting studs at corners of oil filter (11, figure 6-19).

c. Pull oil filter (11) from sump (9). Allow excess oil to drain through scupper (10) into container placed under overboard drain outlet at left underside of fuselage. Discard gasket (6, figure 6-20).

6-44. Deleted.

6-45. Inspection - Transmission Oil Filter.

a. Visually inspect screens (2, figure 6-20) for metal particles, other contamination and damaged screens (paragraph 6-30).

b. Reject and replace any screen (2) which has a thickness of less than 0.115 inch at its inner diameter.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

6-46. Cleaning — Transmission Oil Filter.

a. Plug or cap end of tube, wash filter in solvent (C261) and dry thoroughly with filtered, compressed air. A small soft bristle brush may be used to assist cleaning.

CAUTION

Filter may be disassembled for cleaning if necessary but should be done only if impossible to clean while assembled. Make sure Inner surfaces of screens do not become contaminated before reassembly. Make sure lockwasher tab is securing the nut.

NOTE

Lockwasher (4) may be reused provided a good lock tab is used eachthnatheofl filter is reassembled. The previously used lock tab must be removed from the lockwasher and the lockwasher must be free of any burrs and foreign material. When all the lock tabs have bean used, discard the lockwasher.

b. Disassemble screens (2, figure 6-20) and spacers (3) from fitter tube on valve body (1) by removing retaining nut (5) and lockwasher (4). Discard gasket (6).

6-47. Repair — Transmission Oil Filter. Replace screens (2, figure 6-20) If deformation, tears or holes exist, worn or unable to clean.

6-48. Assembly — Transmission Oil Filter.

NOTE

Lockwasher (4) may be reused provided a good lock tab is used each time the oil filter is reasembled. The previously used lock tab must be removed from the lockwasher and the lockwasher must be free of any burs and foreign material When all the lock tabs have been used, discard the lockwasher.

a. Reassemble filter by alternately instating spacers (3) and screens (2) on oil filter valve body (1). Eleven spacers and ten screens are required.

b. install lockwasher (4) and nut (5). Tighten until spacers and screens cannot be rotated individually; then tighten an additional one-quarter turn. Bend lock-washer tab (4) against flat of nut (5).

6-49. Installation — Transmission Oil Filter

a. install new gasket (6, figure 6-20) on oil filter body (1).

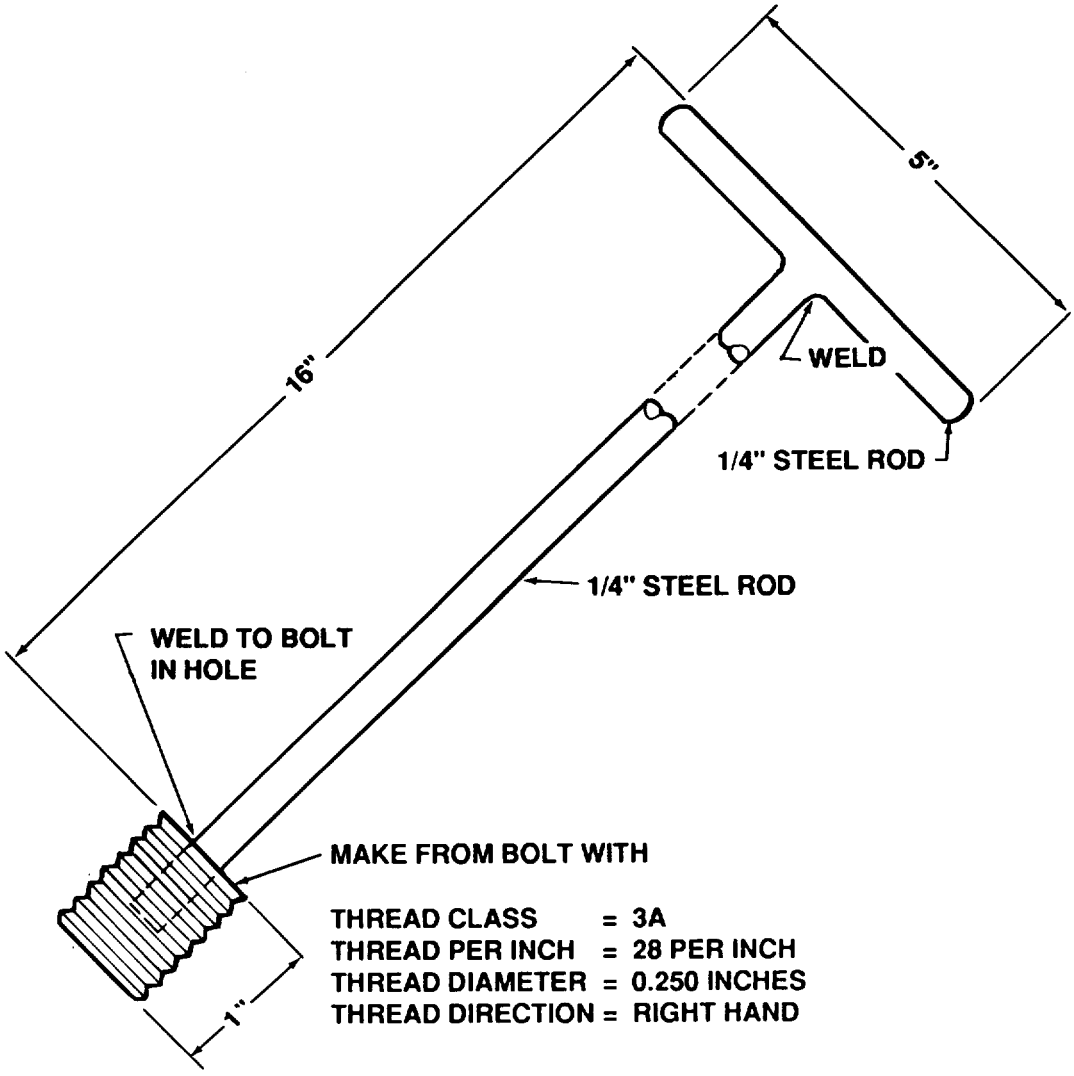


Figure 6-18.1. Transmission work aid.

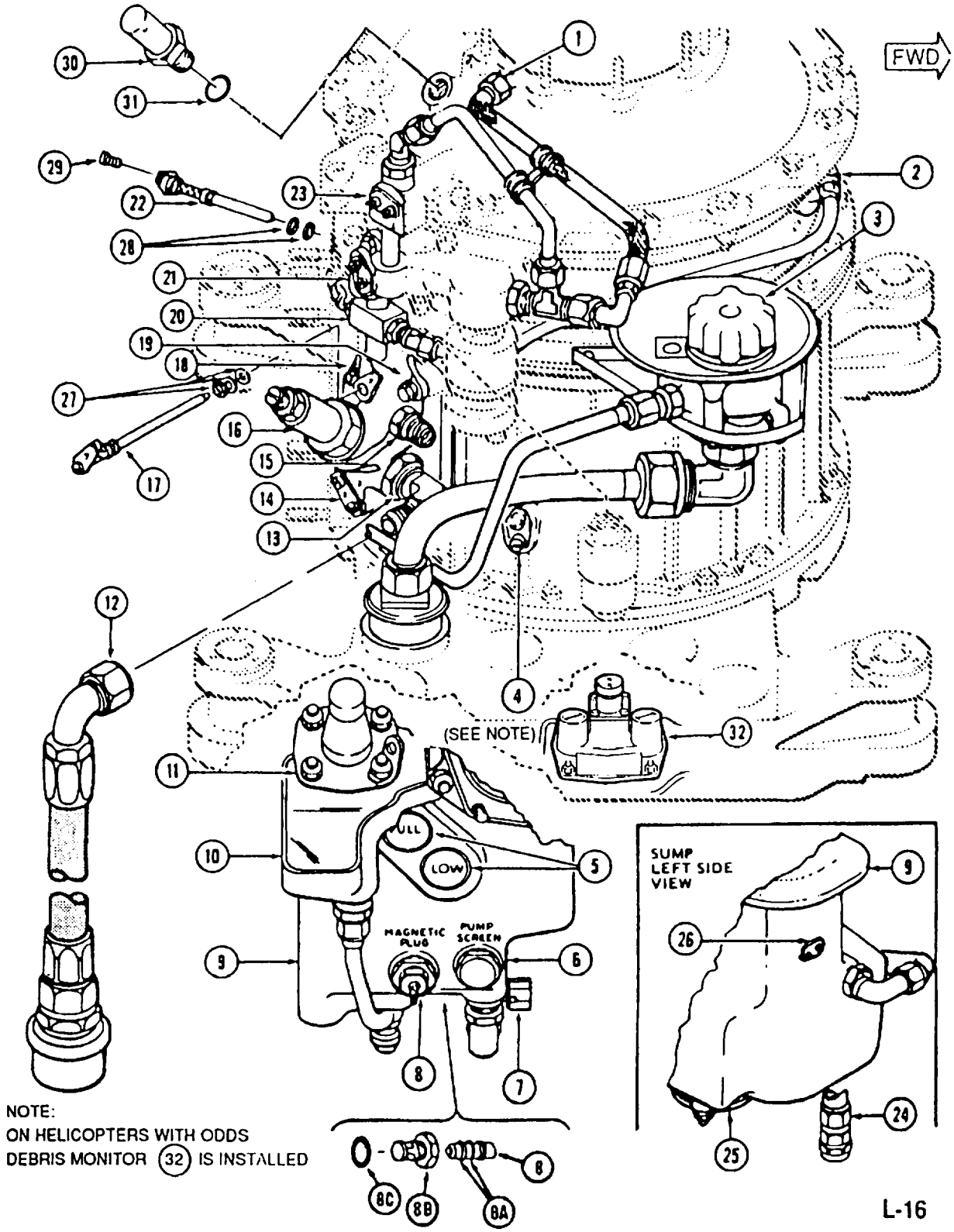


Figure 6-19. Lines, Manifold, Fittings, and Screens - Transmission Assembly (Sheet 1 of 2)

1. Jet No. 8
2. Auxiliary jet No. 2
3. Filler cap
4. Jet No. 6
5. Sight gages
6. Pump screen
7. Drain valve
8. Magnetic chip detector
8A. Packing
8B. Self closing valve
8C. Gasket
9. Sump
10. Scupper
11. Oil filter
12. Inlet hose
13. Elbow
14. Jet No. 3
15. Temperature bulb
16. Pressure relief valve
17. Jet No. 7
18. Thermoswitch
19. Inlet manifold
20. Tee fitting
21. Jet No. 2
22. Jet No. 5
23. Jet No. 1
24. Sump outlet hose
25. Oil pump
26. Jet No. 4
27. Packing
28. Packing
29. Screw
30. Air pressure valve
31. Gasket
32. Debris monitor

Figure 6-19. Lines, Manifold, Fittings, and Screens - Transmission Assembly (Sheet 2 of 2)

b. Insert oil filter (11, figure 6-19) into sump (9) with bypass valve at top position.

c. Install bracket, thin aluminum washer, thin steel washer and replace locknut on each mounting stud.

d. Torque nuts as follows:

NOTE

Filter must be held snug against transmission case prior to torquing nuts.

(1) Torque nut initially to 30 inch-pounds in sequence upper fwd; lower aft; lower fwd; upper aft.

(2) Torque nuts to 60 inch-pounds in sequence.

(3) Torque nuts to 90 inch-pounds in sequence.

e. Service transmission (paragraph 1-6).

f. Reinstall access door and attach soundproofing blanket in place.

g. At next run-up, check for oil leaks and retorque nuts to 90 inch-pounds in sequence.

NOTE

Do not back off nuts before retorque.

6-49.1. DEBRIS MONITOR (Helicopters with ODDS).

6-49.2. Description. A full-flow debris monitor (32, figure 6-19) is installed on threaded studs on aft right comer of transmission sump. Inlet and outlet connections are internal. Ferrous (iron or steel) debris is collected on a magnetic surface with two chip gaps. Non-ferrous debris is collected in removable scavenge cup/screen, screen being rated at 70 microns. Debris monitor also includes two valves for cold start bypass or for bypass when differential pressure exceeds 40 PSI. Design prevents reentry of trapped debris into system during bypass. Chip detector is connected through receptacle to CHIP DET capsule on caution panel. Access to debris monitor is through right side of pylon island in cabin by removing soundproofing and TRANSMISSION OIL LEVEL access panel.

6-49.3. Removal Debris Monitor. Proceed as follows: (figure 6-15) a. Position suitable container under overboard drain.

b. Disconnect cable plug from chip detector receptacle.

c. Remove four nuts (78), washers (76 and 77), and hose clamp bracket (75) from threaded studs.

d. Remove monitor (74) and packing (73). Let oil drain into scupper.

649.4. Cleaning/Inspection Debris Monitor.

NOTE

Debris monitor is inspected when CHIP DET caution light comes on.

a. Remove debris monitor (74, figure 6-15). (Paragraph 6-49.3.)

b. Inspect chip gaps for chips. Remove material for analysis if chips are present.

c. Using a wrench on flats of tube, remove scavenge cup and screen (80).

d. Inspect cup and screen for contamination. Remove material for analysis if there is contamination. (Refer to paragraph 6-49.5).

e. Clean chip gaps and cup and screen. Use a brush and cleaning solvent (C261). Dry parts with compressed air.

f. Inspect screen for damage.

g. Install scavenge cup and screen with new packing (79). Torque tube to **22 to 30** inch-pounds.

h. Install debris monitor (paragraph 6-49.6).

6-49.5. Transmission Oil Contamination Troubleshooting (Helicopters with ODDS). Following a chip light event the particles from the debris monitor (paragraph 6-49.4), screen and external filter shall be examined and classified to determine maintenance action. Identify particles and determine maintenance action using information in paragraph 6-30.2, figure 6-14.2. Examine particles from chip detector (paragraph 6-85) identify particles using information in paragraph 6-30.2, table 6-5 and figure 6-14.1.

WARNING

If fragment can be identified as piece from specific part, replace transmission.

6-49.6. Installation - Debris Monitor.

a. Install packing (73, figure 6-15) in groove on debris monitor (74).

b. Position monitor on threaded studs, receptacle up/inboard.

c. Position hose clamp bracket (75) on studs, flanges aft and outboard.

d. Install four washers AN960PD416L (76, next to monitor), four washers AN960XC416L (77, under nut), and four nuts (78). Torque nuts as follows:

(1) Hold monitor firm against sump.

(2) Torque nuts at **30** inch-pound increments, in sequence — upper fwd, lower aft, lower fwd, upper aft — until a torque of **90** inch-pounds is obtained.

e. Connect and safety wire (C154) MS20995C20 lockwire.

f. Install access door and soundproofing.

6-50. OIL PUMP.

6-51. Description - Oil Pump. The transmission oil pump (figure 6-21) is a direct-drive single element gerotor pump designed for internal installation with flange mounting in the bottom of the transmission sump. Pump is driven by a splined shaft from an accessory drive gear train, and turns clockwise as viewed from drive end. Instructions below apply for the 10.5 gpm pump (P/N: GC1472, GC1669, or GC1275) and the 14.5 gpm pump (P/N: GC2778 or GC2778-1).

6-52. Removal - Oil Pump. a. Obtain access to cargo-sling compartment through hole at bottom or by opening soundproofing blanket and removing access door at front of pylon island in cabin.

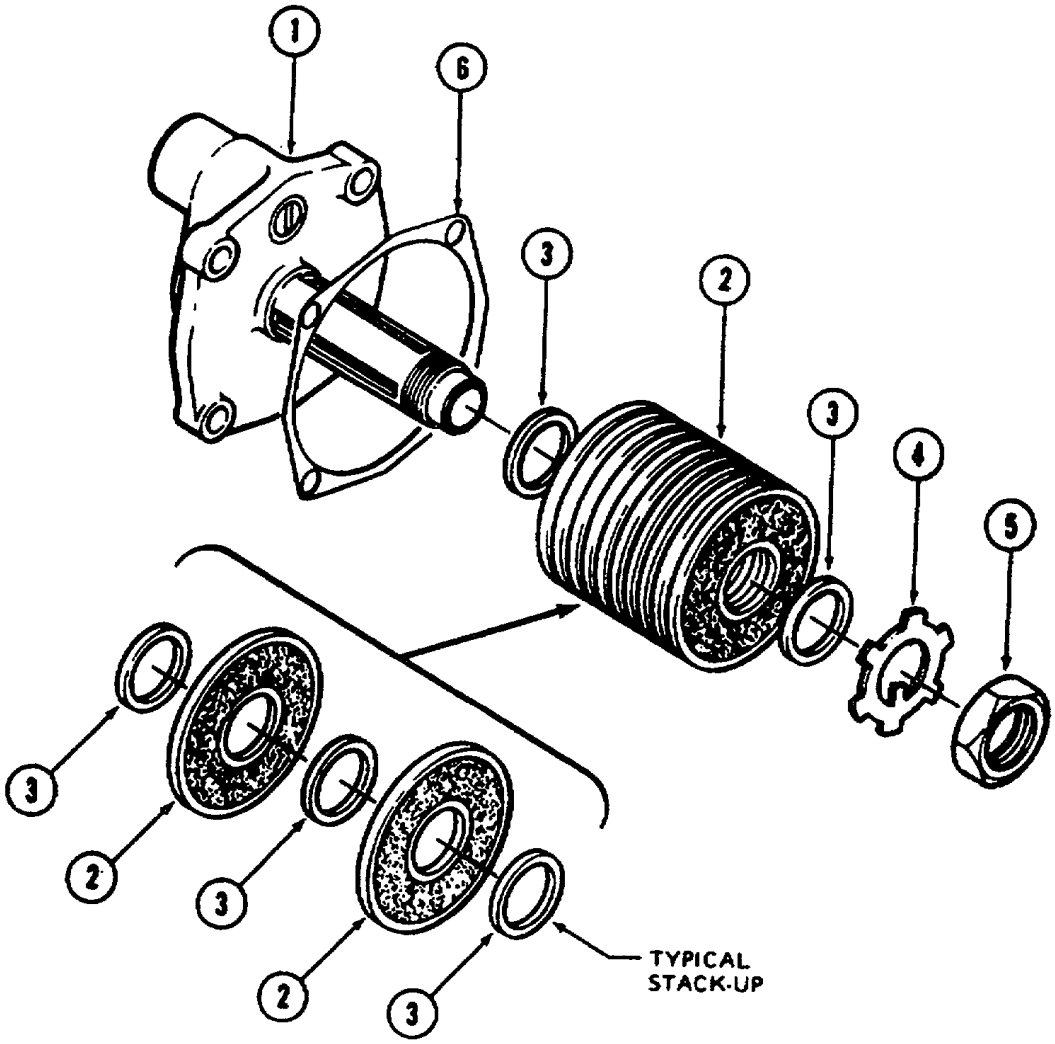
b. Place suitable container under outlet of transmission oil drain line at left underside of fuselage. Open drain valve (20, figure 6-22) and drain transmission sump (1).

c. Disconnect tubes (5 and 11) from drain valve (20) and tee fitting (7) at bottom of sump (1). Provide a container to catch trapped oil when pump (14) is removed.

d. Remove nuts (10 and 15), washers (9, 16, and 17), and drain tee bracket (8) from three mounting studs for oil pump (14).

CAUTION

Threaded hole is for attaching standard slide hammer puller to pump. It is not for a jackscrew, Do not thread puller further than 3/8 inch into pump body.



1. Valve body, oil filter
2. Screen, (10) each
3. Spacer, (11) each
4. Lockwasher
5. Nut
6. Gasket

Figure 6-20. Transmission Primary Oil Filter

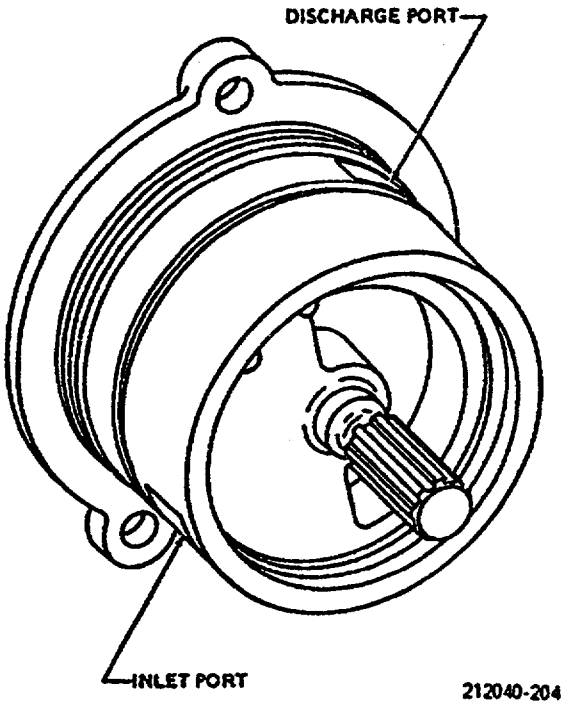


Figure 6-21. Transmission Oil Pump (Typical).

e. Pull oil pump (14) from sump (1) and splined driveshaft. When necessary, use slide hammer puller in 1/4-28 UNF tapped hole is boss at center of pump body.

6-53. Disassembly - Oil Pump. Disassembly is limited to depot maintenance.

6-54. Inspection - Oil Pump (AVIM).

a. Check that corners, grooves, and oil passages are free from sludge.

b. Check that packing grooves on exterior of pump housing are clean and free of nicks, burrs, or scratches.

c. Inspect splines of pump driveshaft for excessive wear, chips, nicks, or cracks. No cracks allowed. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

6-55. Cleaning - Oil Pump.

a. Clean pump with solvent (C261) and dry with a clean air jet. Use a soft bristled brush to aid in cleaning.

b. Lubricate all bearings and machined surfaces immediately after cleaning by flushing pump with oil (C166 or C168).

6-56. Repair - Oil Pump. Repair of pump is limited to depot maintenance.

6-57. Assembly - Oil Pump. (Refer to paragraph 6-53.)

6-58. Testing -Oil Pump (AVIM). Testing consists of an operational check following installation of oil pump in transmission.

6-59. Installation - Oil Pump.

a. Install new preformed packings (18 and 19, figure 6-22) in body grooves around body of the oil pump.

b. Lubricate preformed packings (18 and 19) O.D. of body (14) and opening in pump with lubricating oil (C1 66 or C168).

c. Insert oil pump (14) into opening in sump (17) while main rotor or mast is slowly rotated, until pump shaft is positively engaged to splined driveshaft in sump.

d. Secure oil pump (14) with aluminum washer (17) next to pump, steel washer (16) and nut (15) on two studs, and one steel washer (9) and one nut (10) on stud with tee bracket (8) for drain valve (20). Torque nuts **50 to 70** inch-pounds.

e. Connect drain line tubes to drain valve (5 and 11) to drain valve (20) and tee fitting (7).

f. Service transmission (paragraph 1-6).

g. Perform maintenance operational check (TM 55-1520-210-10). Inspect for leaks, chafing lines, oil pressure and proper oil level.

6-59.1. Transmission Vent Valve Inspection.

a. Inspect for clogged condition.

b. Clean with (C261) and dry, compressed.

c. Install vent cap (30) using new gasket (31). Torque **80 to 120** inch pounds. Lockwire (C155) to drilled hole in case.

6-60. OIL JETS

6-61. Description — Oil Jets. Jet assemblies (figure 6-19) are installed from exterior of transmission at various points, passing through walls of internal passages which carry oil under pressure, and extend inside transmission case to deliver aimed sprays of oil on gears and bearings. Each jet is

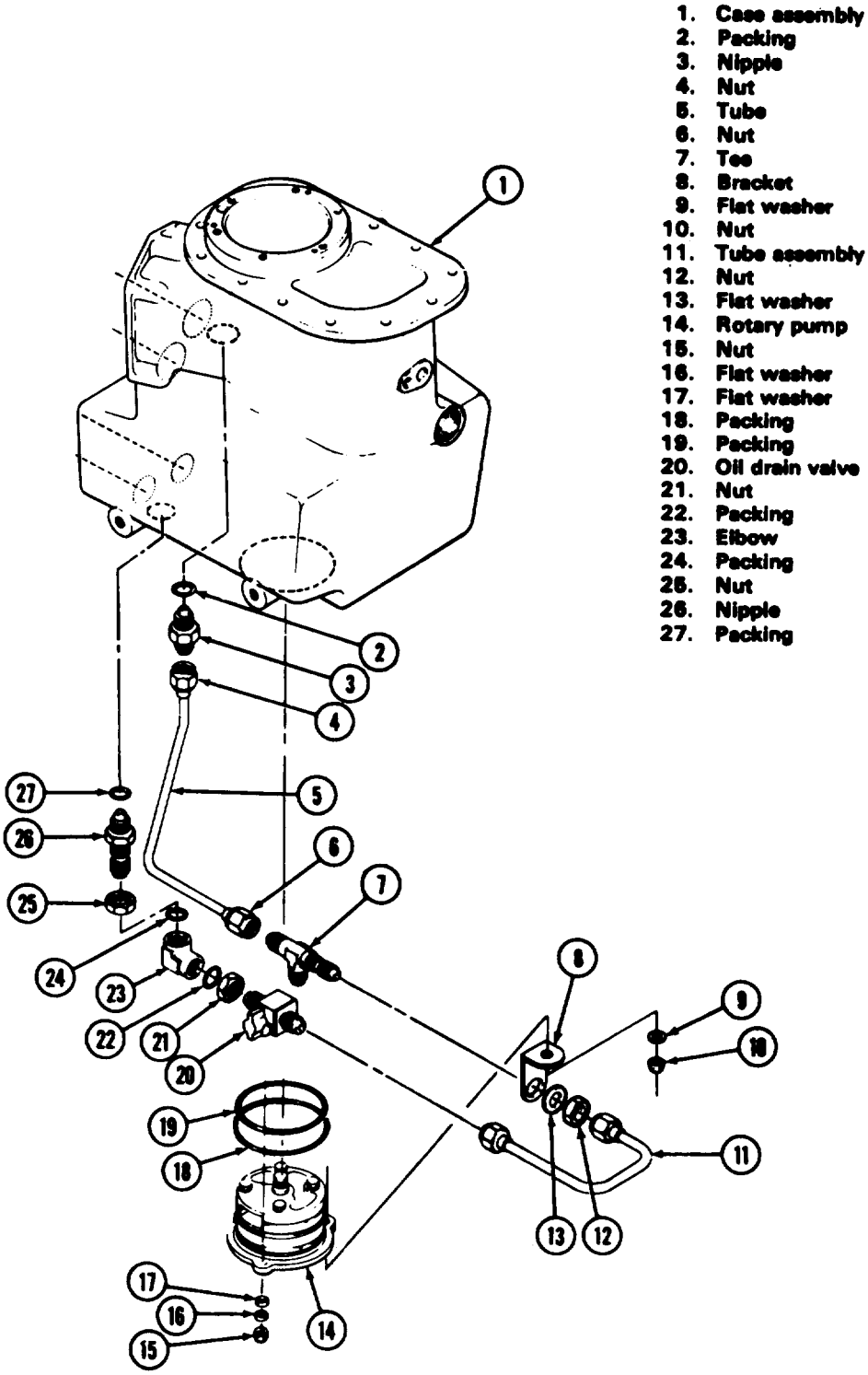


Figure 6-22. Oil Pump Removal and Installation

identified to its mounting port by matching stamped numerals. Attaching screw hole indexes the jet nozzle spray direction. For location and function of transmission oil jets refer to table 6-6.

Table 6-6. Location And Function - Transmission Oil Jets

JET NO.	FIGURE 6-19 INDEX NO.	LOCATION AND FUNCTION
No. 1	(23)	Right aft on top case. Sprays mast upper bearing, mast driving spline area, and upper stage planetary pinion bearings.
No. 2	(21)	On housing at right aft on ring gear case, with two auxiliary jets (2) fed by external tubes and located 120 degrees apart on ring gear case. Sprays spur gear and pinion bearings of both planetary stages.
No. 3	(14)	On bottom of oil manifold at right aft on main case. Sprays input bevel gears (leaving mesh) and delivers oil to No. 6 jet inside case.
No. 4	(26)	On left side of sump case. Lubricates accessory drive gears and tail rotor drive quill.
No. 5	(22)	Left aft main case, beside input drive quill. Lubricates input quill gears (entering mesh).
No. 6	(4)	Right side of main case, near oil manifold. Receives oil from No. 3 jet inside case. Sprays inboard bearing of input drive quill, and through end of gear to lubricate bearings of freewheel coupling.
No. 7	(17)	Through top of oil manifold at right aft on main case. Lubricates bearings of internal gear quill which is driven by input drive gear quill.
No. 8	(1)	Right rear side of upper mast bearing retainer plate. Provides additional lubrication for upper mast bearing assembly and mast driving spline area.

6-62. Removal - Oil Jets.

CAUTION

Remove only the screw(s) securing the jet assembly to the housing assembly. Do not attempt to remove the bolt(s) securing the housing assembly to the transmission assembly.

a. Remove jets No. 1 (23, figure 6-19), No. 3 (14), No. 4(26), No. 5(22), No. 6(4), and No. 8(1) as follows:

(1) Cut lockwire between two screwheads on jet. Remove only the screw, which secures mounting plate of jet to case.

(2) Pull jet, with preformed packings, from case. Cover open port to prevent contamination and discard packings.

b. Remove auxiliary jets of No. 2 (2) as follows:

(1) Disconnect oil tube from jet. Cap open end of tube.

(2) Cut lockwire between screw heads on jet. Remove only the screw, which secures mounting plate of jet to case.

(3) Pull jet, with packings, from case. Cover open port to prevent contamination and disc packings.

(1) Cut lockwire and remove pressure relief valve (16) from inlet manifold (19), (paragraph 6-83).

(2) Remove jet as in preceding steps b. (1), (2), and (3).

6-63. Inspection - Oil Jets. a. Inspect oil jets for damage and distortion.

b. Inspect ports in oil jets for evidence of clogging and cracks. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

6-64. Cleaning - Oil Jets. a. Remove screw with preformed packing from outer end of jet (except auxiliary No. 2 jets) to permit thorough cleaning, drainage, and inspection.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

b. Wash in dry cleaning solvent (C261). A brush can be used to aid cleaning. Drain and dry with filtered compressed air. Ensure all jet nozzles openings are clear.

c. Install screw, with new seal, in outer end of tube.

6-65. Repair - Oil Jets. Replace (without repair) if cracked, corroded, or distorted. Replace seals and preformed packings.

6-66. Installation - Oil Jets. a. Uncover mounting port. Check matching numerals beside port and on jet mounting plate.

b. Install new preformed packings on jet tube in grooves at each side of inlet slot. Lubricate packings with oil (C166, C166A, or C168).

c. Insert jet, align lug, and secure to transmission case with screw. Lockwire (C155) screwheads together.

(1) For No. 3 jet (14, figure 6-19), use bolt for attachment, with bracket for electrical harness clamp installed under bolthead.

(2) Connect oil tubes to auxiliary No. 2 jets (2). Lockwire (C155) attaching screw to elbow fitting next to tube connector nut.

6-67. PRESSURE RELIEF VALVE.

6-68. Description - Pressure Relief Valve. Pressure relief valve (16, figure 6-19) is an adjustable spring-loaded type. The valve controls the oil pressure in the transmission oil system. If the oil pressure from the pump exceeds the setting of the valve, the valve permits oil to return to the transmission sump, controlling the pressure.

6-69. Removal - Pressure Relief Valve. Cut lockwire and using a wrench on hexagonal shoulder of pressure relief valve (16, figure 6-19), remove valve and discard preformed packing.

6-70. Inspection - Pressure Relief Valve. Visually inspect threads of valve for cleanliness, corrosion, or damage.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

6-71. Cleaning - Pressure Relief Valve. a. Clean parts with solvent (C261). Dry with filtered compressed air.

b. Lubricate machined parts immediately after cleaning with oil (C166, C166A, or C168).

6-72. Replacement - Pressure Relief Valve. Replace pressure relief valve if parts are worn or damaged.

6-73. Installation - Pressure Relief Valve. a. Lubricate threads on pressure relief valve (16, figure 6-19) and new preformed packing with oil (C166, C166A, or C168).

b. Insert new preformed packing on valve (16) and install in inlet manifold (19).

c. Lockwire (C155) to temperature bulb (15) and to thermoswitch (18).

6-74. Adjustment — Pressure Relief Valve.
a. Loosen nut (2, figure 6-22.3) while holding setscrew to prevent pressure change.

CAUTION

Ensure that XMSN OIL PRESS indicates at least 30 PSI, but no more than 70 PSI, immediately after starting engine on first ground run after installation of pressure relief valve.

b. Start engine (Maintenance Test Pilot only) (TM 55-1520-210-10 or TM 55-1520-247-10) and operate until engine and transmission oil temperatures stabilize within normal ranges.

c. Set N2 speed at 8600 RPM (324 Rotor RPM). Adjust setscrew (1) to obtain a reading of 50 ±5 PSI.

NOTE

Turning setscrew (1) clockwise will increase pressure, and counterclockwise will decrease pressure.

Replace pressure relief valve if unable to adjust pressure.

d. Tighten nut (2) while holding setscrew (1) to prevent pressure changes.

e. Shut down engine (TM55-1520-210-10 or TM 55-1520-247-10).

6-75. OIL LEVEL SIGHT GAGES.

6-76. Description — Oil Level Sight Gages. Visual indication of oil level in transmission is provided by the oil level sight gages (5, figure 6-19) (two small transparent plastic plugs) set into right side of sump (9), backed by indicator discs with FULL and LOW markings.

CAUTION

A stained sight gage indicator disc can cause erroneous oil level indications and should be repaired or replaced.

6-77. Removal — Oil Level Sight Gages.
a. Detach soundproofing blanket and remove TRANSMISSION OIL LEVEL ACCESS door from right side of pylon island in cabin.

b. Drain oil below level of sight gages (5).

c. Remove spiral retaining ring, sight glass with preformed packing and indicator disc.

6-78. Inspection — Oil Level Sight Gages. Inspect for internal oil stains, discoloration on glass or indicator disc.

6-79. Cleaning — Oil Level Sight Gages. Wipe glass and indicator disc clean using a soft clean cloth. If unable to dean, replace glass or disc.

8-80. Installation — Oil Level Sight Gages.
a. Insert correctly marked indicator disc in port with indexing tab in notch of inner lip. Install new preformed packing in groove around sight glass. Insert glass with flat side out. Install retaining ring.

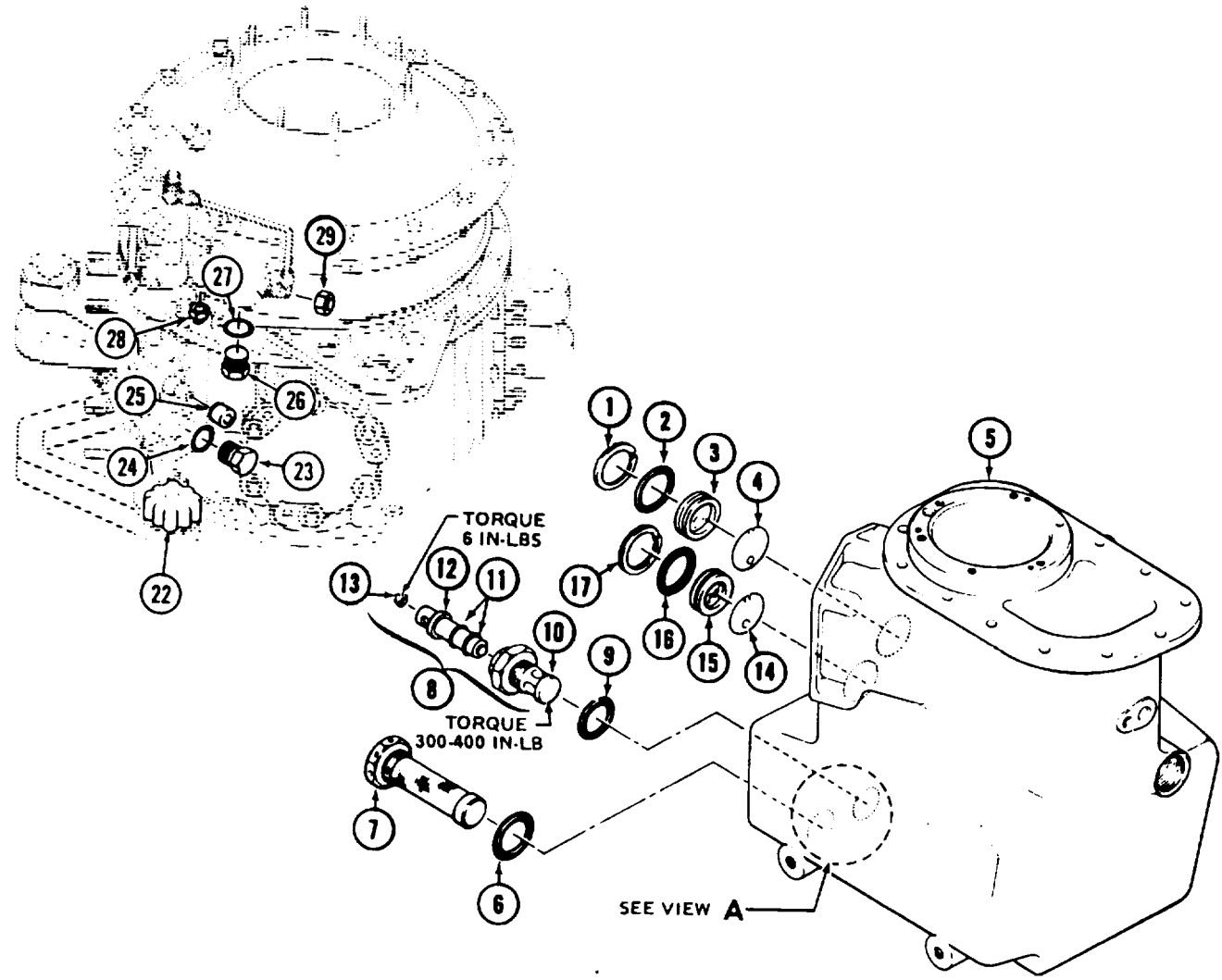
b. Service transmission (paragraph 1-6).

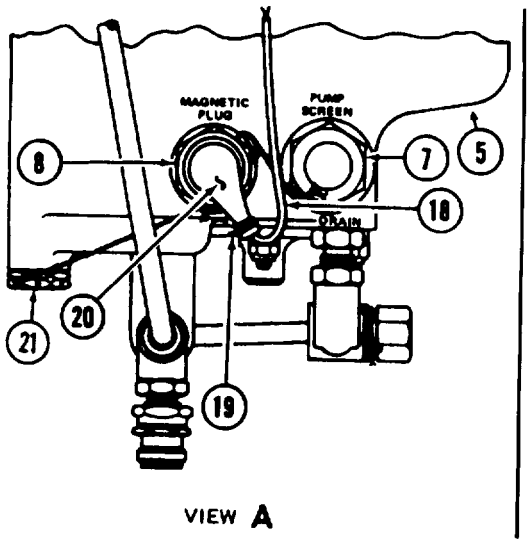
c. Check for leaks around oil level sight gages (5, figure 6-19). Close access door.

6-81. LINES, MANIFOLDS, FITTINGS, AND SCREENS.

6-82. Description — Lines, Manifolds, Fittings, and Screens. a. Lines and manifolds. An inlet manifold (19, figure 6-19) on right side of transmission main case is provided with a relief valve (16) to regulate system pressure, a temperature bulb (15) for oil temperature indicator, and a thermoswitch (18) for caution panel. The manifold inlet hose (12) from sump delivers filtered oil to manifold that is distributed through various outlets, A second port on inner face of manifold supplies internal passages leading to input drive quill bearings. No. 3 and No. 7 jets (14 and 17) extend through manifold into main case. An outlet at top of manifold delivers oil through an external tube to upper part of system.

b. Fittings. A chip detector (8) is located on the lower right side of the transmission sump (9), marked magnetic plug. The chip detector consists of a single pole of a permanent magnet. When the pole attracts sufficient metal chips to complete the circuit between the pole and ground, the “CHIP DET” capsule





VIEW A

1. Retaining ring
2. Preformed packing
3. Sight glass
4. Sight indicator (full)
5. Case assembly
6. Gasket
7. Oil screen
8. Chip detector assembly
9. Gasket
10. Self closing valve
11. Packings
12. Chip detector
13. Nut
14. Sight indicator (low)
15. Sight glass
16. Preformed packing
17. Retaining ring
18. Electrical lead
19. Twine
20. Rubber nipple
21. Plug
22. Cap, oil filler
23. Plug, inlet manifold
24. Preformed packing
25. Cover, temperature bulb
26. Plug, pressure transmitter
27. Preformed packing
28. Cap, pressure switch
29. Cap, No. 8 oil jet

Figure 6-22.1. Transmission Sump - Assembly

1. Screw
2. Screw
3. packing with retainer
4. No. 7 oil jet
5. preformed packing
6. Pressure relief valve
7. Pressure manifold
8. Thermoswitch
9. Preformed packing
10. Oil fitting
11. Elbow
12. Preformed pecking
13. Nut
14. Tuba assembly
15. Preformed packing
16. Gasket
17. Temparature bulb
18. preformed packing
19. Union
20. Tuba assembly — oil filter outlet
21. Preformed packing
22. No. 3 oil jet
23. Packing with retainer
24. Screw
25. Bolt
26. Washer — thin steel
27. Bracket
28. Bolt
29. Washer — thin steel
30. Bracket

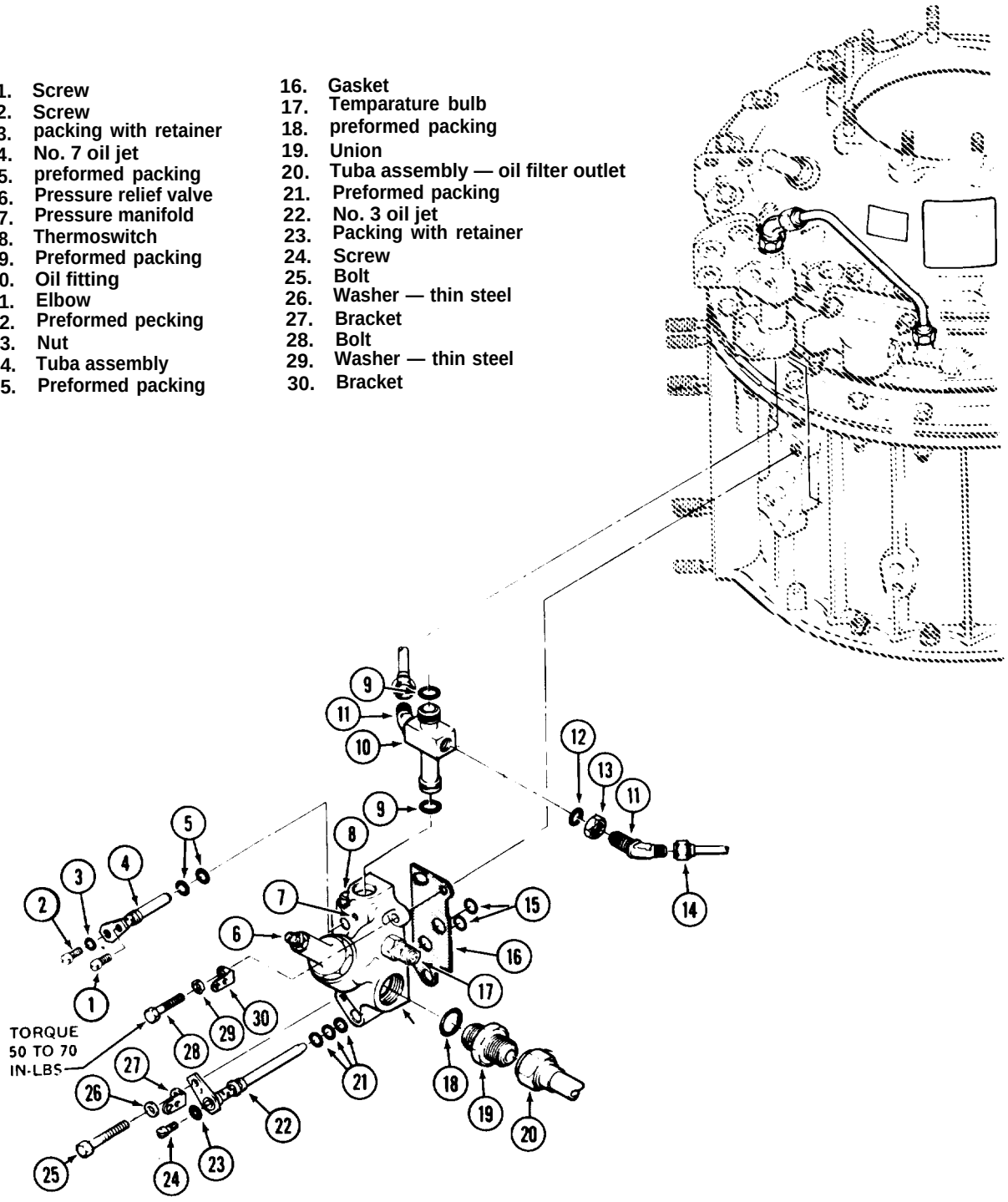
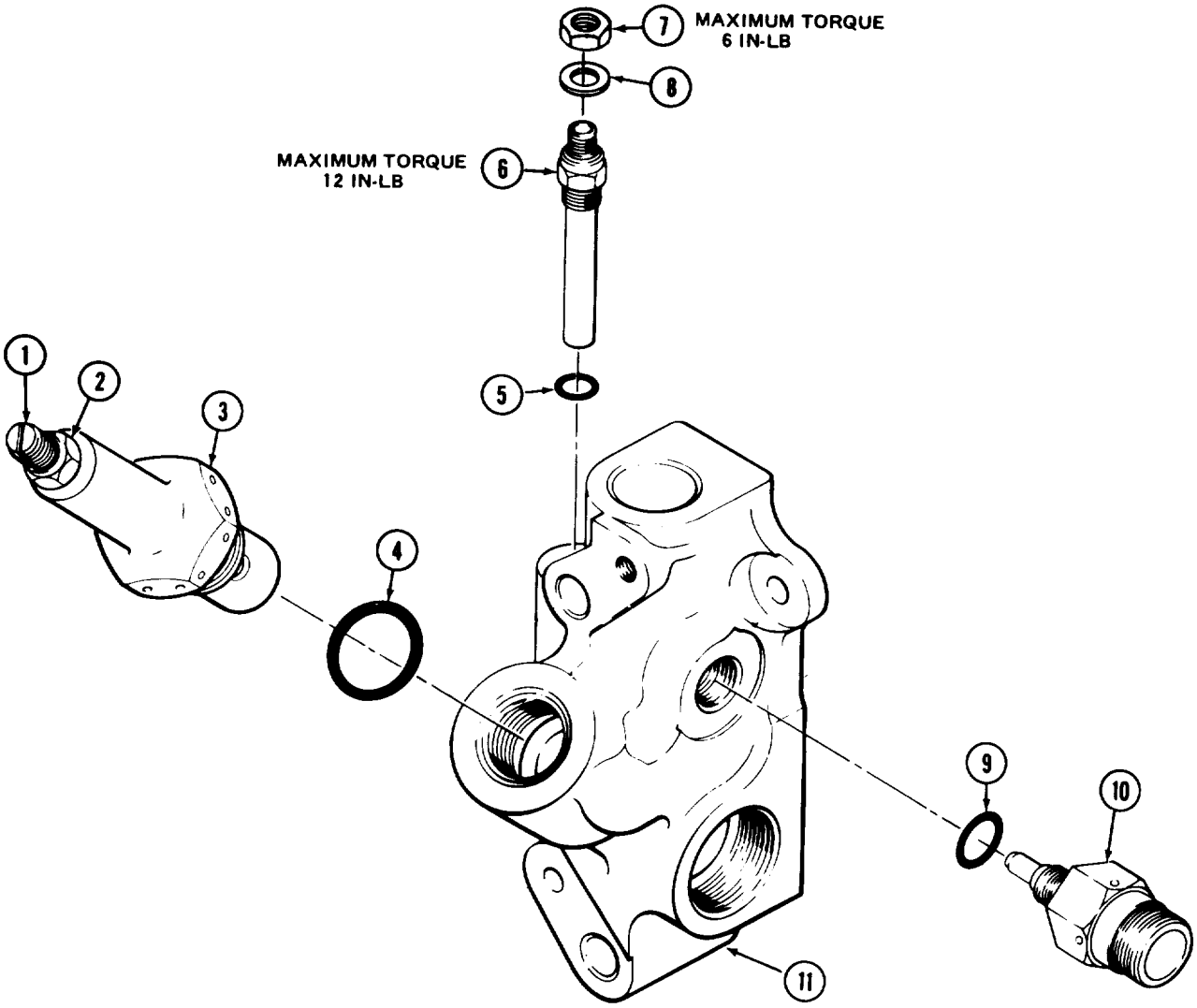


Figure 6-22.2. Pressure Manifold – Removal and Installation



1. Set screw
2. Self-locking nut
3. Pressure relief valve
4. Preformed packing
5. Preformed packing
6. Thermoswitch
7. Nut
8. Washer
9. Preformed packing
10. Temperature bulb
11. Pressure manifold

Figure 6-22.3. Pressure Manifold — Assembly

on the caution panel will illuminate (helicopters without ODDS). On helicopters with ODDS, the CHIP DET caution capsule is connected to chip gaps within debris monitor (32). A magnetic chip detector plug is located in the lower right side of the generator drive quill (paragraph 6-109). The chip detectors incorporate a self-closing valve to prevent loss of oil when magnetic insert is removed to inspect for metal chips or particles. A drain valve (7, figure 6-19) is located under transmission sump (9). Two oil cooler line drain valves are in bottom of fuselage compartment just behind aft cross tube of landing gear (paragraph 6-203).

c. Screens. Intake pump screen (6, figure 6-19) for transmission oil pump (25) is a wire mesh cylinder attached on a threaded plug, externally accessible on lower right side of sump (9), marked PUMP SCREEN.

NOTE

Filler cap (3) for oil system servicing is at top right under fairing.

6-83. Removal - Lines, Manifolds, Fittings, and Screens.
a. Disconnect and detach any defective line as required.

b. Remove inlet manifold (19, figure 6-19) from right side of main case as follows:

(1) Remove manifold inlet hose (12), elbow (13), nut and preformed packing and hoses to tee fitting (20) on top of inlet manifold (19). Discard packings.

(2) Remove electrical wires and connectors from temperature bulb (15) and thermoswitch (18).

(3) Remove jet No. 3 (14), jet No. 7 (17) and jet No. 2 (21), (paragraph 6-62).

(4) Remove two bolts and two washers and remove inlet manifold (19).

c. Remove magnetic chip detector assembly from sump (9) as follows:

(1) Disconnect electrical wires from magnetic chip detector (8).

(2) Push in on magnetic chip detector (8) as far as possible and turn counterclockwise to disengage pins from self-closing valve (8B) and pull out.

(3) Open drain valve (7) and drain oil from sump (9) into an empty container.

(4) Remove self closing valve (8B).

d. Remove magnetic plug from generator drive quill (paragraph 6-112).

e. Remove pump screen (6, figure 6-19) from sump (9) as follows:

(1) Peel down soundproofing blanket from top on right side of pylon island in cabin. Remove access door marked OIL LEVEL ACCESS.

(2) Cut lockwire from hexagonal plug head of pump screen (6), marked PUMP SCREEN.

(3) Remove pump screen (6) and discard preformed packing.

6-84. Disassembly - Manifold.

a. Remove pressure relief valve (16, figure 6-19) and discard preformed packing from inlet manifold (19).

b. Remove temperature bulb (15) and discard preformed packing.

c. Remove thermoswitch (18) and discard preformed packing.

d. Remove elbow(13) with nut and preformed packing and tee fitting (20). Discard packings.

6-85. Inspection - Lines, Manifolds, Fittings, and Screens.

a. Inspect lines, fittings, and inlet manifolds for corrosion and mechanical or thread damage.

b. Inspect transmission quick-disconnect couplings as follows:

(1) With system pressure at zero and the coupling connected, compress the coupling lengthwise and measure from the back of the nipple half adapter hex to the back of the socket half adapter hex (figure 6-23).

(2) Record the measurement as value "A".

(3) Extend the coupling by pulling lengthwise and repeat measurement.

(4) Record this measurement as value "B".

(5) Compare value "A" and "B" to determine amount of length variation.

(6) If variation is greater than **0.068**, early failure is indicated and coupling assembly should be replaced.

c. Inspect electrical chip detector (8, figure 6-19) or debris monitor (32) and magnetic plug in generator drive quill for metallic particles (figure 6-14) as indication of possible excessive wear or internal failure in transmission (paragraph 6-30).

d. Inspect oil pump screen (6, figure 6-19) for metallic particles or other material as indication of oil contamination or internal failure of transmission (paragraph 6-30 or 6-30.1). Inspect screen for holes or other damage.

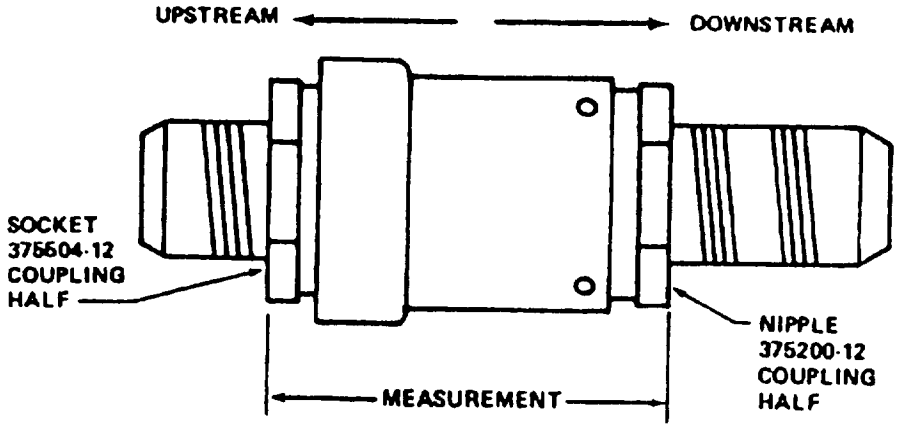


Figure 6-23. Quick Disconnect Coupling - Inspection

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

6-86. Cleaning — Lines, Manifolds, Fittings, and Screens. Clean parts with solvent (C261). Use fiber bristle brush (C52) to dislodge stubborn deposits and drip or air dry with low pressure compressed air.

6-87. Repair — Lines, Manifold, Fittings, and Screens. Repair is limited to replacement of standard hardware and defective parts.

6-88. Assembly — Manifold. a. Install thermoswitch (18, figure 6-19) in inlet manifold (19) as follows:

(1) Lubricate thermoswitch (18) threads and new preformed packing with oil (C166, C166A, or C168). Place packing on lower end of thermoswitch.

(2) Install thermoswitch (18) in top left side of inlet manifold (19), not exceeding 12 inch-pounds of torque on hexagonal body shoulder of thermoswitch.

b. Install temperature bulb (16) In inlet manifold (19) as follows:

(1) Lubricate temperature bulb (15) threads and new preformed packing with oil (C166, C166A, or C168). Place packing on lower end of bulb,

(2) Install temperature bulb (15) in top right side of inlet manifold (19).

c. Install pressure relief valve (16) in inlet manifold (19) as follows:

(1) Lubricate pressure relief valve (16) threads and new preformed packing with oil (C166, C166A, or C168). Place packing on lower end of valve.

(2) Install pressure relief valve (16) in inlet manifold (19).

d. Lockwire (C155) temperature bulb (1 5), pressure relief valve (16) and thermoswitch (18) together.

e. Install tee fitting (20) in inlet manifold (19) as follows:

(1) Lubricate two new preformed packing for elbows with oil (C166, C166A, or C168). Place nuts and packings on elbows.

(2) Install elbows in tee fitting (20) and secure with outlet facing aft.

(3) Lubricate two new preformed packings for tee fitting (20) with oil (C166, C166A, or C168). Place packings on fittings.

(4) Insert long tube of tee fitting (20) into inlet manifold (19) and parallel aft faces,

6-89. Installation — Lines, Manifolds, Fittings and Screens. a. Install inlet manifold (19, figure 6-19) and tee fitting (20) as follows:

(1) Lubricate two new preformed packings with oil (C166, C166A, or C168). Place packings on sleeve bushings on back of manifold. Install new gasket on back of manifold.

(2) Insert short tube of tee fitting (20) into lower side of housing of jet No. 1 (23) and align bolt holes of inlet manifold (19).

(3) Secure inlet manifold (19) with two bolts, two thin steel washers and two brackets.

(4) Install jet No. 3(14), jet No. 7(17) and jet No. 2 (21) (paragraph 6-66).

b. Connect electrical leads to thermoswitch (18, figure 6-19). Torque terminal stud nut to 6 inch-pounds.

c. Connect electrical connector to temperature bulb (15). Lockwire (C154) connector to adjacent bolt head or bulb.

d. Install magnetic plug in generator drive quill (paragraph 6-117).

e. Install Magnetic Chip Detector Assembly in sump (9) as follows:

(1) Install new gasket (8C) on self-closing valve (86) and install in sump (9). Torque valve 300 TO 400 inch-pounds.

(2) Install new packings (8A) on chip detector (8) and insert chip detector (8) into self-closing valve (8 B), press and turn clockwise to engage locking pins.

(3) Lockwire (C155) self-closing valve (86) to pump screen (6).

(4) Connect electrical lead to terminal on chip detector (8).

NOTE

Perform operational check to insure proper wiring to caution light.

f. Install oil pump screen (6) as follows:

(1) Lubricate gasket with oil (C166, C166A, or C 168). Place gasket on pump screen (6).

(2) Install pump screen (6) in sump (9) at location marked PUMP SCREEN.

(3) Torque head of pump screen (6) **300 TO 400** inch-pounds. Lockwire (C155) self-closing valve of chip detector (8).

g. Connect other lines and fittings previously removed.

6-90. INPUT DRIVE QUILLS.

6-91. Description — Input Drive Quill. An input drill quill (P/N 204-040-363, figure 6-24 or P/N 205-040-263, figure 6-26) equipped wit h a free-wheel coupling is located on aft side of transmission main case section. Engine torque is transmitted through main driveshaft to quill, which drives transmission gear trains. Freewheel clutch in quill coupling operates automatically, engaging to allow engine to drive rotor or disengaging the idling engine during autorotational descent. Input drive quill (P/N 205-040-263) has a wide sleeve on the clutch assembly end, a replaceable internal wear sleeve, and an external drain connection which are not characteristics of input drive quill (P/N 204-040-363).

6-92. INPUT DRIVE QUILL (P/N 204-040-363)

6-93. Removal — Input Drive Quill (P/N 2044140-363).

Premaintenance requirement for removal and disassembly input drive quill (P/N 204-040-363)

Conditions	Requirements
Model	All
Part No. or Serial No.	204-040-363
Special Tools	(T31), (T57)
Test Equipment	None
Support Equipment	Heat Lamp
Minimum Personnel Required	One

Conditions	Requirements
Consumable Materials	(C48), (C68), (C86), (C96), (C105), (C115), (C122), (C129), (C166), (C166A), (C168), (C177), (C237), (C244), (C261), (C263), (C264), (C279)
Special Environmental Conditions	None

a. Open transmission fairing. Remove engine intake fairing. Remove top section of induction baffle and upper left intake section.

b. Remove main driveshaft (paragraph 6-17).

NOTE

Seal (9, figure 6-24) may be replaced without removing quill from transmission (refer to paragraph 6-94).

c. Remove nuts, washers, and bracket from mounting studs around flange of input drive quill ring (8, figure 6-24) and cut sealing compound from around outside of quill sleeve flange and jackscrew holes with a sharp non-metallic tool, If installed, remove lockwire, threaded plugs and gaskets from jackscrew holes.

CAUTION

When using jackscrews to remove quill assembly, following procedures must be followed: The jackscrews must be screwed in evenly, exerting equal pressure on quill sleeve to prevent damage to flanges. Do not use force by prying to remove quill, in the event quill cannot be removed by using jackscrews, heat case, and use jackscrews. Do not use torch or open flame to heat case.

d. Use three jackscrews (T31) to pull quill from transmission case. Remove jackscrews and discard preformed packings (14).

e. After removing quill, secure ring (8) and sleeve (11) together to avoid damage to seal (9) with three screws (P/N AN502416-10), through jackscrew holes.

f. Remove drain tube (13) and discard preformed packings (12).

g. Cover quill opening in transmission case.

6-94. Disassembly — Drive Quill (P/N 2044140-363).

a. Fabricate a workaid (figure 6-24.1), Secure to clutch assembly using tape or other suitable material,

NOTE

Disassemble quill only to extent necessary to replace seal (9, figure 6-24), if required.

Seal may be replaced without removing quill from transmission.

a.1. Remove retaining ring (1), retainer (2) and preformed packing (3) from freewheeling clutch assembly (7).

b. Remove locking spring (4) and plate (5) from nut (6).

c. Insert wrench (T57) into the quill; matching the spline teeth of the tool with splines of nut (6), Insert a 3/4 inch square drive extension through wrench and engage inner end of pinion gear (15),

d. Loosen nut (6) using a 3/4 inch drive handle.

e.

Remove wrench (T57) and nut (6).

e.1. Reinstall retainer (2) (without packing (3)) and retaining ring (1), Remove workaid (figure 6-24.1).

CAUTION

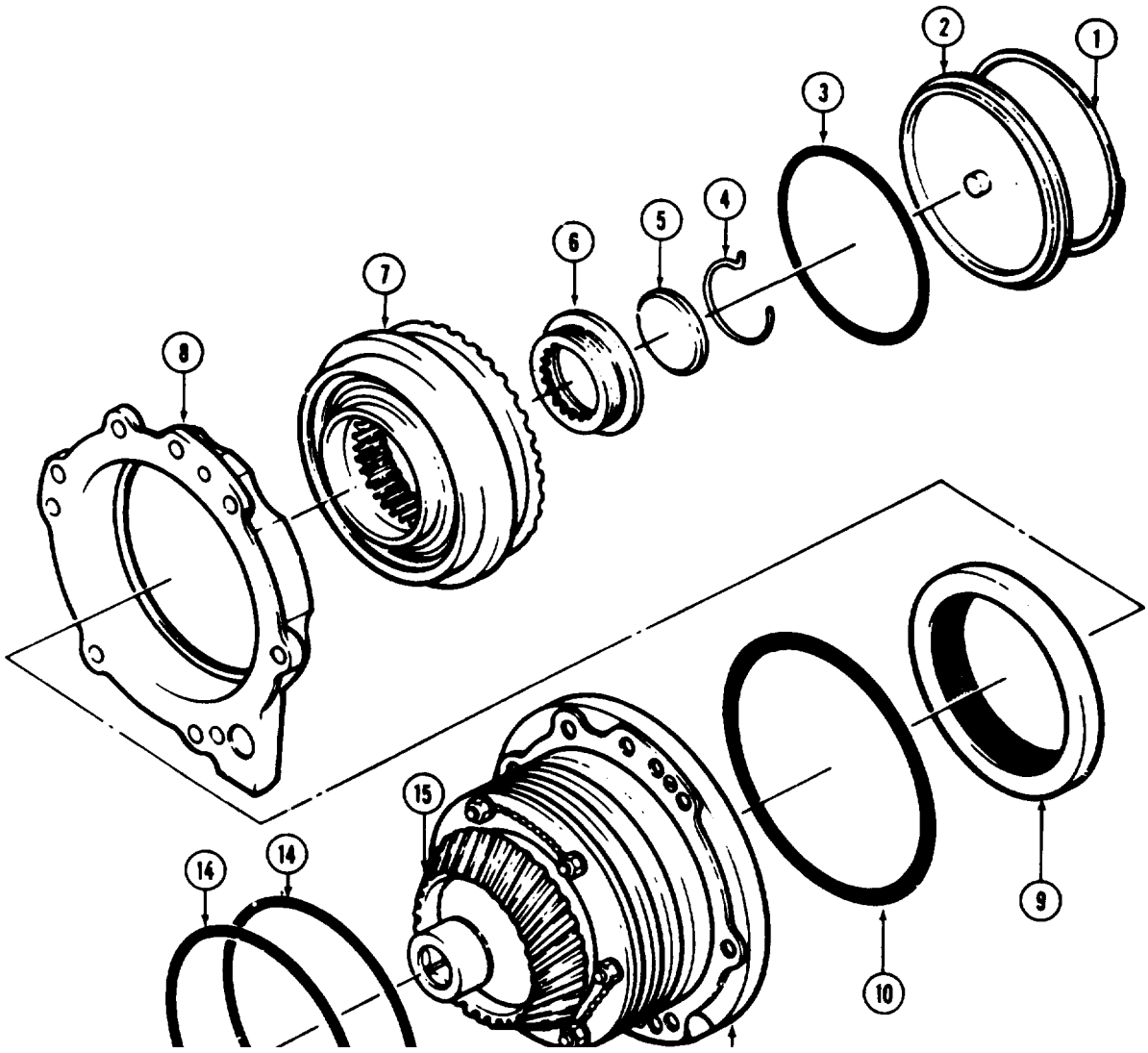
Do not bump or push inboard on the outer race freewheeling clutch assembly this could allow the drag spring of clutch assembly to drop over the inner race. If the drag spring should drop over the inner race the freewheeling clutch assembly will require disassembly to correct.

f. Remove the freewheeling clutch assembly (7) as a unit from ring (8) and remainder of quill.

NOTE

Handle freewheeling clutch assembly (7) carefully to prevent drag springs from dropping over the inner race.

g. Remove ring (8), seal (9) and preformed packing (10) from sleeve (11).



1. Retaining ring
2. Grease retainer
3. Preformed packing
4. Locking Spring
5. Plate
6. Nut
7. Clutch assembly
8. Ring
9. Seal
10. Preformed packing
11. Sleeve assembly
12. preformed packing
13. Drain tuba
14. Preformed packing
15. Pinion gear

Figure 6-24. Input Drive Quill, P/N 204-040-363

h. Press seal (9) from ring (8) and discard packing (10)

6-95. Inspection — Input Drive Quill. (P/N 204-040-363). a. Visually inspect for oil leakage.

NOTE

External leakage is not permitted from transmission quill seals. However, a small amount of seepage assures a satisfactory seal condition. Continuous flow (droplets) is considered excessive and requires seal replacement,

b. Inspect for damage. pitting and corrosion in area of seal (9, figure 6-24), preformed packings (3. 10 and 14) and mating surfaces of close tolerance machines surfaces.

c. Inspect groove in retainer (2) for burrs which could damage preformed packings.

d. Inspect outer race of freewheeling clutch (7) in contact area with seal (9) for rough surface or damage.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

6.96, Cleaning — Input Drive Quill (P/N 204-040-363). a. Clean parts with solvent (0261) and dry with filtered compressed air.

b. Lubricate all bearings and machined surfaces immediately after cleaning with oil (C166, C166A, or C168).

6-97. Repair — Input Drive Quill (P/N 204-040-363). a. Replace seal (9, figure 6-24) if leakage exists (paragraph 6-98),

b. Replace (without repair) if inspection requirements are not met, if pitted, corroded, or rough areas or damage are found on outer race of freewheeling clutch assembly (7) where seal contacts.

c. Remove burrs from retainer (2) using crocus cloth (C68) or fine stone (C263 or C264).

d. Prepare input drive quill for return to overhaul in accordance with paragraph 6-100.

6-98. Assembly — Input Drive Quill (P/N 204-040-363). a. Install new seal (9, figure 6-24) in ring (8) as follows:

(1) Remove old sealant from ID of ring (8) using a sharpened plastic scraper.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(2) Scrub sealant surface of ring (8) using a cloth dampened with methyl-ethyl-ketone (Cl 77).

(3) Clean OD of new seal (9) using a cloth dampened with methyl-ethyl-ketone (C177).

(4) Apply a film sealant (C237) to ID of ring (8) and OD of seal (9).

(5) Using a pressing plate slightly smaller than OD of seal (9); press seal into ring (8) with seal lip facing inboard toward pinion gear (15), Remove excess sealant.

b. Lubricate ID of ring (8), lip of seal (9) and new preformed packings (3, 10 and 14) with oil (C166, C166A, or C168).

c. Install new preformed packing (10) in outboard grooved lip of sleeve (11).

d. Carefully press ring (8) over sleeve (11) and align jackscrew holes. Install three screws (P/N AN502-416-10) to hold parts together.

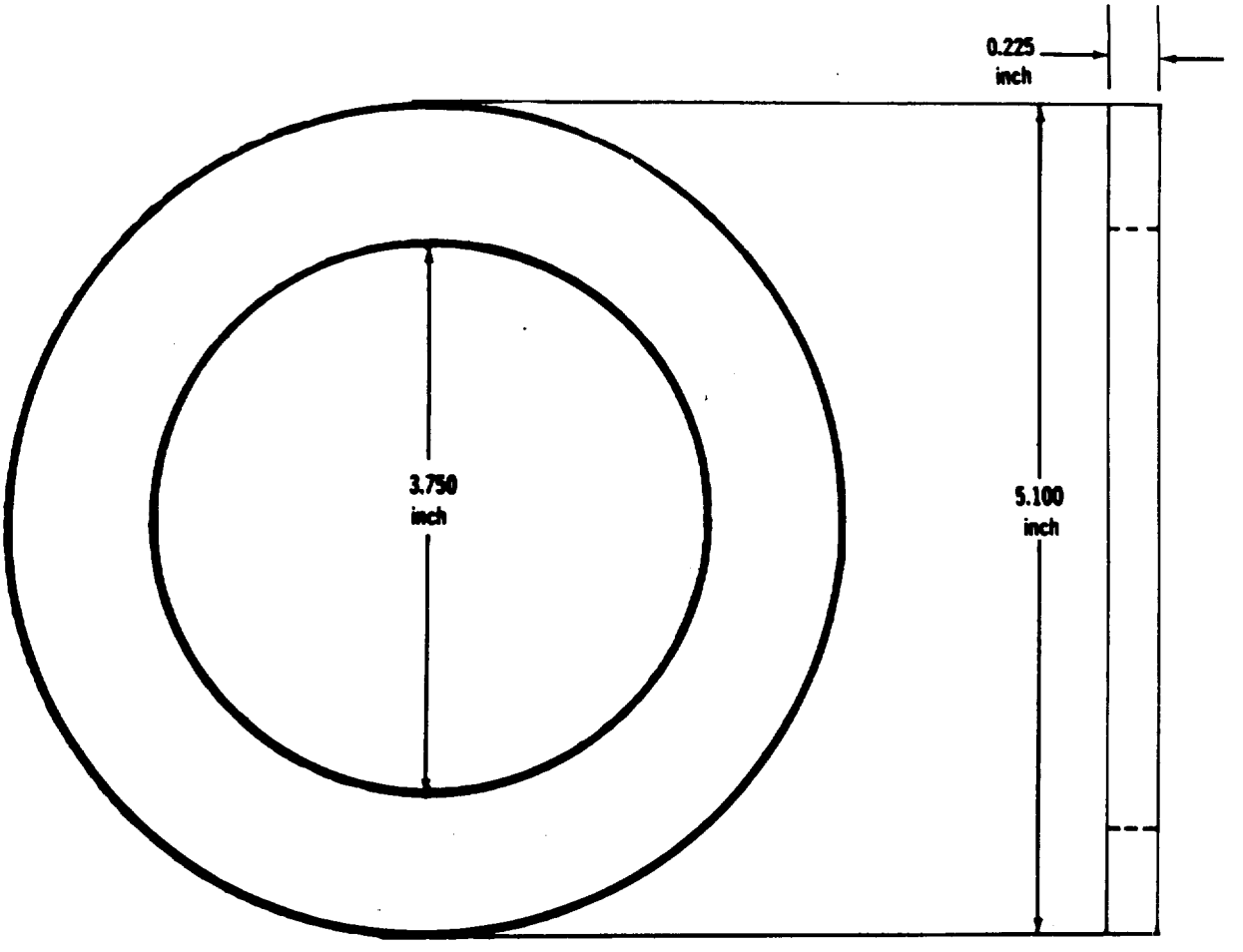
e. Install freewheeling clutch assembly (7) as follows:

(1) Carefully insert freewheeling clutch assembly (7) into ring (8) and sleeve (11) engaging teeth of pinion gear (15).

a. Install workaid (figure 6-24.1), and secure with tape or other suitable material.

b. Remove retaining ring (1) and retainer

(2) Install nut (6). using wrench (T57) with a 314 inch square drive extension through wrench and engaging inner end of pinion gear (15). Torque nut **350 TO 400** foot-pounds.



Make from 132024, NSN 9535-00-084-4533 or other similar material.

Figure 6-24.1 Transmission input quill work aid

NOTE

Use the 3/4 inch square drive extension to hold pinion gear (15) while torquing.

(3) Install plate (5) and locking spring (4). Ensure that spring tang fully engages nut (6) and pinion gear (15).

(4) Install new preformed packing (3) on inboard lip of retainer (2).

CAUTION

Hold out on outer race of the freewheeling clutch assembly (7) while installing retainer (2) and retaining ring (1).

(5) Press retainer (2) into freewheeling clutch assembly (7) and secure with retaining ring (1).

(6) Remove workaid (figure 6-24.1).

f. Check quill assembly for freedom of rotation. Freewheeling coupling for freewheeling and for engagement in proper direction.

g. Place new preformed packings (12) on drain tube (13).

NOTE

It may be necessary to replace only one preformed packing (12) if drain tube (13) was not removed and if packing was not leaking.

h. Allow sealant used in preceding step a. (4) to cure for **24** hours at **70 TO 80** degrees F (21 - 27 degrees C).

6-99. Installation "Input Drive Quill (P/N 204-040-363).

CAUTION

Do not use input drive quill, P/N 204-040-363 on transmission assembly 204-040-016-5.

a. Uncover opening for input drive quill in aft side of transmission case. Check that mating surfaces of case and quill are clean.

b. Inspect openings for quill in transmission case for the following conditions:

(1) Any pitting or surface deterioration in the area of seals, gaskets, preformed packings, and mating surfaces of close tolerance machine surfaces, is not acceptable if it will affect the proper function and performance of the mating component or assembly.

(2) Any minor scratches on the preformed packing contact surface should be reworked to blend with the surrounding surface to prevent leakage using crocus cloth (C68) or fine stone (C263 or C264).

c. Remove cover from unused mount opening at left side of transmission and remove No. 6 oil jet.

d. Fabricate work aid (figure 6-25) as follows:

(1) Cut a rubber plug (C230) slightly larger than the diameter of the roller bearing inner race on the inboard end of the input pinion gear (15, figure 6-24).

(2) Insert a 3/16 cotter pin of 0.9375 length through center of rubber plug and through a 0.9375 inch washer having a 1/4 inch hole. Bend ends of cotter pin back against washer and plug.

(3) Attach a piece of **0.125** inch nylon cord (C84) or wire (C156), approximately **2** feet long, to the eye of the cotter pin.

e. Position the rubber plug (figure 6-25) in the bearing that mates with end of pinion gear (15, figure 6-24) from inside of the transmission,

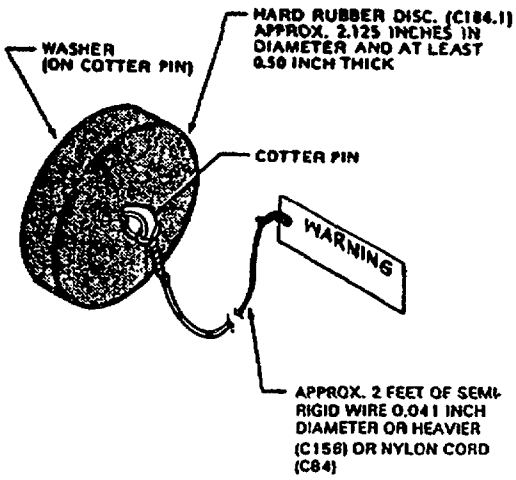


Figure 6-25. Work Aid for Input Drive Quill Installation

in such a manner that the rollers are held against the bearing outer race. Cord to extend outside uncovered quill opening at left side of transmission (step c).

NOTE

No. 6 oil jet must be removed to prevent it from being damaged when plug is removed. Rubber plug installation procedure must be followed to prevent damage to bearing in transmission when installing quill.

f. If not previously accomplished, lubricate new preformed packings (12 and 14) with oil (C166 or C168).

(1) Place preformed packings (12) on ends of drain tube (13) and install one end in transmission case opening.

(2) Place preformed packings (14) in each of the two outside grooves on sleeve (15), leaving middle groove open for oil flow.

(3) Recoat packings (14), OD of sleeve (15) and ID in transmission case opening with oil (C166 or C168).

g. Using a heat lamp, heat the transmission case opening at quill until case is hot to touch or **250** degrees F (**121** degrees C).

h. Remove screws temporarily securing ring (8) to sleeve (11). Insert quill into transmission case and remove rubber plug through unused quill opening on left side of case. Install pusher set (T59.1) (3 each). Exercise care to engage gear teeth and to align nose of pinion gear (15) into roller bearings as quill is installed. Ensure that drain tube (13) is properly installed.

NOTE

Do not tap on outer race of freewheeling clutch assembly (7) while installing quill.

i. Secure quill assembly to case using aluminum washers, thin steel washers, and nuts. On the two lower studs, install aluminum washers, bracket, thin steel washers, and nuts. Torque all nuts **160 to 190** inch-pounds.

j. Verify that backlash exists between quill pinion gear (15) and bevel gear by moving adapter flange of freewheeling clutch assembly (7) back and forth, some backlash must be evident. If no backlash exists, install new quill.

k. Apply a bead of class B-2 sealing compound (C244) around ring (11) and mating edge surfaces of transmission case. Fill three jackscrew holes with sealing compound or use threaded plugs (P/N MS24391D2L) and gaskets (P/N MS28777-2). Plugs should be torqued to **30** inch-pounds and safety wired (C155).

l. Install left cover assembly (PN 204-040-174-1) and new preformed packing over transmission case opening. Secure cover with washers and bolts. Torque nuts **160 to 190** inch-pounds.

m. Install No. 6 oil jet (paragraph 6-66).

n. Install main driveshaft (paragraph 6-23).

o. Service transmission (paragraph 1-6).

p. Install upper left intake section, top section of induction baffle, and engine intake fairing. Close transmission cowl.

q. Check input drive quill for leakage on first engine runup, and perform maintenance test flight to check for freewheeling operation (TM 55-1500-328-25).

6-100. Return to Overhaul - Drive Quills. (AVIM). The following procedures provide instructions for the preservation and packaging of reparable transmission drive quills (input, generator, hydraulic and tachometer) for shipment to an overhaul facility.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

a. Thoroughly clean transmission drive quills with solvent (C261), and blow out all crevices and holes with dry filtered low-pressure compressed air.

b. Coat the entire quill with grade 3 corrosion preventive compound (C86). If a preservative compound is not available, use aircraft grease (C123 or C124) as an alternate.

c. Attach directly to the respective quill an unserviceable (Reparable) Tag, DD Form 1577-2, properly filled out.

d. Annotate DA Form 2410 (Component Removal and Repair/Overhaul Record) per TB 55-1500-307-24 in accordance with TB 750-126.

NOTE

Ensure copies of all records are placed in a greaseproof envelope and stowed with item in the container.

e. If fresh dry desiccant (C105) is available, wrap the quill with flexible barrier material (C115) and secure with tape (C279). If fresh dry desiccant is not available, place quill in a transparent bag (C48), evacuate air, and heat seal.

f. Place wrapped transmission quill, in its reusable metal shipping container with molded hair pads, insert 48 units of dry desiccant (C105). If applicable, and cover quill with molded cushioning material. Secure lid of container. If molded cushioning material is not available, follow procedures as closely as possible, centering transmission quill in the container with adequate cushioning material (C96) surrounding quill. Ensure the quill is held firmly in position and all voids filled with cushioning material. Secure lid of container.

g. As a field expedient only, prepare the transmission quill for shipment as stated below:

NOTE

The procedures stated in this step are based on the assumption that all of the provisions of steps a through f cannot be complied with, that the work will be done under less than ideal conditions with limited equipment, and that on some occasions the work will be done by personnel who are not experts in the field of preservation. This procedure will be used only at locations where the facilities for the application of normal preservation procedures do not exist.

(1) Clean quill to extent possible with available materials and dry with a clean cloth. Prepare the necessary forms and tags in accordance with steps c and d.

(2) Coat entire quill with a heavy coat of any grease type corrosion preventive compound available, or in the absence of material, apply a light coat of aircraft grease (C122 or C129).

(3) Wrap transmission quill with flexible barrier material (C115), and secure barrier material with tape (C279).

(4) Insert wrapped quill in the best available container (constructed if necessary) of metal, wood, or weather resistant fiberboard. Cushion block and brace as necessary.

h. Obliterate old markings from container that do not comply with item to be returned. Mark container in accordance with MIL-STD-129. Stencil DA Form 2410 control number on exterior of container.

6-101. INPUT DRIVE QUILL (P/N 205-040-263).

6-102. Removal - Input Drive Quill (P/N 205-040-263).

NOTE

Seal (10, figure 6-26) may be replaced without removing quill from transmission.

Premaintenance requirements for removal and disassembly - input drive quill

Conditions	Requirements
Model	All
Part No. or Serial No,	205-040-263
Special Tools	(T31), (T57)
Test Equipment	None
Support Equipment	Heat Lamp
Minimum Personnel Required	
Consumable Materials	(C48), (C68), (C86), (C96), (C105), (C115), (C122), (C129), (C166), (C166A), (C168), (C177), (C237), (C244), (C261), (C263), (C264), (C279).
Special Environmental Conditions	None

a. Open transmission fairing. Remove engine intake fairing. Remove top section of induction baffle and upper left intake section.

b. Remove main driveshaft (paragraph 6-17).

c. Disconnect tube assembly (1, figure 6-26, view A), from union (2).

d. Remove nuts, washers, and bracket from mounting studs around flange of input drive quill sleeve assembly (11), and cut sealing compound from around outside of quill sleeve flange and jackscrew holes.

CAUTION

When using jackscrews to remove quill assembly, following procedures must be followed: The jackscrews must be screwed in evenly, exerting equal pressure on quill sleeve to prevent damage to flanges. Do not use force by prying to remove quill, In the event quill cannot be removed by using jackscrews, heat case with appropriate heating tool to facilitate removal of quill assembly. Do not use open flame to heat case.

e. Use three jackscrews (T31) to pull quill from transmission case. Remove jackscrews and discard preformed packings (13).

f. After removing quill, cover opening in transmission case.

g. Remove drain tube (15) and discard preformed packings (14 and 16).

6-103. Disassembly - Input Drive Quill (P/N 205-040-263).

a. Fabricate a work aid (figure 6-24.1). Secure to clutch assembly using tape or other suitable material.

CAUTION

When installing or removing work aid, handle freewheeling clutch (4) with extreme care to prevent loss of sprags. Do not bump or push inboard on the outer race of the free wheeling clutch assembly (4); this could allow the drag spring of the clutch assembly to drop over the inner race. Should either of these conditions exist ship complete clutch and quill assembly to depot for reassembly.

NOTE

Disconnect input drive quill only to extent necessary to replace seal (10, figure 6-26) if required. Seal may be replaced without removing quill from transmission.

a.1. Remove retaining ring (9) and retainer (8) from quill. Remove preformed packing (7) from grease retainer and discard. Install work aid and retaining ring (9). Keep work aid installed during removal, maintenance, and reinstallation.

b. Remove locking spring (6). Insert wrench (T57) into the quill; match the spline teeth on the tool with splines of nut (5). Insert a 3/4 inch square drive extension through wrench and engage inner end of pinion gear (12).

c. Loosen nut (5) using a 314 inch drive handle.

d. Remove wrench (T57) and nut (5).

e. Reinstall retainer (8) (without packing (7)), and retaining ring (9).

f. Remove freewheeling clutch assembly (4) as a unit from sleeve assembly (11) and remainder of quill.

NOTE

Wear sleeve (18) is bonded to outer race of freewheeling clutch assembly (4) in the area contacted by seal (10). The wear sleeve will be removed with the clutch assembly and the seal will remain in the sleeve assembly when the clutch is removed.

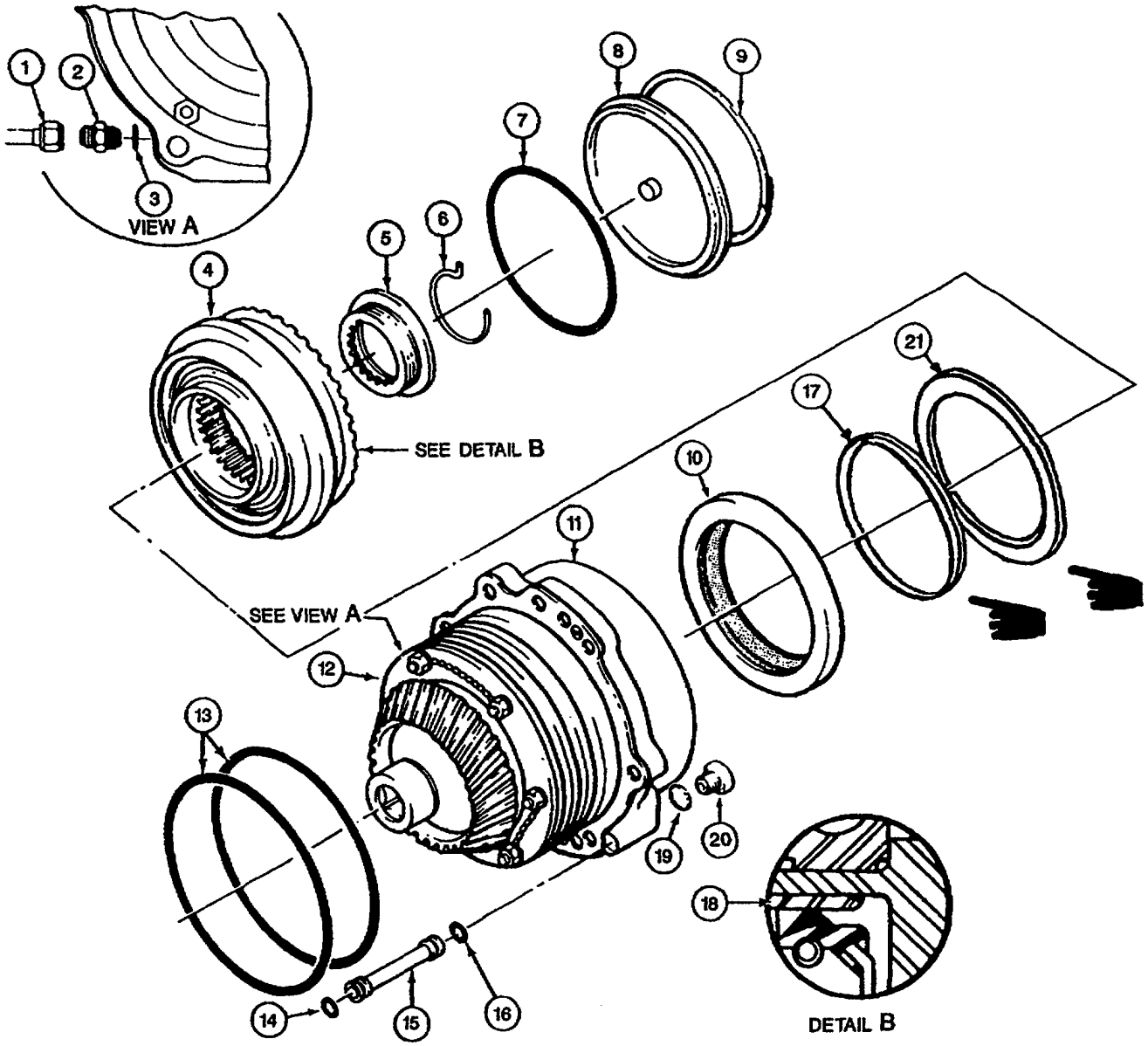
g. Pull seal (10) from sleeve assembly (11).

6-104. Inspection - Input Drive Quill (P/N 205-040-263).

a. Visually inspect for oil leakage.

NOTE

External leakage is not permitted from the transmission quill seals. However, a small amount of seepage assures a satisfactory seal condition. Continuous flow (droplets) is considered excessive and will require seal replacement.



1. Tube assembly
2. Union
3. Packing
4. Clutch assembly
5. Nut
6. Locking spring
7. Packing
8. Grease retainer
9. Retaining ring
10. Seal
11. Sleeve assembly
12. Pinion gear
13. Packing
14. Packing
15. Drain tube
16. Packing
17. Retaining ring
18. Wear sleeve
19. Packing
20. Plug
21. Shield

Figure 6-26. Input Drive Quill, P/N 205-040-263

b. Inspect for damage, pitting and corrosion in area of seals (10, figure 6-26), preformed packings (7, 13, 14 and 16) and mating close tolerance machines surfaces.

c. Inspect groove in retainer (8) for burrs which could damage packings.

d. Minor scratches, nicks, or dents on the preformed, packing contact surface shall be blended with the surrounding surface to prevent leakage. No cracks are allowed.

e. Inspect wear sleeve (18) for security, and for cracks or grooves that will cause damage to seal (10). Refer to paragraph 6-106b. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact arid breathing of solvent vapors.

6-105. Cleaning - Input Drive Quill (P/N 205-040-263).

a. Clean parts with solvent (C261) and dry with filtered compressed air.

b. Lubricate all bearing and machined surfaces immediately after cleaning with oil (C166, C166A or C168).

6-106. Repair - Input Drive Quill (P/N 205-040-263).

a. Replacement of wear sleeve.

(1) Remove freewheeling unit from quill (use tool, T29, P/N 101306, NSN 4920-00-797-3672).

(2) Discard packing, (7, figure 6-26).

(3) Remove seal (10) from quill housing (11).

(4) Remove RR 511 snap ring (17) and shield (21).

CAUTION

After removal of RR 511 snap ring (17) do not allow freewheeling coupling outer race to move axially relative to the coupling inner race.

(5) Drive pins from wear sleeve with a punch.

(6) Remove old wear sleeve from outer race.

(7) Prepare surfaces for bonding as follows:

CAUTION

Replace grease retainer (8), prior to surface preparation and make every effort to insure bearings remain clean and free of contaminates during sleeve replacement.

(a) Initially remove old adhesive using plastic scraper.

(b) Lightly abrade fraying surfaces with 400 grit abrasive paper (C233 or C6) or scotchbrite (C11) and then clean with MEK (C177).

(8) After thoroughly mixing adhesive (C30) per manufacturer's instructions apply to wear sleeves ID as per illustration (figure 6-26.1) 3 to 8 mils thick.

(9) Press new sleeve (18, figure 6-26) onto outer race - insure wear sleeve is pressed onto the race with the internal radius first. Also the outer edge of wear sleeve (see figure 6-26.1) shall be recessed flush to 0.020 inch.

(10) After installation, insure a 0.06R fillet is provided on the inside diameter chamfer of wear sleeve as shown in figure 6-26.1.

(11) Clean-up any excess adhesive that may have seeped through the holes where pins were previously installed.

CAUTION

If heat is used to accelerate cure time do not exceed 250F.

(12) Cure adhesive at room temperature for 24 hours, at 70-95F.

(13) Reinstall shield (21, figure 6-26) and RR 511 snap ring (17).

(14) Mask off all surfaces except O. D. of wear sleeve. Spray O. D. of installed wear sleeve with Teflon-flouroglide (C322). Allow five minutes for drying then buff with a clean dry lint free cloth.

(15) Install new seal (10) in quill housing (para 6-107). Coat the seal lip (10) and wear sleeve (18) with a light film of grease (C-129).

(16) Upon installation of freewheeling unit inspect for proper direction of freewheeling (outer race of clutch drives clockwise).

NOTE

When installing nut (5) torque 350 to 400 ft-lbs (use tool, T29, P/N T1011306, NSN 4920-00-797-3672).

(17) Install new packing (7) and reinstall grease retainer (8) and secure with RR511C snap ring (9).

b. Prepare input drive quill for return to overhaul in accordance with paragraph 6-100.

6-107. Assembly - Input Drive Quill (P/N 205-040-253).

a. Install new seal (10, figure 6-26) in sleeve assembly (11) as follows.

(1) Remove old sealant from ID of sleeve assembly (11) using a sharpened plastic scraper.

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(2) Scrub surface of sleeve assembly (11) using a cloth dampened with methyl-ethyl-ketone (C177).

(3) Clean OD of new seal (10) using a cloth dampened with methyl-ethyl-ketone (C177).

(4) Apply 0.25 inch bead of sealant (C237) to OD of seal (10). Do not apply sealant to top of sleeve assembly (11).

(5) Using a pressing plate slightly smaller than OD of seal (10); press seal into sleeve assembly (11) with seal lip facing inboard toward pinion gear (12). Ensure seal is bottomed in sleeve; remove excess sealant.

b. Clean and lubricate wear sleeve (18) of clutch assembly (4). Lubricate packings (7 and 13) and lip of seal (10) with oil (C166, C66A, or C168).

c. Install freewheeling clutch assembly (4) as follows:

(1) Carefully insert freewheeling clutch assembly (4) into sleeve assembly (11) engaging teeth of pinion gear (12).

(2) Install nut (5) using wrench (T57) with a 3/4 inch square drive extension through wrench and engaging inner end of pinion gear (12). Torque nut **350 TO 400** foot-pounds.

NOTE

Use 3/4 inch square drive extension to hold pinion gear (12) while torquing.

(3) Install locking spring (6). Ensure that spring tang fully engages nut (5) and pinion gear (12).

(4) Remove work aid and install new preformed packing (7) on inboard lip of retainer (8).

(5) Press retainer (8) into freewheeling clutch assembly (4) and secure with retaining ring (9).

(6) Check quill assembly for freedom of rotation. Freewheeling coupling for freewheeling and for engagement in proper direction.

d. Place new preformed packing (14 and 16) drain tube (15).

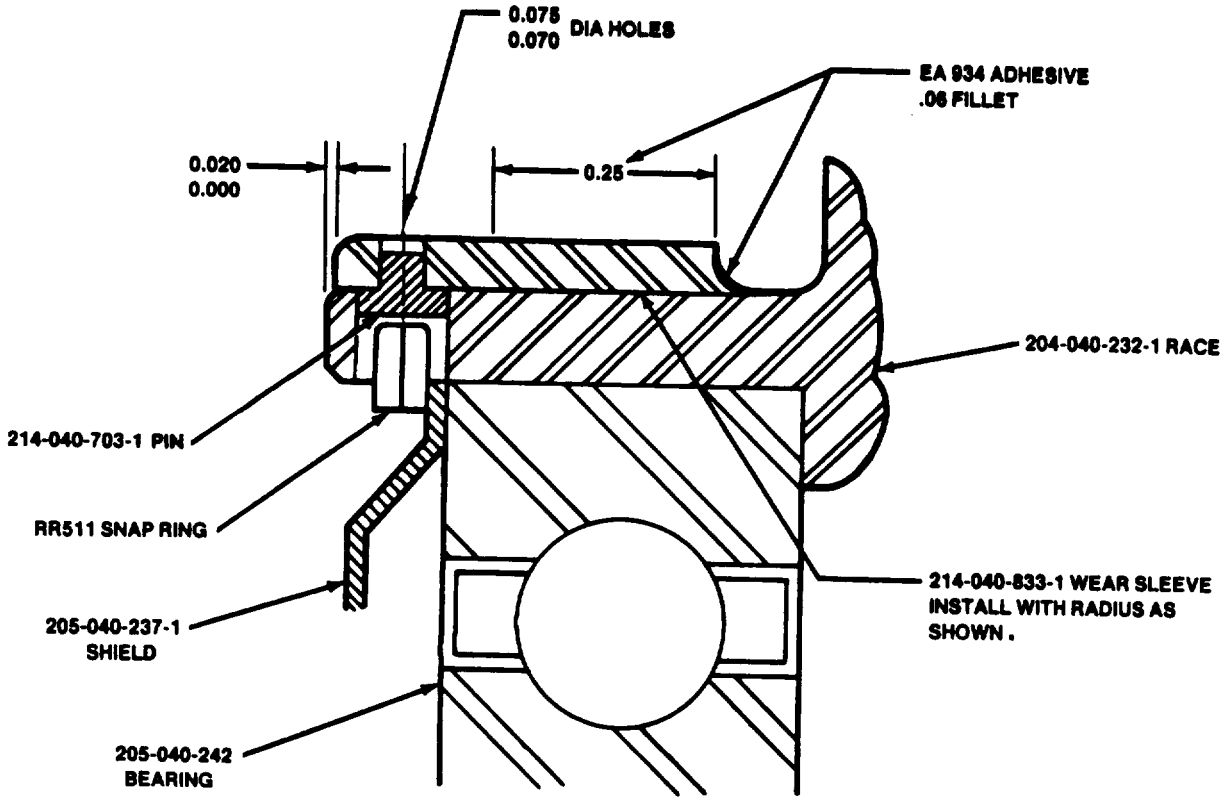


Figure 6-26.1. Input Drive Quill Wear Sleeve Replacement

NOTE

It maybe necessary to replace only one of preformed packing (14 or 16) if drain tube (15) was not removed and if packing was not leaking.

e. Allow sealant used in preceding step a. to cure for 24 hours at **70 to 80** degrees F.

6-108. Installation - Input Drive Quill (P/N 205-040-263).

a. Uncover opening for input drive quill on aft side of transmission case. Check that mating surfaces of case and quill are clean.

b. Inspect opening for quill in transmission case for the following conditions:

(1) Any pitting or surface deterioration in the area of seals, gaskets, packings, and mating surfaces of close tolerance machine surfaces, is not acceptable if it will affect the proper function and performance of the mating component or assembly.

(2) Any minor scratches on the preformed packing contact surface should be reworked to blend with the surrounding surface to prevent leakage using crocus cloth (C68) or fine stone (C263 or C264).

c. Remove cover from unused mount, opening side of transmission.

d. Remove No. 6 oil jet (paragraph 6-62).

e. Fabricate work aid (figure 6-25) as follows:

(1) Cut a rubber plug (C230) slightly larger than the diameter of the roller bearing inner race on the inboard end of the pinion (12, figure 6-26).

(2) Insert a 3/1 6 cotter pin of 0.9375 inch length through center of rubber plug and through a 0.9375 inch washer having a 1/4 inch hole. Bend ends of rotter pin back against washer and plug.

(3) Attach a piece of 0.125 inch nylon cord (C84) or wire (C156), approximately 2 feet long, to the eye of the cotter pin.

f. Position the rubber plug (figure 6-25) in the bearing that mates with end of pinion gear (12, figure 6-26), from inside of the transmission, in such a manner that the rollers are held against the bearing outer race. Cord to extend outside uncovered quill opening at left side of transmission (step c).

NOTE

No. 6 oil jet must be removed to prevent it from being damaged when plug is removed. Rubber plug installation procedure must be followed to prevent damage to bearing in transmission when installing quill.

g. Lubricate new preformed packings (14 and 16) with oil (C166, C166A, or C168) and place preformed packings (14 and 16) on ends of drain tube (15).

(1) Install one end of drain tube (15) in transmission case opening.

(2) Place preformed packings (13) in each of the two outside grooves on sleeve assembly (11), leaving the middle groove open for oil flow.

(3) Recoat preformed packings (13), OD of sleeve assembly (11) and ID in transmission case opening with oil (C166, C166A, or C168).

NOTE

Using a heat lamp, heat transmission case opening at quill until case is hot to touch or 250 degrees F (121 degrees C).

h. Insert quill into transmission case opening and remove rubber plug through unused quill opening on left side of case. Exercise care to engage gear teeth and to align nose of pinion gear (12) into roller bearings as quill is installed. Ensure that drain tube (15) is properly installed.

CAUTION

Do not tap on outer race of freewheeling clutch assembly (4) while installing quill.

i. Secure quill to transmission case with bracket on lower studs, washers, and nuts. Torque nuts **160 TO 190** inch pounds.

NOTE

Refer to paragraph 6-36f., for installation of special input quill mounting studs. These studs are required for use of pusher set (T59.1).

j. Remove set screws from end of quill mounting studs at one, five and nine o'clock positions. Install studs from pusher set into quill mounting studs finger tight and proceed as follows:

(1) Install Input quill onto studs far enough to install spacers of pusher set and three nuts.

(2) Tighten three nuts evenly to seat quill Into case. Exercise care to engage gear teeth and to align nose of pinion into roller bearing. Ensure drain tubs is properly Installed. Remove pusher set, when quill is seated.

(3) Install set screws in end of three mounting studs.

k. Verify that backlash exists between quill pinion gear (12) and bevel gear by moving adapter flange of freewheeling clutch assembly (4) back and forth, some backlash must be evident. If no backlash exists, install new quill.

l. Apply a bead of class B-2 sealing compound (C244) around sleeve assembly (11) and mating edge surfaces of transmission case. Fill jackscrew holes with sealing compound.

m. Install left cover assembly (PIN 204-040-174-1) and new preformed packing over transmission case opening. Secure cover with two thick aluminum washers and bolts. Torque bolts **160 TO 190** inch-pounds. Seal rover.

n. Install No. 6 oil jet (paragraph 6-66).

o. If removed, install new preformed packing (3, figure 6-26, view A) on union (2). Install union in sleeve assembly (11).

p. Fabricate and install seal drain tube (1, view A) as shown in Appendix D.

q. If removed, install new preformed packing (19, figure 6-26) on plug (20). Install plug in sleeve assembly (11) and lockwire (C155).

r. Install main driveshaft (paragraph 6-23).

s. Service transmission (paragraph 1-6).

t. Install upper left intake section, top section of induction baffle, and engine intake fairing. Close transmission fairing.

u. Check input drive quill for leakage on first engine runup, and perform maintenance test flight to check for freewheeling operation (TM 55-1500-328-25).

6-109. GENERATOR DRIVE QUILL

6-110. Description "Generator Drive Quill.
Generator drive quill for DC generator is a quill assembly mounted on front of the transmission, with a generator drive pad above cabin roof level. Quill is driven through a gear train from a spiral bevel drive gear mounted in transmission main case. Quill is equipped with a vent breather and a magnetic plug.

6-111. Removal Generator Drive Quill.

Premaintenance requirements for removal and disassembly of generator/alternator drive quill.

Conditions	Requirements
Model	All
Part No. or Serial No.	205-040-200
Special Tools	(T26)
Test Equipment	None
Support Equipment	Heat Lamp
Minimum Personnel Required (MOS)	One
Consumable Materials	(C68), (C155), (C166), (C166A), (C168), (C177), (C237), (C244), (C261), (C262), (C264)
Special Environmental Conditions	None

a. Remove transmission (paragraph 6-31).

NOTE

Generator drive quill cannot be removed or installed while transmission Is In place In helicopter.

b. Remove dc generator (paragraph 9-64).

c. Remove four bolts (3, figure 6-27), washers (2 and 8), spacers (7 and 10), nuts (11), and cyclic spring bracket (1) from transmission top case.

d. Remove two nuts (5), washers (6), support bracket (4), and shims (9) from transmission case and generator drive quill (14).

e. Remove five bolts (17) and washers (16 and 15) securing generator drive quill (14) to transmission case and out sealing compound from around outside of quill sleeve flange and jackscrew holes.

CAUTION

When using jackscrews to remove quill assembly these procedures must be followed: Two jackscrews must be screwed in evenly exerting equal pressure on quill sleeve to prevent damage to flanges. Do not use force by prying on flanges. In the event quill cannot be removed by using jackscrews, heat case, and use jackscrews. Do not use torch or open flame to heat case.

f. Use jackscrews (T33) and pull generator drive quill (14) from transmission case. Remove jackscrews.

g. Cover opening in transmission case to prevent entry of foreign materials.

h. Cut lockwire and remove magnetic plug (18) and self-closing valve (19) from generator drive quill (14).

6-112. Disassembly "Generator Drive Quill.

a. Remove retaining ring (1, figure 6-23) from drive quill (8).

b. Use pliers as shown in figure 6-28, catch lip of seal housing (3) and work from quill.

c. If shim (5) comes out, carefully reinstall against bearing (6). Cover quill.

d. Press seal (4) from seal housing (3) and discard preformed packing (2).

6-113. Inspection "Generator Drive Quill.

a. Inspect for evidence of oil leaks.

NOTE

External leakage from seal (4, figure 6-28) is not permitted. However, a small amount of seepage assures a satisfactory seal condition. Continuous flow (droplets) is considered excessive and will require seal replacement.

b. Check OD of generator drive quill (8) in area of preformed packing groove for corrosion and wear. Corrosion not permitted; replace quill if OD is less than **4.9989** inches (figure 6-28).

c. Visually inspect case of quill (8) for cracks, chipping, scoring, and wear. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

d. Inspect seal surface on gear (7) for nicks, scratches, or excessive wear.

e. Inspect bearings in quill (8) for smoothness and freedom of operation.

f. Check magnetic plug (18, figure 6-27) for metal particles paragraph 6-30 and figure 6-14.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

g. Remove vent cap and vent, determine if vent is unclogged and clean throughout.

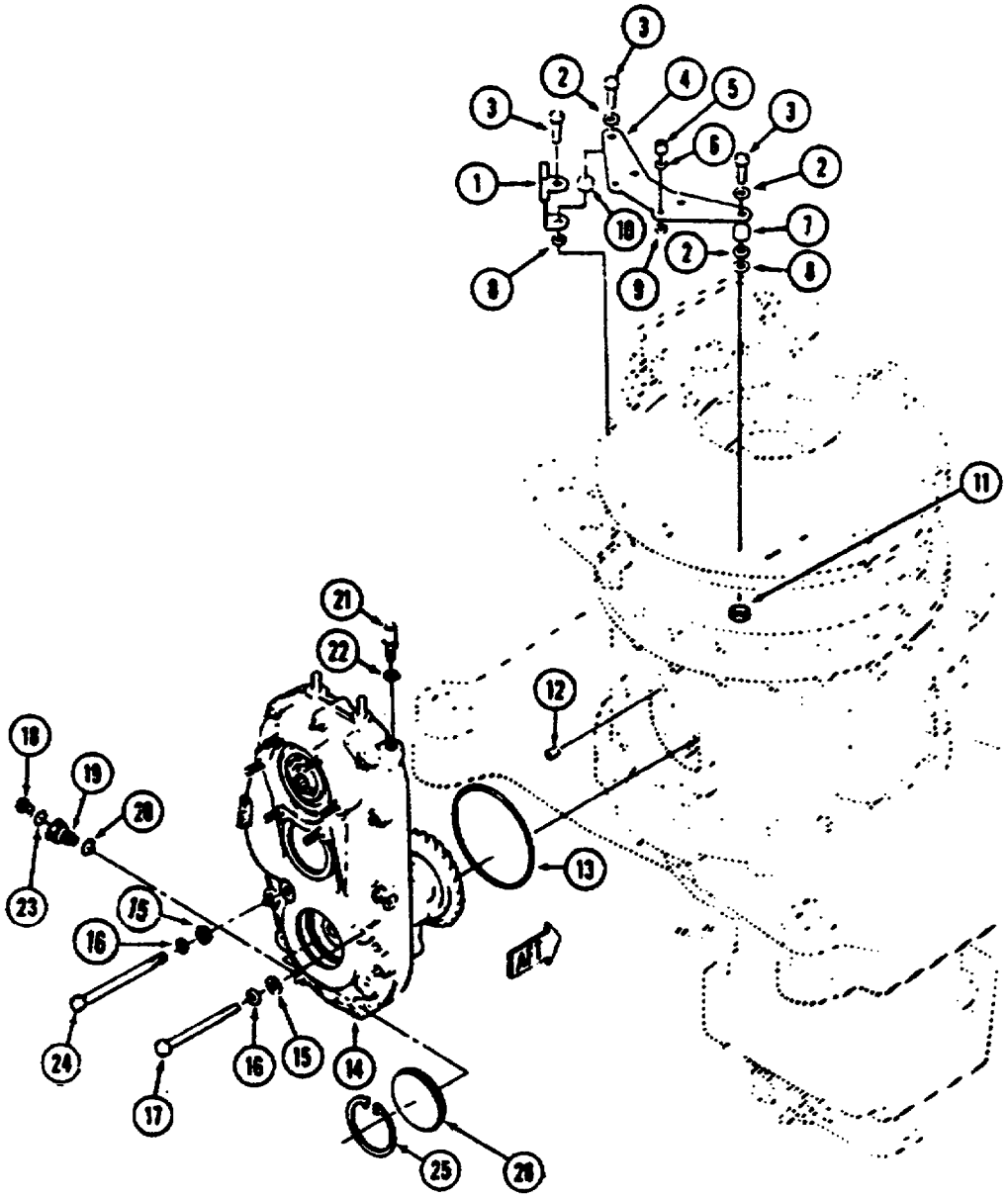
6-114. Cleaning "Generator Drive Quill.

a. Clean parts with solvent (C261) and dry with filtered compressed air.

b. Lubricate bearings and machined surfaces immediately after cleaning with oil (C1 66, C166A, or C168).

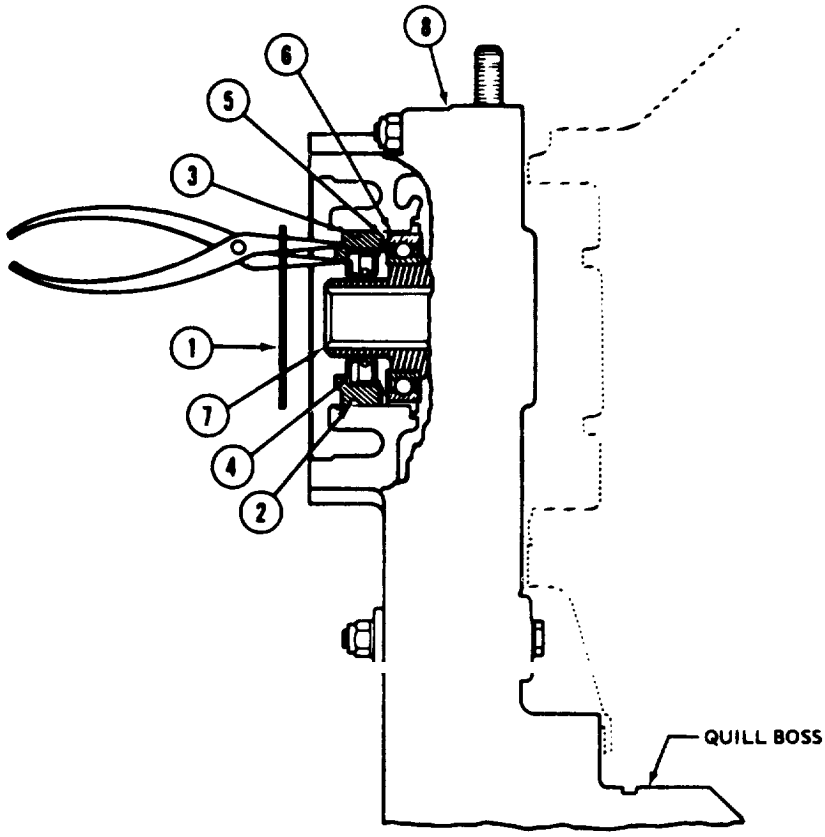
6-115. Repair "Generator Drive Quill.

a. Replace seal (4, figure 6-28), if leakage exists (paragraph 6-116).



1. Cyclic spring bracket
2. Washer
3. Bolt
4. Support Bracket
5. Nut
6. Washer
7. Spacer
8. Washer
9. Shim
10. Spacer
11. Nut
12. Set screw
13. Preformed packing
14. Generator drive quill
15. Washer
16. Washer
17. Bolt
18. Magnetic plug
19. Self-closing valve
20. Gasket
21. Vent breather
22. Gasket
23. Preformed packing
24. Bolt
25. Retaining ring
26. Cover plate

Figure 6-27. Generator - Removal and Installation



1. Retaining ring
2. Preformed packing
3. Seal housing
4. Seal
S. Shim
6. Bearing
7. Gear
8. Generator drive quill

Figure 6-28. Generator/Alternator Drive Quill – Seal Replacement

b. Replace (without repair) if quill boss is corroded or worn beyond replacement limit of **4.9989** inches O.D.

c. Replace (without repair) if gear teeth are cracked, chipped, scored or worn,

d. Replace (without repair) if bearings are **binding or rough.**

e. Polish out minor nicks or scratches in seal surface of gear (7) with fine stone (C262 or C264) or crocus cloth (C68).

f. If metal particles are noted on magnetic plug conduct action required by figure 6-14.

g. Prepare generator drive quill for return to overhaul in accordance with paragraph 6-1 W.

6-116. Assembly — Generator/Alternator Drive Quill. a. Install new seal (4, figure 6-28) in seal housing (3) as follows:

(1) Remove old sealant from ID of seal housing (3) using a sharpened plastic scraper.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(2) Scrub I. D. of seal housing (3) using a cloth dampened with methyl-ethyl-ketone (C177).

(3) Clean O.D. of seal (4) using a cloth dampened with methyl-ethyl-ketone (C177).

(4) Apply a film of sealant (0244) to O.D. of seal (4) and ID of seal housing (3).

(5) Using a pressing plate slightly smaller than O.D. of seal (4); press seal into seal housing (3) with seal lip facing inboard. Ensure seal is bottomed in housing; remove excess sealant.

b. Lubricate new preformed packing (2) with grease (C129). Place packing in groove of seal housing (3).

CAUTION

Do not pull on gear (7) while retaining ring (1) is removed.

c. Check to ensure that shim (5) is in place against bearing (6).

d. Lubricate lip of seal (4) and OD of gear (7) with oil (C166, C166A, or C168).

e. Carefully press seal housing (3) and seal (4) over gear (7) and into generator drive quill (8). Secure housing with retaining ring (1).

6-117. Installation" Generator Drive Quill.

a. Inspect transmission case at opening for drive quill (14, figure 6-27) for the following conditions:

CAUTION

Ensure that set screw (12, figure 6-27) is installed prior to Generator Drive Quill (paragraph 6-39).

(1) Pitting or surface deterioration in the area of seals gaskets, preformed packings, and mating surfaces of close tolerance machine surfaces, is not acceptable if if will affect the proper function and performance of the mating component or assembly.

(2) Any minor scratches on the preformed packing contact area should be reworked to blend with the surrounding surface to prevent Ieakage. using a fine stone (C263 or C264) or crocus cloth (C68).

b. Lubricate new preformed packing (13) with oil (C166, C166A, or C168). Apply oil film to boss of generator drive quill (14) and opening in transmission case.

c. Place preformed packing (13) on boss of generator drive quill (14).

d. Using a heat lamp, heat the transmission case at opening for quill (14) until case is hot to touch or 250 degrees F. Do not use torch or frame to heat transmission case.

NOTE

A work aid for installling the generator drive quill may be fabricated as shown in figure 6-29.

e. If work aid is required then install the three work aid studs into case threads at equally spaced intervals.

f. Install generator drive quill (14, figure 6-27) as follows:

NOTE

To verify backlash in the following step, Retaining Ring (25) and Cover Plate (26) must be removed.

(1) Align and position generator drive quill (14) over work aid studs.

(2) Install steel washers on work aid studs and against case of generator drive quill (14). Thread work aid pushers onto studs.

CAUTION

Ensure that gears of generator drive quill (14) and transmission driving gear are properly meshed before seating quill.

(3) Tighten work aid pushers evenly until generator drive quill (14) is fully seated. Remove work aids.

(4) Secure generator drive quill (14) to transmission with five bolts (17), steel washers (16) and aluminum washers (15). Torque bolt 160 to 190 inch-pounds. Verity presence of backlash between quill (14) bevel gear and drive gear in transmission.

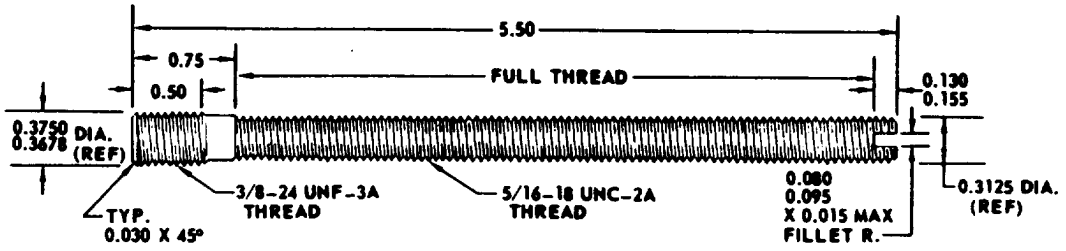
NOTE

Deleted

(5) EX Secure drive quill (14) to transmission with four bolts (17), one bolt (24) (ten o'clock position), steel washers (16) and aluminum washers (15). Torque bolts **160 to 190** inch-pounds. Verify presence of backlash between quill (14), bevel gear and drive gear in transmission.

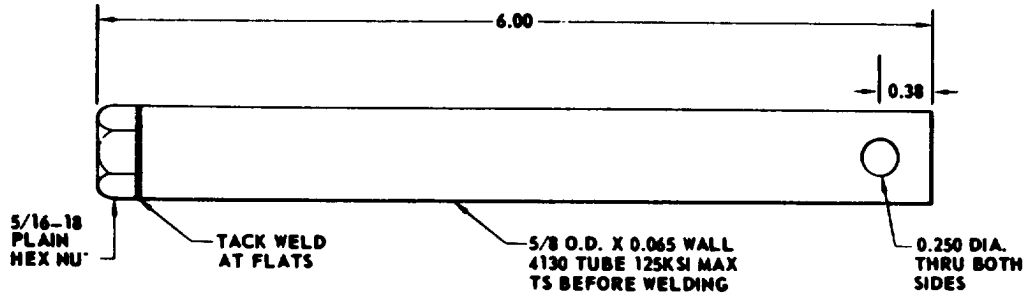
(6) Apply bead of sealing compound (C244) around perimeter of generator drive quill (14) and mating edge surfaces of transmission case. Fill jackscrew holes with sealing compound.

g. Install cyclic spring bracket (1) and support bracket (4) as follows:



STUD

MAKE FROM 4130 STEEL ROD 125-145KSI TS



PUSHER

FLASH CAD PLATE

WORK AID

TO INSTALL ALL QUILLS EXCEPT INPUT QUILL IN MAIN GEAR CASE

USE STEEL WASHER BETWEEN PUSHER AND QUILL FLANGE

THREE EACH REQUIRED

205040-30

Figure 6-29. Work Aid for Installing H V Generator Drive Quill and EX Alternator Drive Quill

(1) Assemble brackets (1 and 4), bolts (3), steel washers (2), aluminum washers (8), and spacers (7 and 10) to transmission case.

(2) Add shims (9) between support bracket (4) and generator drive quill (14) until shims are equal in height to spacers (7 and 10) within **0.003** inch.

(3) Install nuts (11) to bolts (3) and nuts (5) and steel washers (6) to studs on generator drive quill (14).Torque nuts **160 TO 190** inch-pounds.

h. If removed, replace gasket (22) on vent breather (21).

(1) Install vent breather (21) with gasket (22) in top right comer of generator drive quill (14). Torque vent breather **30 TO 40** inch-pounds.

(2) Safety vent breather (21) to quill boss with lockwire (C155).

i. Using new preformed packing (23), assemble magnetic plug (18) in self-closing valve (19).

(1) Install self-closing valve (19) in lower right comer of generator drive quill (14). Torque valve **200 TO 300** inch-pounds. Torque magnetic plug **50 TO 70** inch-pounds.

(2) Safety magnetic plug (18) and self-closing valve (19) to quill boss with lockwire (C155).

j. Install dc generator (paragraph 9-66).

k. Install transmission (paragraph 6-40).

l. Service transmission (paragraph 1-6).

m. Check generator drive quill for oil leakage and dc generator for operation on first engine runup. (TM 55-1520-210-10).

6-118. HYDRAULIC PUMP AND TACHOMETER DRIVE QUILL.

6-119. Description - Hydraulic Pump and Tachometer Drive Quill. The hydraulic pump and tachometer accessory drive quill (figure 6-30), located on right side of transmission sump case, is driven by an accessory gear train. Gear shaft of this quill directly drives the hydraulic system pump, and also drives the rotor tachometer generator by means of a chain-and-sprocket offset drive.

6-120. Removal - Hydraulic Pump and Tachometer Drive Quill.

a. Obtain access by detaching soundproofing blanket and removing access plates on right side of pylon island in cabin.

b. Remove rotor tachometer generator by disconnecting electrical connector and removing four nuts and four washers from four mounting studs through flange of drive quill, discard gasket (paragraph 8-36).

c. Remove hydraulic pump (paragraph 7-21).

CAUTION

When using jackscrews to remove quill assembly, following procedures must be followed: the jackscrews must be screwed in evenly exerting equal pressure on quill sleeve to prevent damage to flanges. Do not use force by prying to remove quill, in the event quill cannot be removed by using jack-screws, heat case and use jackscrews. Do not use torch or open flame to heat case.

d. Remove two nuts (1, figure 6-30) and washers (2) from shortest top and bottom studs. Cut sealing compound from around outside of quill sleeve flange and jackscrew holes.

e. Use jackscrews (T31) to pull hydraulic pump and tachometer drive quill (3) from sump case. Remove jackscrews and discard preformed packing (4).

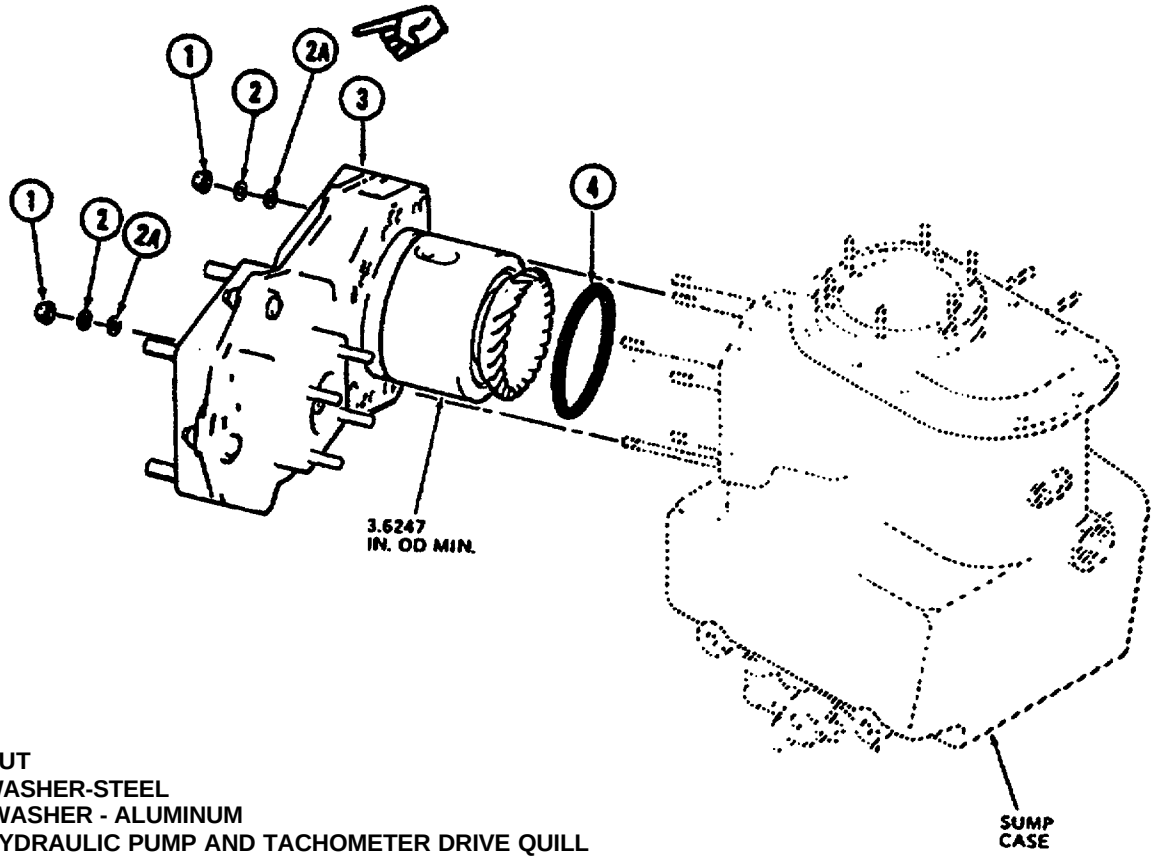
f. Cover opening in sump case to prevent entry of foreign materials.

6-121. Inspection - Hydraulic Pump and Tachometer Drive Quill.

a. Visually inspect for oil leaks.

NOTE

External leakage of quill seals is not permitted. However, a small amount of seepage assures a satisfactory seal condition. Continuous flow (droplets) is considered excessive and will require quill replacement.



1. NUT
2. WASHER-STEEL
2A. WASHER - ALUMINUM
3. HYDRAULIC PUMP AND TACHOMETER DRIVE QUILL
4. PREFORMED PACKING

Figure 6-30. Hydraulic Pump and Tachometer Drive Quill - Removal and Installation

b. Check O. D. of hydraulic pump and tachometer drive quill (3, figure 6-30) in area of preformed packing groove for corrosion and wear. Corrosion not permitted; replace quill if O. D. is less than 3.6247 inches (Figure 6-30).

c. Visually inspect case of quill (3) for cracks, chipping, scoring and abrasion. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

d. Inspect bearings in quill (3) for smoothness and freedom of operation.

e. Visually inspect gear teeth of quill (3) for cracks, chipping, scoring and wear. No cracks allowed. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

6-122. CLEANING - HYDRAULIC PUMP AND TACHOMETER DRIVE QUILL.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

a. Clean parts with solvent (C261) and dry with filtered compressed air.

b. Lubricate bearings and machined surfaces immediately after cleaning with oil (C166, C166A or C168).

6-123. Repair - Hydraulic Pump and Tachometer Drive Quill.

a. Replace preformed packing (4, figure 6-30) if oil leakage is evident or if packing has deformed or swelled. Replace (without repair) if seal leakage is evident.

b. Replace (without repair) if quill (3) boss is corroded or excessively worn beyond replacement limit of **3.6247** inches O. D.

c. Replace (without repair) if bearings are binding or rough.

d. Replace (without repair) if gear teeth are cracked, chipped, scored or worn.

e. Prepare hydraulic pump and tachometer drive quill for return to overhaul in accordance with paragraph 6-100.

6-124. Installation - Hydraulic Pump and Tachometer Drive Quill.

a. Inspect sump case, at opening, for hydraulic pump and tachometer drive quill (3, figure 6-30) for the following conditions:

(1) Pitting or surface deterioration in the area of seals, gaskets, preformed packing, and mating surfaces of close tolerance machine surfaces, is not acceptable if it will affect the proper function and performance of the mating component or assembly.

(2) Any minor scratches on the preformed packing contact surface should be reworked to blend with the surrounding surface to prevent leakage using a fine stone (C262 or C264) or crocus cloth (C68).

b. Lubricate new preformed packing (4), boss of quill (3) and mating surfaces in sump case with oil (C166, C166A, or C168).

c. Place preformed packing (4) on boss of quill (3).

d. Using a heat lamp, heat the sump case at opening for quill (3) until case is hot to touch or 250 degrees F. Do not use torch or flame to heat sump case.

CAUTION

Ensure that gears of quill (4) and sump driving gear are properly meshed before seating quill.

e. Position quill (3) over sump case studs and press in place aligning gear teeth.

f. On two shortest studs on top and bottom of quill (3), install washers (2) and nuts (1). Torque nuts evenly **100 TO 140** inch-pounds.

g. Verify that backlash exists between quill (3) pinion gear and drive gear by moving hydraulic pump drive gear back and forth, some backlash must be evident. If no backlash exists, install new quill.

h. Apply a bead of class B-2 sealing compound (C244) around perimeter of quill (3) and mating edge surfaces of sump case. Fill jackscrew holes with sealing compound.

i. Install rotor tachometer generator with a new gasket and Connect electrical wiring (paragraph 8-39).

j. Install hydraulic pump with new gasket and connect lines (paragraph 7-21).

k. Service transmission (paragraph 1-6).

l. Check hydraulic pump and tachometer drive quill for oil leakage, hydraulic system operation, and rotor tachometer operation on first engine runup (TM 55-1520-210-10).

6-125. TAIL ROTOR DRIVE QUILL.

6-126. Description - Tail Rotor Drive Quill. The tail rotor drive quill (figure 6-31) is mounted into aft side of transmission sump case and is driven by an accessory gear train. A flexible splined coupling on quill provides means of attaching tail rotor driveshaft.

6-127. Removal Tail Rotor Drive Quill.

Premaintenance requirements for removal and disassembly of tail rotor drive quill

Conditions	Requirements
Model	All
Part No. or Serial No.	204-040-207
Special Tools	(T33), (T60), (T30)

Conditions	Requirements
Test Equipment	None
Support Equipment	Heat Lamp
Minimum Personnel Required	One
Consumable Materials	(C68), (C155), (C158), (C166), (C166A), (C168), (C177), (C237), (C244), (C261), (C262), (C264)
Special Environmental Conditions	None

a. Open cowling at either side of transmission.

b. Remove forward section of tail rotor driveshaft (paragraph 6-162).

c. Drain oil level below tail rotor drive quill (2, figure 6-31).

d. Remove nuts (5), washers (3 and 4), spacers (6), clamp (7), and bracket (9) with sump outlet hose assembly (8) from six studs securing tail rotor drive quill (2). Cut sealing compound from around outside of quill sleeve flange and jackscrew holes.

CAUTION

When using jackscrews to remove quill assembly, following procedures must be followed: The jackscrews must be screwed in evenly, exerting equal pressure on quill sleeve to prevent damage to flanges. Do not use force by prying to remove quill, in the event quill cannot be removed by using jackscrews, heat case, and use jackscrews. Do not use torch or open flame to heat case.

e. Use three jackscrews (T33) to pull quill (2) from sump case. Remove jackscrews and discard preformed packing (1).

f. Cover opening in sump case to prevent entry of foreign materials.

6-128. Disassembly - Tail Rotor Drive Quill.

WARNING

Remove plate assembly (21, figure 6-32) slowly so centering spring (20) will not fly out.

a. Remove retaining ring (22), plate assembly (21) and centering spring (20).

b. Remove retaining ring (19) and retainer (18) with packing (17).

c. Use wrench (T30) to hold driveshaft coupling (6). Using male end of 1/2 inch square drive extension, remove coupling bolt (16), and ring spacer (15).

d. Remove spherical coupling (14) with driveshaft coupling (6), and sleeve spacer (8).

e. Cut and remove lockwire from ring (11).

f. Using special tool (T60), remove ring (11) and seal (10).

g. Press seal (10) from ring (11).

h. Remove seal (7) from coupling (6) if damaged or shows signs of leakage.

6-129. Inspection - Tail Rotor Drive Quill.

a. Visually inspect for oil leakage.

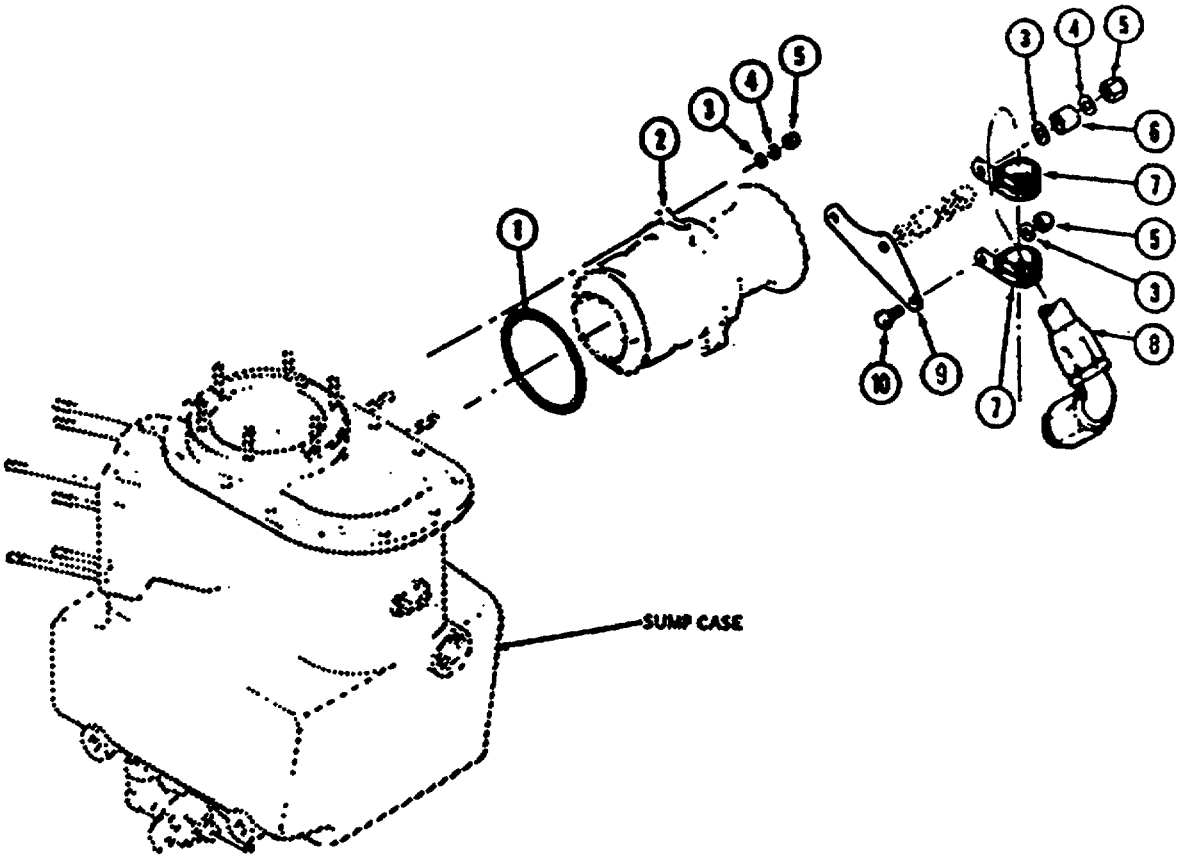
NOTE

External leakage from quill seal is not permitted. However, a small amount of seepage assures a satisfactory seal condition. Continuous flow (droplets) is considered excessive and will require seal replacement.

b. Visually inspect sleeve assembly (5, figure 6-32) for cracks, chipping, scoring and abrasion. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

c. Inspect roller bearings (3) and duplex bearings (13) for smoothness and freedom of movement.

(1) Inspect center spring (20) by applying a test load of 5.0 plus or minus 0.5 pounds to compress spring 1.5 plus or minus 0.10 inches.



1. PREFORMED PACKING
2. TAIL ROTOR DRIVE QUILL
3. WASHER
4. WASHER
5. NUT
6. SPACER
7. CLAMP
8. HOSE ASSEMBLY
9. BRACKET
10. BOLT

Figure 6-31. Tail Rotor Drive Quill - Removal and Installation

d. Visually inspect gear teeth of bevel gear (1), sleeve spacer (8), for cracks, chipping, scoring, and wear. Inspect driveshaft coupling (6) and spherical coupling (14) per paragraph 6-200.1. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

6-130. Cleaning - Tail Rotor Drive Quill.

WARNING

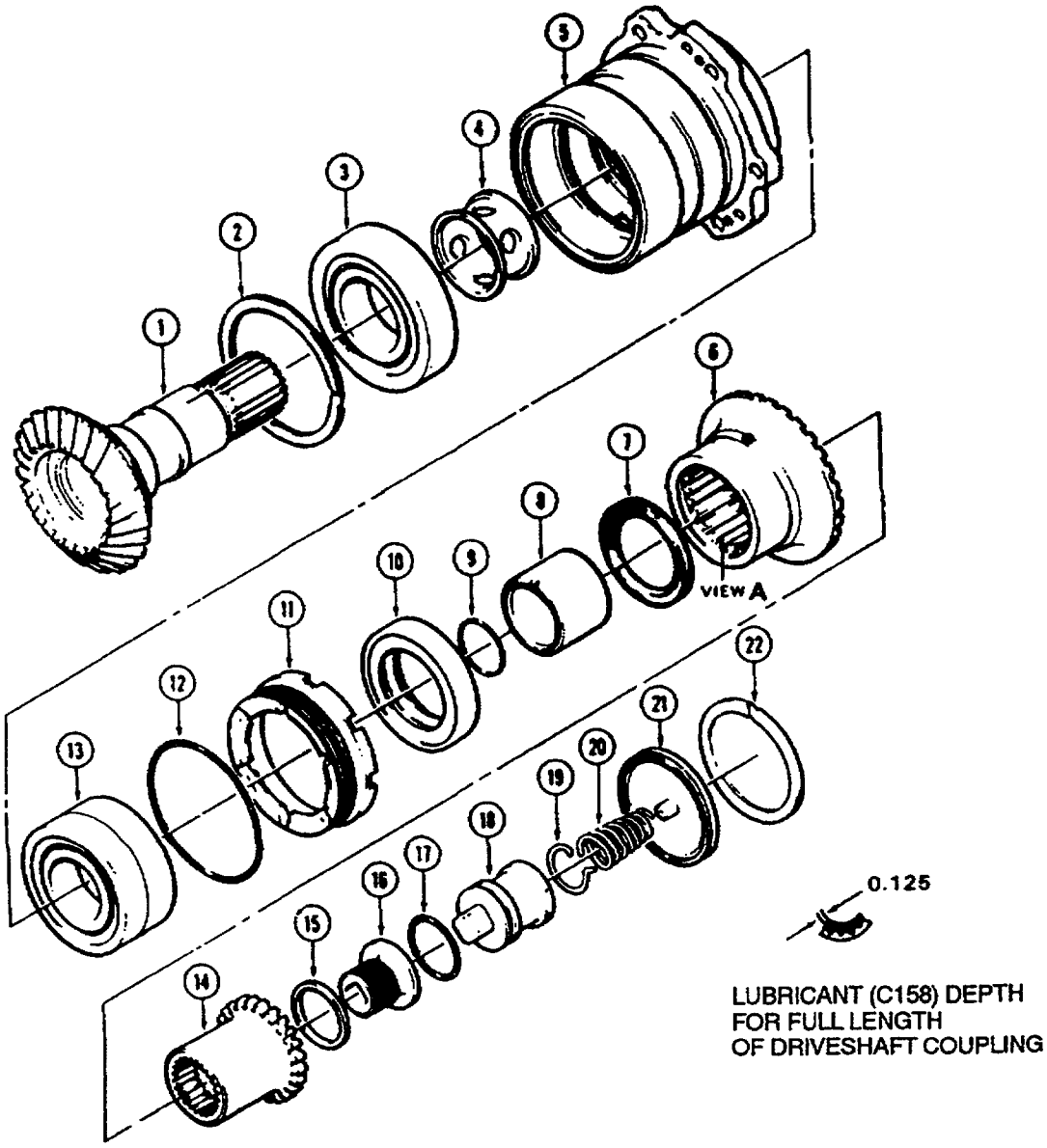
Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

a. Clean all parts with solvent (C261) and dry with filtered air.

CAUTION

Clean driveshaft coupling (6) and spherical coupling (14) with clean dry cloths only. Do not solvent clean.

b. Lubricate bearings and machined surfaces immediately after cleaning with oil (C166, C166A, or C168), except for couplings (6 and 14).



1. Bevel gear
2. Retaining ring
3. Roller bearing
4. Sleeve bearing
5. Sleeve assembly
6. Driveshaft coupling
7. Seal
8. Sleeve spacer
9. Preformed packing
10. Seal
11. Ring
12. Preformed packing
13. Duplex bearing
14. Spherical coupling
15. Ring spacer
16. Coupling bolt
17. Preformed packing
18. Retainer
19. Retaining ring
20. Centering spring
21. Plate assembly
22. Retaining ring

Figure 6-32. Tail Rotor Drive Quill - Seal Replacement

6-131. Tail Rotor Drive Quill -Seal Replacement.

a. Repair by replacement of seal (10, figure 6-32) if there is oil leakage. Replace seal (7) if there is evidence of grease leakage.

b. Replace centering spring (20) if damaged.

c. Replace (without repair) if sleeve assembly (5) is corroded or excessively worn beyond replacement limit of 3.6247 inches O.D.

d. Replace (without repair) if bearings are binding or rough.

e. Replace (without repair) if gear teeth are cracked, chipped, scored, or wom.

f. Replace (without repair) if couplings (6 and 14) are cracked, chipped, scored, worn or show evidence of having overheated in service.

g. Prepare tail rotor drive quill for return to overhaul in accordance with paragraph 6-100.

6-132. Assembly Tail Rotor Drive Quill.

a. Install new seal (10, figure 6-32) in ring (11) as follows:

(1) Remove old sealant from I.D. of ring (11) using a sharpened plastic scraper.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(2) Scrub I.D. ring (11) using a cloth dampened with methyl-ethyl-ketone (C177).

(3) Clean O.D. of seal (10) using a cloth dampened with methyl-ethyl-ketone (CI77).

(4) Apply a film of sealant (C237) to O.D. of seal (10) and I.D. of ring (11).

(5) Using a pressing plate smaller than O.D. of seal (10); press seal into ring (11) with seal lip facing inboard. Ensure seal is bottomed in ring; remove excess sealant

b. Lubricate lip of seal (10) and new preformed packings (9 and 12), and O.D. of sleeve spacer (8) with oil (C166, C166A, or C168).

c. Place packing (9) on bevel gear (1) at end of splines and packing (12) in groove on O.D. of ring (11).

d. Using wrench (T60), install ring (11) in sleeve assembly (5) and torque 1200 TO 1800 inch-pounds. Remove wrench.

e. Carefully apply a bead of sealing compound (C244) around the mating joint of ring (11) and sleeve (5). Smooth the sealing compound. Lockwire (C155) ring (11) to sleeve assembly (5).

f. Install sleeve spacer (8) on bevel gear (1) with packing (9) and carefully press seal (10) until bottomed.

g. Install new seal (7) in groove at small end of outer coupling (6). Use crocus cloth (C68) to burnish seal seat between gear teeth and end of coupling.

h. Lubricate driveshaft coupling (6) and spherical coupling (14) as follows:

(1) Apply a coating of lubricant (Cl58) to faces of internal splines on driveshaft coupling (6). Additional lubricant is required in step (3) below.

(2) Use wrench (T30) to hold driveshaft coupling (6). Insert spherical coupling (14) in driveshaft coupling (6) and install on bevel gear (1) with ring spacer (15) and coupling bolt (16). Torque bolt 960 TO 1200 inch-pounds.

WARNING

Tail rotor drive quill couplings must be inspected and lubricated prior to the installation of a new or overhauled transmission.

(3) Move driveshaft coupling (6, view A) fully outboard. Hand pack coupling with lubricant (C158) to 0.125 inch depth over full length of internal spline teeth. Maintain coupling position until retaining ring (22) is installed (step j).

i. Install newpreformed packing (17) on retainer (18) and press into coupling bolt (16) and spherical coupling (14). Secure retainer inside coupling with retaining ring (19). Ensure end of ring (19) is engaged through hole in retainer (18) and slot in coupling (14).

j. Insert large end of centering spring (20) into retainer (18). Hold driveshaft coupling (6) outboard and press in plate assembly (21), engaging boss in plate with center of spring, secure with retaining ring (22).

k. Apply a bead of class B-2 sealing compound (C244) around ring (11) and mating surface of sleeve assembly (5).

6-133. Installation Tail Rotor Drive Quill.

a. Inspect sump case opening for tail rotor drive quill (2, figure 6-31) for the following conditions:

(1) Pitting or surface deterioration in the area of seals, preformed packings, and mating surfaces of close tolerance machined surfaces, is not acceptable if it will affect the proper function and performance of the mating component or assembly.

(2) Any minor scratches on the preformed packing contact surface should be reworked to blend with the surrounding surface to prevent leakage using a fine stone (C263 or C0264) or crocus cloth (C68).

b. Lubricate new preformed packing (1, figure 6-31), boss of quill (2) and opening in sump case with oil (C166, C166A or C168).

c. Place preformed packing (1) on boss of quill (2).

d. Using a heat lamp, heat sump case at opening for quill (2) until case is hot to touch or 250 degrees F. Do not use torch of flame to heat sump case.

CAUTION

Ensure that bevel gear and sump driving gear are properly meshed before seating quill. Do not tap or press on flexible coupling.

e. Position quill (2) over sump case studs and press in place aligning gear teeth.

f. Position bracket (9) and clamp (7) on sump case studs with washers (3), spacers (6), washers (4), and nuts (5). Torque nuts evenly 50 TO 70 inch pounds.

g. Verify that backlash exists between quill (2), bevel gear and drive gear by moving driveshaft coupling back and forth; some backlash must be evident. If no backlash exists, install new quill.

h. Apply a bead of class B-2 sealing compound (C244) around perimeter of quill (2) and mating edge surfaces of sump case. Fill jackscrew holes with sealing compound.

i. Install forward section of tail rotor driveshaft, secured by clamps to couplings of quill (2) and first bearing hanger (paragraph 6-165).

j. Service transmission (paragraph 1-6).

k. Close cowling at either side of transmission.

I. Check tail rotor drive quill for oil leakage on first engine operation (TM 55-1520-210-10).

6-134. MAIN ROTOR MAST ASSEMBLY.

6-135. Description Main Rotor Mast. The main rotor mast assembly (figure 6-33) is a tubular steel shaft fitted with two bearings which support it vertically in the transmission. Mast driving splines engage with transmission upperstage planetary gear, providing counterclockwise rotation as viewed from above. Splines on upper portion of mast provide mounting for main rotor and control assemblies. The upper bearing retainer plate contains the No. 8 oil jet fed by an external hose.

6-136. Removal Main Rotor Mast.

Premaintenance requirements for removal and repair of main rotor mast

Conditions	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	None Test
Equipment	None Support
Equipment	Hoist 800 pound capacity
Minimum Personnel Required	Two

Conditions	Requirements
Consumable Materials	(C86), (C96), (C110), (C115), (C122), (C129), (C166), (C166A), (C168), (C177), (C262), (C237), (C244), (C261), (C263), (C264), (C279)
Special Environmental Conditions	None

a. Open transmission fairing.

b. Use hoist with 800 pound capacity.

c. Prior to incorporation of MWO 55-1520-242-50-1, remove stabilizer bar, main rotor, dampers and supports, scissors and sleeve, and swashplate and support assemblies (paragraph 5-12, 5-40, 5-61, 5-71, and 5-79).

c.1. After incorporation of MWO 55-1520-242-50-1, remove hub moment springs and support assembly (paragraph 5-56.3) in addition to stabilizer bar, main rotor, dampers and supports, scissors and sleeve, and swashplate and support assemblies (paragraph 5-12,5-40,5-61,5-71, and 5-79).

d. Install mast nut (1, figure 6-33) on top of mast (2).

e. Attach hoist to mast nut (1) and take up cable slack.

f. Remove nuts (3) and washers (4 and 5) securing retainer plate (6) to the transmission (8) case studs.

g. Disconnect oil hose for No. 8 let (9) from retainer plate (6).

CAUTION

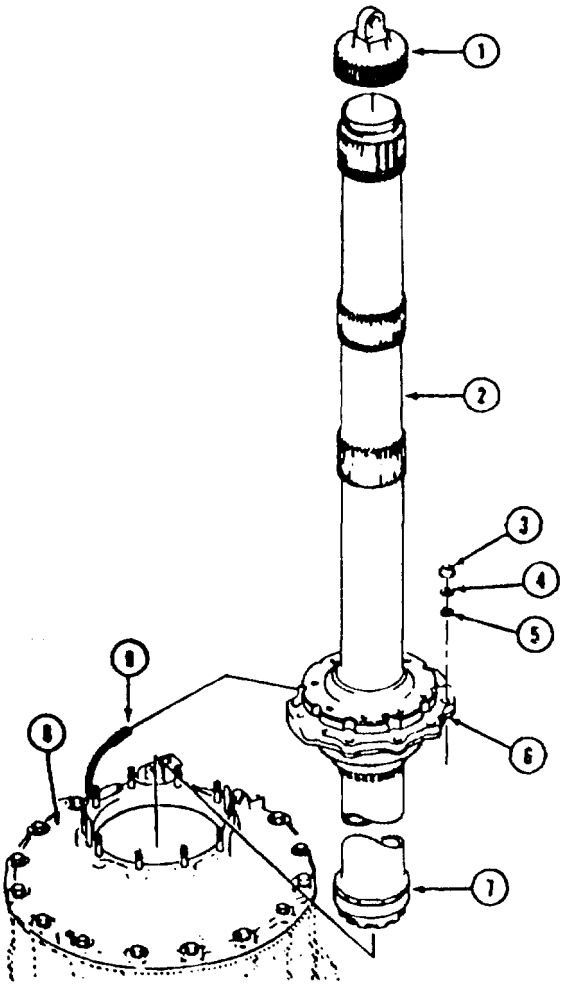
To prevent corrosion, do not handle mast assembly with bare hands below bearing liner.

h. Carefully lift and guide mast (2) out of transmission (8). Immediately install a cover on top of transmission case.

i. Place mast assembly on padded bench.

6-137. Inspection — Main Rotor Mast. a. Inspect lower bearing inner race and retainer plate (6, figure 6-33) as follows:

(1) Check visually for evidence of spalling, corrosion, or mechanical damage on lower bearing race (7). Check security of nut and cotter pin below race,



1. Mast nut
2. Mast
3. Nut
4. Washer
5. Washer
6. Retainer plate
7. Lower bearing race
8. Transmission
9. Oil hose for No. 8 jet

Figure 6-33. Main Rotor Mast — Removal and Installation

(2) Inspect upper bearing visually by slowly rotating mast to check for freedom of rotation.

(3) DELETED

WARNING

Cleaning materials are flammable and toxic Avoid skin contact and breathing of solvent vapors.

b. Mast Nut. Thoroughly dean mast nut (1, figure 6-34) with solvent (C261) and dry with filtered compressed air before inspecting for the following conditions:

(1) Visually inspect for nicks and scratches.

(2) Visually inspect for pits and corrosion.

(3) If cracks are suspected, inspect by magnetic method, refer to TM 1-1500-344-23.

(4) Inspect hex head for deformation of hole or rounded shoulders.

(5) Visually inspect for damage, with particular attention given to the area below the upper spline, there should be no yielding or deformation.

c. Mast.

(1) Inspect exposed surfaces of mast (3) for nicks, scratches end corrosion. Check top of mast for installation of cap plug (2).

(2) Remove cap plug (2) and inspect I.D. of mast for corrosion.

(3) Check splines for deformation, excessive wear, or damage.

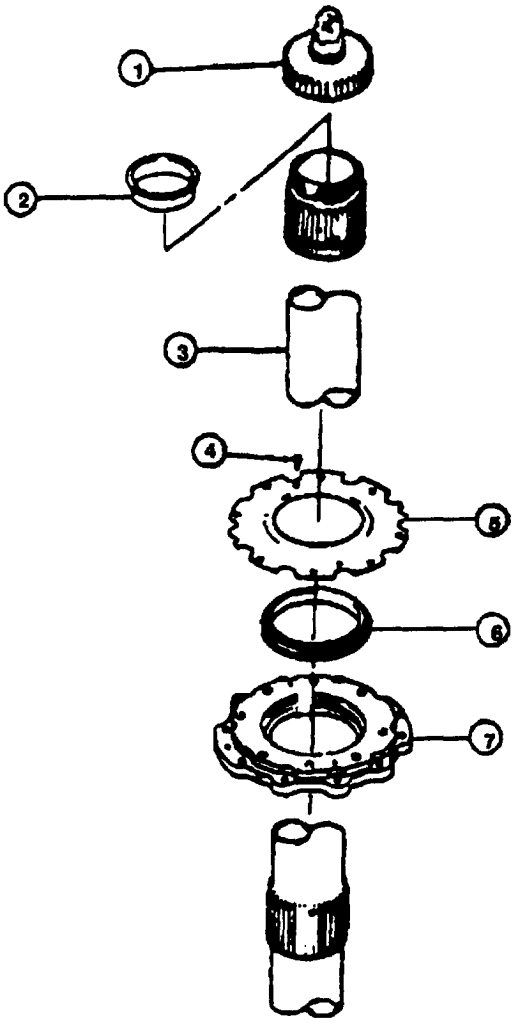
d. Seal. Inspect seal (6) in retainer (7) for any evidence of leakage.

6-138. Cleaning - Main Rotor Mast.

WARNING

Cleaning materials are flammable and toxic. Avoid side contact and breathing of solvent vapors.

a. Clean all parts except seal with solvent (C261) and dry with filtered compressed air.



1. MAST NUT
2. CAP PLUG
3. MAST
4. SCREW
5. SHIELD PLATE
6. SEAL
7. RETAINER

Figure 6-34. Main Rotor Mast - Seal

CAUTION

Solvent shall not be allowed to contact oil Seal.

b. Lubricate mast bearings and machined surfaces immediately after cleaning with oil (C166, C166A, or C166).

6-139. Repair - Main Rotor Mast (AVIM).

a. Upper Bearing.

(1) Replace mast assembly (without repair) if visual inspection reveals damaged or worn balls, cages, or raceways.

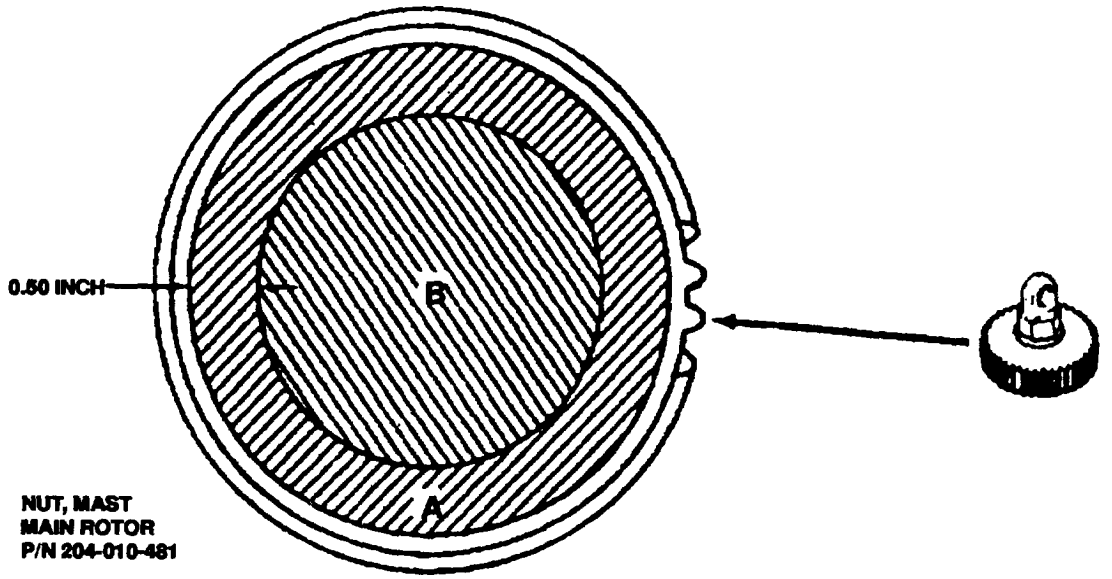
(2) Replace mast assembly (3) if bearing exhibits roughness or binding when mast is rotated by hand. (paragraph 6-140).

b. Mast Nut.

(1) Repair mast nut (1) if nicks, scratches, pits and corrosion in area A, figure 6-35 do not exceed 0.010 inch depth after rework. Nicks, scratches, pits and corrosion in area B, figure 6-35, not to exceed 0.040 inch after rework Repair as follows:

(a) Rework corroded surfaces using ooarse abrasive paper or fine stone (C263 or C264) until firm, rust-free surfaoe is reached. Continue rework to remove course irregularities. Polish surfaoe with fine abrasive paper after rework to obtain smooth contoured finish.

(b) Apply a coat of epoxy polymide primer (C206) on exposed metal surfaces.



TYPE OF DAMAGE	DAMAGE LOCATION SYMBOLS MAXIMUM DEPTHS AND REPAIR AREA ALLOWED		
MECHANICAL DAMAGE AND CORROSION DAMGE	Minor clean-up to permit installation of torque wrench is allowed on splines	A.0.010 Inch	B.0.040 Inch

Figure 6-35. Damage Limits - Main Rotor Mast Nut

(2) Replace mast nut (1) (without repair) if cracks are found using magnetic particle inspection method (TM 43-0103).

(3) Repair mast nut (1, figure 6-34) (within limits) by reworking deformed surfaces of hex head to the extent necessary to accommodate torque wrench.

c. Mast.

(1) Repair mast (3) if nicks, scratches or corrosion do not exceed depth limits shown after rework (figure NO TAG), or repair up to **0.010** inch depth after rework on areas which are exposed when mast is installed in transmission.

(2) If cap plug (2) is not installed in top of mast (3), visually inspect I.D. for corrosion. If any corrosion is evident, replace mast (without repair). Install cap plug.

d. Seal. (AVIM).

(1) Replace seal (6, figure 6-34) as follows:

NOTE

External leakage of seal is not permitted. However, a small amount of seepage assures a satisfactory seal condition. Continuous flow (droplets) is considered excessive and will require seal replacement.

(a) Remove two screws (4) that secure shield plate (5) to retainer plate (7).

(b) Remove seal (6) from retainer plate (7).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

(c) Clean surface where seal (6) seats in retainer plate (7) using a sharpened plastic scraper and methyl-ethyl-ketone (C177) to remove sealing compound.

(d) Coat O.D. of new seal (6) and I.D. of retainer plate (7) with sealing compound (C237).

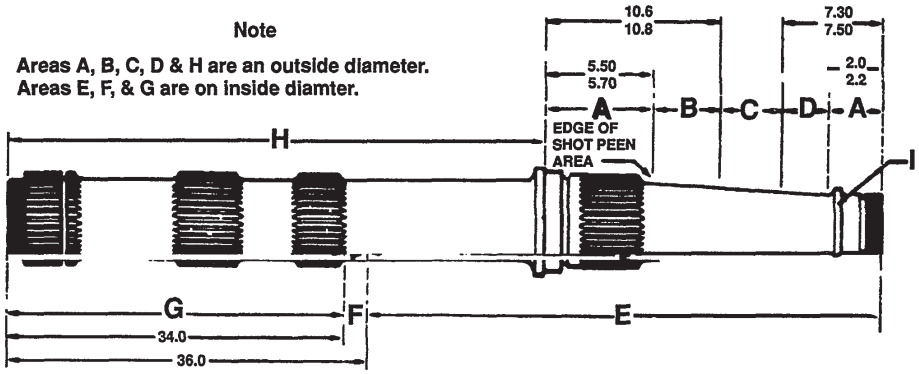
(e) Press seal (6) into retainer plate (7) with lip up until firmly seated. Remove excess sealing compound.

(f) Install shield plate (5) with bevel lip up, over mast (3) and align with retainer plate (7). Secure shield with two screws (4).

6-140. Return to Overhaul — Main Rotor Mast. The following procedures provide instructions for the preservation and packaging of a reparable main rotor mast for shipment to an overhaul facility.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.



MAXIMUM ALLOWABLE DEPTH OF CLEANUP TO REMOVE CORROSION

AREA A – Surface Corrosion. Only that which can be removed by wire brush or steel wool.

Note

Do not touch mast in AREAS B, C and D. If touched, remove fingerprints within two hours using fingerprint remover (C55). Cotton gloves (C66B) should be worn when handling the mast in these areas.

AREA B – 0.002 Inch
AREA C – 0.015 Inch
AREA D – 0.020 Inch
AREA E – 0.005 Inch – or to a maximum I.D. of 2.980 inches, provided cleanup is accomplished by honing or similar method, so that material removal is uniform around the diameter.
AREA F – Max I.D. of 2.970 inches
AREA G – See table below:

Note

Table for AREA G, indicates maximum allowable I.D. for Various O.D.'s at Stations measured from top of mast.

O.D.	3.545	3.550	3.555
Max. I.D. Sta. 0-10	2.980	2.986	2.993
Max. I.D. Sta. 10-20	2.976	2.982	2.989
Max. I.D. Sta. 20-34	2.970	2.976	2.983

AREA H – 0.010 inch after cleanup.

SPLINE AREAS (SPLINES 1, 2 AND 3)

SPLINE AREAS:

Corrosion on spline-tooth surfaces is generally limited to that which can be removed by steel wool or Scotch Brite. Localized, more severe corrosion and mechanical damage may be removed up to 0.010 inch depth of rework on any surface on the spline teeth provided:

Figure 6-36. Damage Limits - Main Rotor Mast (Sheet 1 of 2)

(1) The sum of all reworked areas on any single spline tooth surface may not exceed 20% of the total area of that tooth surface.

(2) IN SNAP RING GROOVES OF SPLINE 2 AND ADJACENT 0.100 INCHES ON EITHER SIDE (see Details A & B):

Area 1:

Repair of mechanical/corrosion damage to a depth of 0.002 inches permitted. Repair to a depth of 0.005 inches permitted if 50X inspection is accomplished after repair to verify clean-up and check for burrs.

Area 2:

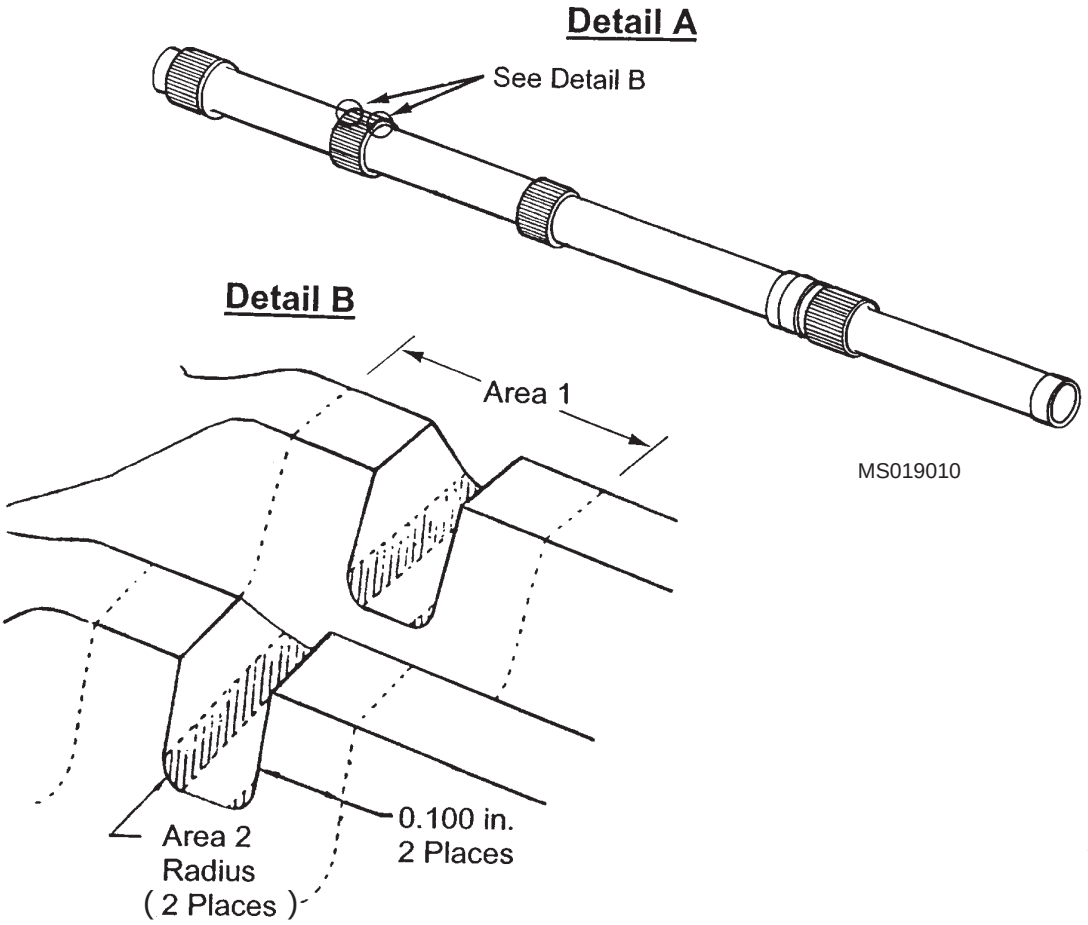
Repair of mechanical/corrosion damage to a depth of 0.002 inches permitted if 50X inspection is accomplished after repair to verify clean-up and check for burrs. Verify that radii are 0.020-0.030 inches in repaired area for burrs.

(3) No more than two (2) adjacent teeth on any spline may be reworked.

(4) No more than four (4) teeth of Spline 1 may be reworked per note 1.

(5) All teeth of Spline 2 may be reworked per note 1 and note 2.

(6) No more than eight (8) teeth of Spline 3 may be reworked per note 1.



AREA I – After cleanup; mark “REWORKED” on flange, using vibrating stylus (Clean-up limited to surface corrosion, which can be removed as specified in Detail A, does not require that mast be marked “Reworked”).

Note Pitting must be completely removed within allowable cleanup depth for mast to be acceptable. Finish reworked areas to 32 RMS.

Figure 6-36. Damage Limits Main Rotor Mast (Sheet 2 of 2)

a. Thoroughly clean main rotor mast with solvent (C261), and blow out all crevices and holes with dry filtered low-pressure compressed air.

b. Coat the entire mast assembly to include bearings with grade 2 corrosion preventive compound (C87).

c. Attach a properly filled out DA Form 1577-2 (Unserviceable/ReparableTag)tothe mast assembly.

d. Initiate DA Form 2410 (Component Removal and Repair/Overhaul Record) in accordance with DA PAM 738-751.

NOTE

Ensure copies of all records are placed in a greaseproof envelope and stowed with item in the container.

e. Wrap entire mast assembly with flexible barrier material (C115) and secure wrap with tape (C279) to protect item from cushioning material and prevent preservation from rubbing off.

f. The preferred method to prepare the mast assembly for return to overhaul facility:

(1) Use a reusable metal container (P/N 204-040-366MUSC-A19, NSN 8115-00-083-8335), complete with molded hair pads if available.

(2) Insert the wrapped mast in the container. if hair pads are not available, follow procedures as closely as possible centering wrapped mast assembly in container with adequate cushioning material (C96) surrounding assembly. Ensure the mast assembly is held firmly in the container and that ail open spaces are filled with cushioning material.

g. The alternate method for preparing mast aeaembly for return to overhaul facility

(1) If a plywood shipping container is available, place the preserved mast assembly in the plywood container between the molded hair pads.

(2) Follow procedures as established in step f. (2) above and secure lid.

h. As a field expedient only, prepare the mast assembly for return to overhaul facility as follows:

NOTE

This procedure is based on the assumption that the provisions of steps f. through g. cannot be complied with, that the work will be done under less than ideal conditions with limited equipment, and that on some occasions, by personnel who are not experts in the field of preservations. This procedure will be used only at locations where facilities for the application of normal preservation procedures do not exist.

(1) Clean the main rotor mast assembly.

(2) Coat the entire mast to include bearings with any grease type corrosion preventive compound that is available, or in the absence of that material, use aircraft grease (C122 or C129).

(3) Wrap the mast assembly with flexible barriet material (C115). Secure wrap with any type tape available and insert in the best available container (constructed, if necessary) of wood or metal. Cushion block and brace securely as necessary.

i. Obliterate old markings that do not coincide with the item to be returned. Mark container in accordance with MIL-STD-129, Stencil DA Form 2410 control number on exterior of container.

6-141. Installation - Main Rotor Mast.

NOTE

Check for installation of cop plug in mast before installing nut (1).

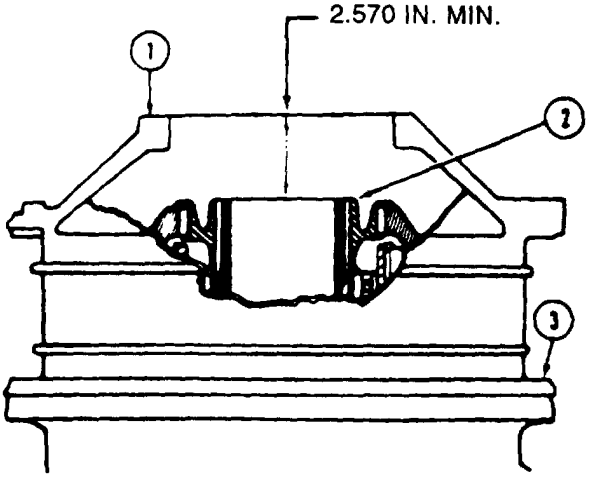
a. Check that mast (2, figure 6-33) as an assembly is clean, that bearing assemblies are serviceable and properly secured and that moat nut (1) is installed.

b. Attach hoist hook to cover nut on top of mast and take up slack in cable.

c. Uncover opening in top of transmission.

d. Perform dimensional check between upper surface of transmission case and upper surface of planetary adapter as follows:

(1) Place a straight edge across opening in top caase (1, figure 6-37) and measure distance from bottom surface of straight edge to top surface of planetary adapter (2). Distance shall be a minimum of **2.570** inches.



1. Top case
2. Planetary adapter
3. Transmission

Figure 6-37. Seating of Upper Planetary Adapter - Main Rotor Mast Installation

(2) If minimum measurement is not obtained, examine upper and lower planetary support liners to determine if tangs of liner are engaged with mating slots of lower planetary liner. This can be determined by use of finger tips. If tangs are disengaged, a gap of approximately 0.25 inch will be evident between the two liners.

WARNING

Exercise caution during reindexing of parts to prevent the possibility of injury to finger tips.

(3) If gap exists, reindex two liners by inserting hands into the adapter and slightly rotating until the liners are correctly aligned. Repeat dimensional check outlined in preceding step.

NOTE

The measurement in figure 6-37 should be taken again. If the minimum measurements still cannot be met, the transmission should be replaced.

d.1. Thoroughly inspect interior of transmission for any foreign objects, Liberally coat mast bearing and complete lower portion of shaft and interior of transmission with transmission oil.

e. Lift mast (2, figure 6-33) as an assembly to a position directly over opening in transmission (8). Carefully lower the mast assembly into the transmission opening, guiding lower bearing race (7) into bearing. Rotate retainer plate (6) to proper position (FWD arrow etched on plate) transmission case. Rotate mast by hand to ensure that there is no binding or unusual noise.

f. Apply thin even coating of sealant (C237) between top case of transmission (8) and lower flange of retainer plate (6).

g. Install aluminum washers (5), steel washers (4) and nuts (3) on ten studs, top of transmission (8).

(1) Torque nuts (3) evenly 100 to 140 inch-pounds. Allow sealant to set for 15 to 20 minutes.

(2) Retorque nuts (3) evenly 100 to 140 inch-pounds.

h. Apply a bead of sealant (C237) around lower edge surface of retainer plate (6) and mating edge surfaces of transmission (8).

NOTE

Ensure four drain holes in retainer plate (6) above seal remain clear.

i. Connect oil hose (9) from tee fitting on left rear side of transmission top case to No. 8 oil jet on retainer plate (6).

j. During and after completion of mast installation, the mast shall be rotated by hand to ensure that there is no binding or unusual noise.

k. Prior to incorporation of MWO 55-1520-242-50-1, install swashplate and support, scissors and sleeve, dampers and supports, main rotor, and stabilizer bar assemblies (paragraph 5-13, 5-47, 5-68, 5-74 and 5-85)

k.1 After incorporation of MWO 55-1520-242-50-1, install hub moment springs and support assembly (paragraph 5-56.6) in addition to swashplate and support, scissors and sleeve, dampers and supports, main rotor, and stabilizer bar (paragraph 5-13, 5-47, 5-68, 5-74, and 5-85),

l. Service transmission (paragraph 1-6)

m. Remove maintenance hoist. Close transmission cowling.

6-141.1. Main Rotor Mast Insert (Plug). The main rotor mast plug is used to reinforce mast assembly (P/N 2044140-366-9) at the upper end. This plug should not be inadvertently removed. Refer to Chapter 5 for removal of the mast nut.

6-141.2. Removal - Main Rotor Mast Insert (Plug). a. Remove cap-plug (2, figure 6-37.1).

b. Remove mast plug (7) from mast using extraction lugs inside plug.

c. Remove O-ring (8) from mast plug (7).

6-141.3. Inspection - Main Rotor Mast Insert (Plug). a. Inspect plug for mechanical and corrosion damage.

b. Inspect tape for damage and security.

c. Inspect O-ring (8) for cuts, abrasions, and damage.

6-141.4. Repair — Main Rotor Mast Insert (Plug). a. Repair damage to plug using 180 grit abrasive cloth (C236). Minimum diameter for plug after repair is 3.102 inches.

b. Treat repaired areas with chemical film (C215).

c. Refinish plug as follows:

(1) Apply one coat of epoxy primer (C110).

(2) Apply two coats of grey lacquer (C14).

d. Replace tape as follows:

(1) Remove existing tape.

(2) Clean area with dry cleaning solvent (C261).

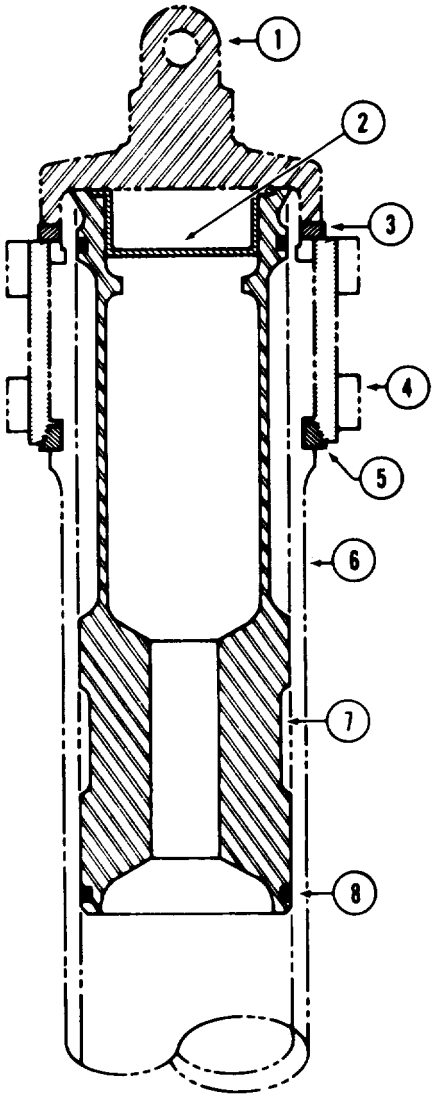
(3) Trim tape (C280) to 0.25 inch wide. Cut length to allow 0.030 inch maximum end gap when tap is installed.

(4) Apply tape to plug.

6-141.5. Installation — Main Rotor Mast insert (Plug). a. Lubricate O-ring (8, figure 6-37.1) with grease (C 129), install on plug (7).

b. Install cap-plug (2) in plug (7).

c. Install plug (7) in mast.



1. Mast nut (ref)
2. 30-063-31 caplug (ref)
3. Washer (ref)
4. Trunnion (ref)
5. Cone (ref)
6. Mast (ref)
7. 209-010-090-1 mast plug assembly
8. MS29561-223 O-ring, 2 reqd

Figure 6-37.1. Mast Plug Installed

6-142. PYLON MOUNTS AND LIFT LINK.

6-143. Description – Pylon Mounts And Lift Link. A lift link and five pylon isolation mounts (figure 6-38) are used to attach transmission to the helicopter fuselage. The forged steel lift link with self - aligning end bearings, is connected between forward underside of the transmission support case and a fuselage beam directly below.

Four main isolation mounts are located on pylon supports under corners of transmission support case. Each mount consists of a cylindrical molded rubber core bonded between steel inner and outer sleeves, with outer sleeve flange secured on pylon support by four bolts.

NOTE

If the four bolts that secure each mount to the pylon support are not lockwired, this would not be a safety-of-flight condition on a new and/or overhauled aircraft, since bolts are self-locking type. However, drilled bolts will be installed and lockwired when the transmission is removed or when other maintenance is performed on the pylon mount.

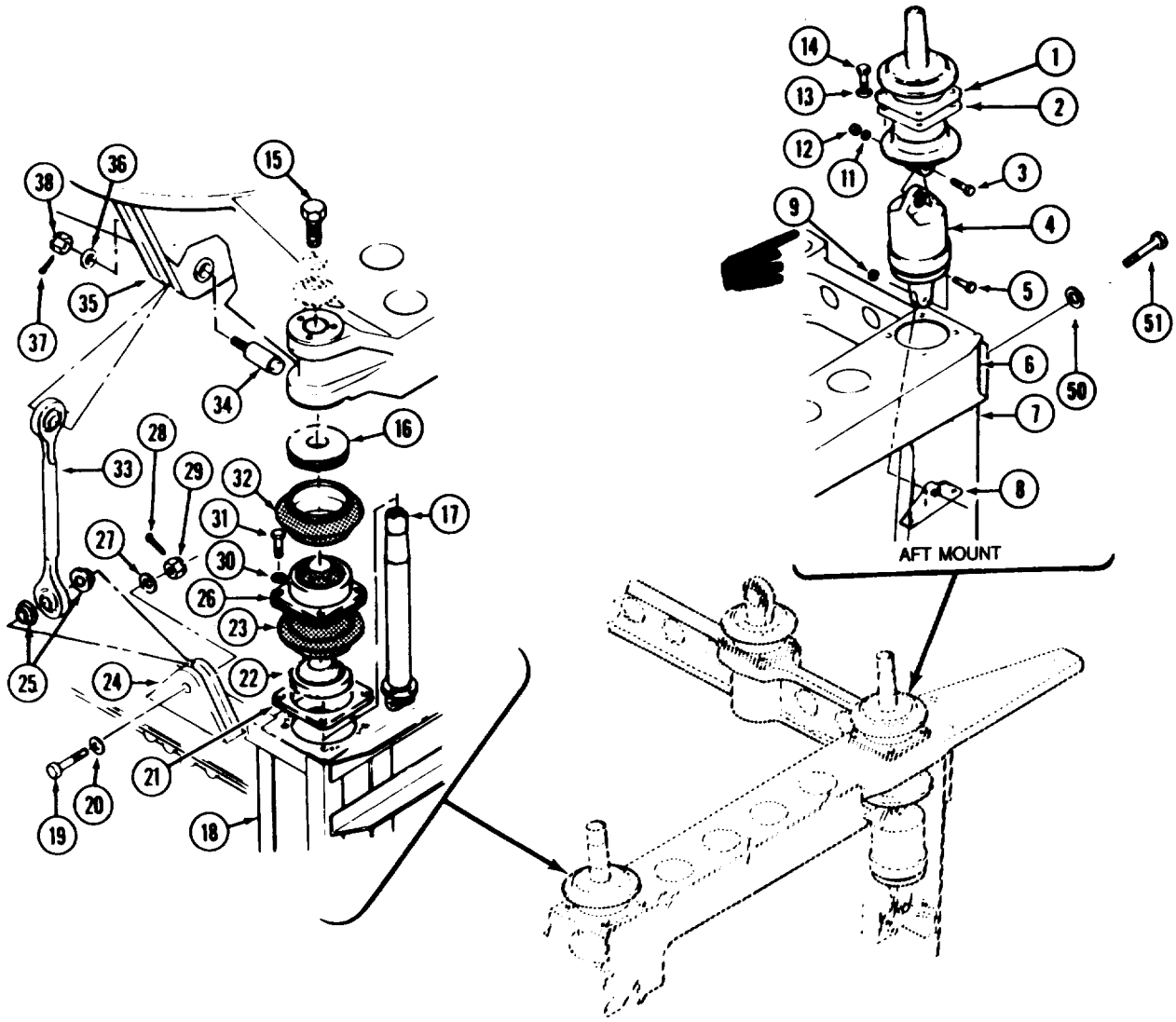
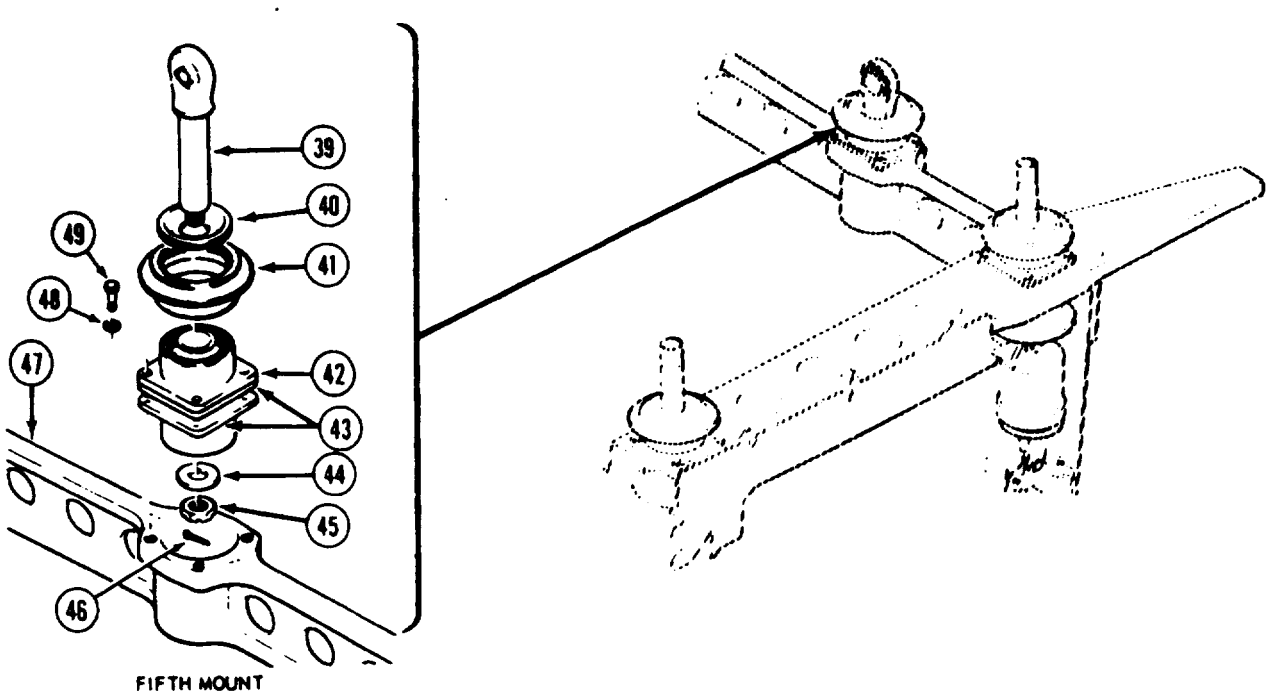


Figure 6-38. Transmission Pylon Mounts (Sheet 1 of 2)



1. AFT MOUNT
2. FILLER PLATES
3. BOLT
4. FRICTION DAMPER
5. BOLT
6. SHIM
7. PYLON SUPPORT
8. DAMPER FITTING
9. NUT
10. DELETED
11. WASHER
12. NUT
13. WASHER
14. BOLT
15. BOLT
16. BUSHING
17. BOLT
18. PYLON SUPPORT
19. BOLT
20. WASHER
21. FILLER PLATES
22. BUSHING
23. BOOT
24. CLEWS
25. BUSHING
26. FORWARD MOUNT
27. WASHER
26. C55OTTER PIN
29. NUT
30. WASHER
31. BOLT
32. BOOT
33. LIFT LINK
34. BOLT ASSEMBLY
35. SUPPORT CASE
36. WASHER
37. COTTER PIN
38. NUT
39. EYEBOLT
40. WASHER
41. BOOT
42. FIFTH MOUNT
43. LAMINATED FILLER PLATES
44. WASHER
45. RETAINING NUT
46. COTTER PIN
47. SUPPORT FITTING
48. WASHER
49. BOLT
50. WASHER
51. BOLT

Figure 6-38. Transmission Pylon Mounts (Sheet 2 of 2)

A large mount bolt extends up through the mount inner sleeve to seat in tapered bushing of transmission support case leg, and is secured by a retaining bolt installed from top through a flat washer and a broad special washer and threaded into tapped upper end of mount bolt. Silicone rubber protective boots, with supporting bushings, cover both ends of mount. Both rear main pylon isolation mounts are restrained by friction dampers, which are cylindrical units connected between lower ends of mount bolts and fittings in pylon support structure. A fifth isolation mount, similar to the four main mounts, is located at center aft of pylon on a support fitting bridged across rear side of pylon support. Fifth mount bolt has a self-aligning bearing at upper end, which is attached by a bolt to middle of a welded beam extending between aft legs of transmission support case.

6-144. Removal - Pylon Mounts And Lift Link.

a. Remove transmission assembly and fifth mount support beam (paragraph 6-31).

NOTE

During transmission removal, retaining bolts (15, figure 6-38) and washers will be removed from the two forward mounts (26) and two aft mounts (1); bolt assembly (34), washer (36) and nut (38) will be removed from lift link (33); and fifth mount eyebolt (39) will be disconnected from support beam, which is removed with the transmission.

b. Remove access door (81, figure 2-18). Disconnect electrical connection (1, figure 7-10).

c. Detach lift link (33) from clevis (24) on lift beam by removing bolt (19), washers (20 and 27), nut (29), bushings (25), and cotter pin (28). Retain hardware for installation.

d. Remove aft and forward mounts (1 and 26) as follows:

(1) Remove four bolts (14) and washers (13) attaching each aft mount (1) to pylon support (7). Remove bolts (3), washers (11) and nuts (12) attaching each aft mount to friction dampers (4). Remove aft mounts.

(2) Remove four bolts (31) and washers (30) attaching each forward mount (26) to pylon support (18). Remove complete forward mount assemblies, including bolt (17), from pylon support.

NOTE

Keep filler plates (2 and 21) at original locations on pylon supports (7 and 18) to avoid possible error at time of installation. Forward and aft filler plates are of different thickness and are not interchangeable, the forward filler plate being the thicker of the two.

(3) On both aft and forward mounts (1 and 26) separate upper and lower bushings (16), boots (23 and 32) from bolts (17).

e. Remove fifth mount (42) as follows:

(1) Remove four bolts (49) and washers (48) attaching fifth mount (42) to support fitting (47). Remove mount and laminated filler plates (43).

(2) Remove cotter pin (46), retaining nut (45) and washer (44), and separate mount (42), boot (41), and washer (40) from eyebolt (39).

(3) Remove eight bolts and washers attaching fifth mount support fitting (47) to aft side of pylon support (7) and remove fitting and shims (6) (if shims are installed).

6-145. Inspection - Pylon Mounts And Lift Link.

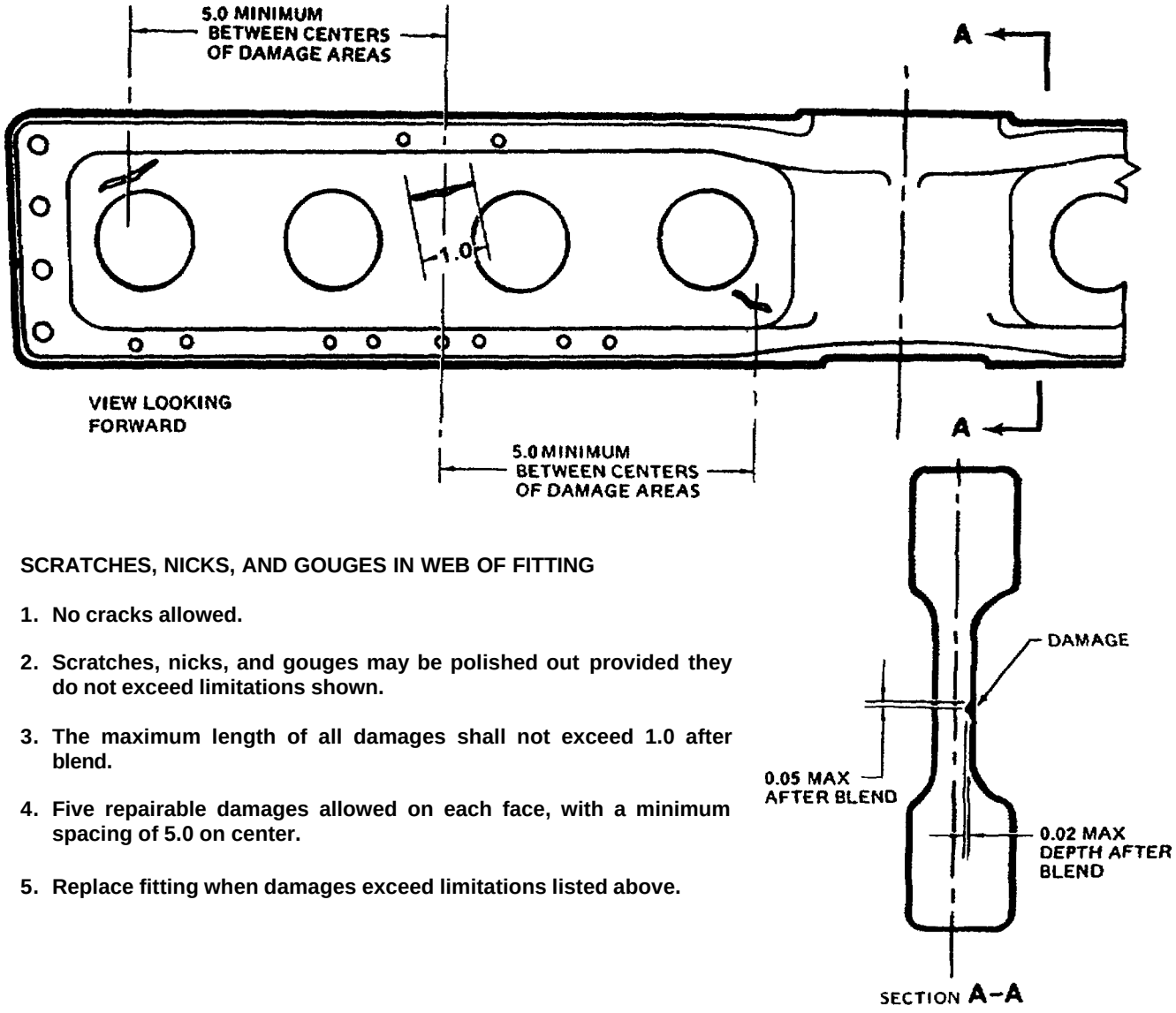
a. Inspect rubber core at both ends of aft, forward and fifth mounts (1, 26 and 42, figures 6-38) for deterioration and separation using a **0.010** inch feeler gage. A separation exceeding **0.250** inch maximum depth for 1/3 circumference or separation exceeding **0.750** inch maximum depth any one point requires replacement of mount.

b. Inspect boots (23, 32 and 41) on aft, forward and fifth mounts (1, 26 and 42) for rips, cuts, deterioration, and proper installation.

c. Inspect bearings in fifth mount eyebolt (39) for wear. Maximum allowable wear is **0.008** inch radial and **0.016** inch axial.

d. Inspect bolts (17) for worn surfaces, scoring, nicks, dents, corrosion, and cracks. If cracks are suspected, inspect by magnetic particle method (TM 55-1500-335-23). Alternate inspection method: If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

e. Inspect support fitting for cracks, nicks, gouges, and scratches (figure 6-38.1). If cracks are suspected, inspect by fluorescent penetrant method (TM 55-1500-335-23). Alternate inspection method: If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.



SCRATCHES, NICKS, AND GOUGES IN WEB OF FITTING

1. **No cracks allowed.**
2. **Scratches, nicks, and gouges may be polished out provided they do not exceed limitations shown.**
3. **The maximum length of all damages shall not exceed 1.0 after blend.**
4. **Five repairable damages allowed on each face, with a minimum spacing of 5.0 on center.**
5. **Replace fitting when damages exceed limitations listed above.**

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

Figure 6-38.1. Damage Limits - Fifth Mount Support Fitting

f. Inspect lift link (33, figure 6-38) as follows:

(1) Inspect bearings in lift link (33) for wear. Maximum allowable wear is **0.008** inch radial and **0.016** inch axial.

(2) Inspect center **8.0** inches of lift link (33) for nicks, sharp dents and scratches. A maximum depth of **0.010** inch is allowed after cleanup. No damage allowed on outer **2.0** inches of either end of link.

(3) If damage to the lift link bushing hole is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

6-146. Cleaning - Pylon Mounts and Lift Link. Wipe exposed surfaces clean with a soft, lint-free, dry cloth.

CAUTION

Keep rubber portions of mounts clean of any oil, grease, or solvents to prevent deterioration and weakening of bonds between rubber and metal. Protective boots are silicone rubber, not affected by oil, and should be kept carefully in place while mount is installed.

6-147. Repair-Pylon Mounts and Lift Link.

a. Replace (without repair) if aft, forward or fifth mounts (1, 26 and 42, figure 6-38) are deteriorated, or if rubber to metal bond separation exceeds **0.250** inch maximum depth for 1/3 circumference or **0.750** inch maximum depth at any one point.

b. Replace (without repair) boots (23, 32 and 41) that are deformed, punctured, torn, cut, or deteriorated.

c. Replace (without repair) if evidence of mounts (1, 26 and 42) bottoming exists of excessive vibration during helicopter operation indicates that the mounts no longer have correct spring rate to isolate normal pylon vibrations.

d. Replace lift link (without repair) if cracks or damage are found using magnetic particle inspection method.

e. Replace (without repair) if support fitting (47) is found to be cracked using fluorescent penetrant inspection method TM 55-1500-335-23.

f. Replace (without repair) if washer (44, figure 6-38) is found to be cracked or damaged using fluorescent penetrant inspection method TM 55-1500-335-23.

g. Repair (within limits) if rubber washer becomes detached from steel bushings (16, figure 6-38). Rebond with adhesive (C29).

h. Replace bearing in eyebolt (39) if maximum allowable axial play of **0.016** inch or maximum radial play **0.008** inch is exceeded.

i. Blend out nicks, dents and scratches on lift link (33) not to exceed **0.010** inch depth using No. 400 grit abrasive cloth (1) or fine stone (C263 or C264). Polish to a scratch free finish using crocus cloth (C68). Prime repaired areas with primer (C206 or C312).

j. Replace bolts (17) (without repair) if worn, scored, nicked, dented, corroded, or cracked.

k. Replace mount bolts, bushings and retaining washers when excessively worn, scored, nicked or when there is any indication of cracks.

6-148. Installation - Pylon Mounts and Lift Link.

a. Install aft and forward mounts (1 and 26, figure 6-38) as follows:

NOTE

Keep filler plates (2 and 21) at original locations on pylon supports (7 and 18) to avoid possible error at time of Installation. Forward and aft filler places are of different thickness and are not interchangeable, the forward filler plate being the thicker of the two.

(1) Assemble bushings (16 and 22) and boots (23 and 32) on each forward mount (26). Insert bolts (17) through mounts from lower side.

(2) Position forward mounts (26) to filler plates (21) and pylon support (18). Secure each mount (26) with four bolts (31) and thin steel washers (30). Torque bolts (31) and lockwire (C155) in pairs.

NOTE

Use AN175H10A bolts on aft mounts in forward inboard and aft outboard holes. Use AN175H11A bolts on aft mounts in forward outboard and aft inboard holes. Use AN175H11A bolts on forward mounts in aft holes, Use AN175H12A bolts on forward mounts in forward holes.

(3) Assemble aft mounts (1) as outlines in preceding step (1).

(4) Position aft mounts (1) to filler plates (2) on pylon support (7). Attach mount (1) to friction damper (4) with bolts (3), thin steel washer (11) and nut (12). Secure each mount (1) with four bolts (14) and thin steel washer (13). Torque bolts (14) and lockwire (C155) in pairs.

NOTE

Use AN175H10A bolts on aft mounts in forward inboard and aft outboard holes. Use AN175H11 bolts on aft mounts in forward outboard and aft inboard holes. Use AN175H11 bolts on forward mounts in aft holes. Use AN175H12 bolts on forward mounts in forward holes.

(5) If disconnected, secure friction damper (4) to fitting (8) with bolt (5), washer (10) and nut (9).

CAUTION

When Hub Spring is installed use link assembly P/N 209-030-357-1.

b. Maintain tension on hoist for installation of link (33) to clevis (24) with bushings (25) and install bolt (19), steel washers (20 and 27), and nut (29). Torque nut **480 TO 600** inch-pound (**40 TO 50** ft. lbs.), secure with cotter pin (28).

c. Install electrical connector (1, figure 7-10) and secure with lockwire (C153). Install access (81, figure 2-18).

d. Install fifth mount (42, figure 6-38) and support fitting (47) as follows:

(1) Secure support fitting (47) using equal thickness of shims (6) to pylon support (7) with bolts (51) and washers (50). Adjust shims (6) equally on each side to prevent support fitting (47) from contacting the pylon support structure (7) rivets. Torque eight bolts (51) and lockwire (C155) in pairs.

(2) Assemble boot (41) with washer (40) (concave side up) on top (shortest end) end of fifth mount (42). Insert eyebolt (39) down through mount and install washer (44) and retaining nut (45). Torque nut **480 TO 600** inch pounds, secure with cotter pin (46).

(3) Insert fifth mount (42) with two laminated filler plates (43) into support fitting (47). Secure with four bolts (49) and steel washers (48). Do not torque bolts at this time.

e. Temporarily install fifth mount support beam to aft mounts (1):

(1) Check vertical alignment of eyebolt (39, figure 6-38) with bolt hole in fifth mount support beam. If not correct, remove fifth mount (42) from support fitting (47).

(2) Adjust thickness of laminated filler plates (43), as required, and reinstall fifth mount (42) in support fitting (47).

(3) When alignment is correct, tighten bolts (49) and lockwire (C155) in pairs.

f. Install transmission assembly and fifth mount support beam (paragraph 6-40).

6-149. FRICTION DAMPERS.

6-150. Description - Friction Damper. Friction dampers are used to restrain both pylon aft mounts. These cylindrical units connect between lower ends of mount bolts and damper fittings in pylon support structure.

6-151. Removal - Friction Damper.

a. Disconnect friction damper (4, figure 6-38) from damper fitting (8) by removing bolt (5) and nut (9).

b. Disconnect friction damper (4) from lower end of bolts in aft mounts (1) by removing bolt (3), washer (11) and nut (12). Remove damper.

6-152. Inspection - Friction Damper.

a. Check boot for deterioration and security.

b. Inspect bearing P/N LS4 at top of damper housing, and bearing P/N LS4 on damper mount at bottom of damper for wear and damage, maximum allowable radial play is **0.006** inch, and axial play of **0.012** inch.

c. Inspect damper (4) in area that mates with isolation mount bolt (17). Surface defects such as nick, gouges, or scratches are acceptable if depth does not exceed **0.010** inch and if length does not exceed **0.25** inch. Cracks are not permitted. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

6-153. Repair - Friction Damper.

a. Replace deteriorated boot.

b. Replace bearing that fails to meet inspection requirements.

6-154. Testing - Friction Damper.

a. Install damper in a tension testing machine.

CAUTION

Do not open damper over 0.5 inch.

b. Check loose motion of damper, which is the amount of motion in the damper prior to applying load. Loose motion, must be plus or minus 0.035 inch for damper (P/N 204-031-920-3).

c. Apply tension load to damper and observe load required to start motion on damper above loose motion area. The required load to start motion must be 115 to 180 pounds. If motion occurs at a lower load, replace damper.

6-155. Installation - Friction Damper.

a. Position friction damper (4, figure 6-38) between damper fitting (8) and aft mount (1).

b. Secure friction damper (4) to lower end of bolt in aft mounts (1) with bolts (3), washer (11) and nut (12).

c. Secure friction damper (4) to fitting (8) with bolts (5) and nut (9).

d. Torque nuts (9 and 12) **50-70** inch-pounds.

SECTION IV. TAIL ROTOR DRIVESHAFT

6-159. TAIL ROTOR DRIVESHAFT.

6-160. Description - Tail Rotor Driveshaft. Six driveshaft sections are incorporated in power train aft of transmission tail rotor drive quill; these driveshafts serve as a line between four bearing hanger assemblies, an intermediate gearbox on tailboom, and a tail rotor gearbox on vertical fin (figure 6-40). Each shaft section is an anodized aluminum alloy tube with a curvic-splined coupling riveted to each end and is statically or dynamically balanced by metal strips bonded near middle on tube surface, with an identification plate showing part and serial numbers. Forward shaft section extends through a tunnel between engine firewalls, with ends connected by V-band clamps to mating splined couplings on transmission tail rotor drive quill and on forward bearing hanger. Other shaft sections are mounted in similar manner along tailboom and vertical fin between hangers and gearboxes.

6-161. Inspection - Tail Rotor Driveshaft (Installed).

a. Inspect driveshaft clamps for security and damage. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

b. Inspect for rivet failure. Any rivet failure is cause for removal.

c. Visually inspect shaft for cracks. Any indication of cracks is cause for removal and inspection using fluorescent penetrant method. No cracks allowed. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

d. Inspect shaft for corrosion, any corrosion is cause for removal of shaft for repair if corrosion is within limits (paragraph 6-164).

e. Inspect shaft for dents.

NOTE

All dents should be carefully inspected for cracks, nicks, and scratches. No cracks permitted. Nicks or scratches shall be within limits. Total depth of defect shall not exceed limits for dents.

(1) Sharp dents are permissible to maximum depth of **0.010** inch in "Area A" and **0.015** inch in "Area B" (figure 6-41).

(2) Nonsharp dents are permissible to maximum depth of **0.020** inch in "Area A" and **0.030** inch in "Area B" (figure 6-41).

f. Inspect shaft for nicks and scratches.

(1) Nicks or scratches aligned within 15 degrees of spanwise axis are acceptable without repair to maximum depth of **0.002** inch in central area "A" or **0.004** an area "B", which is **14.0** inches on each end of shaft (figure 6-41).

(2) Other nicks and scratches is cause for removal of shaft for repair (paragraph 6-164).

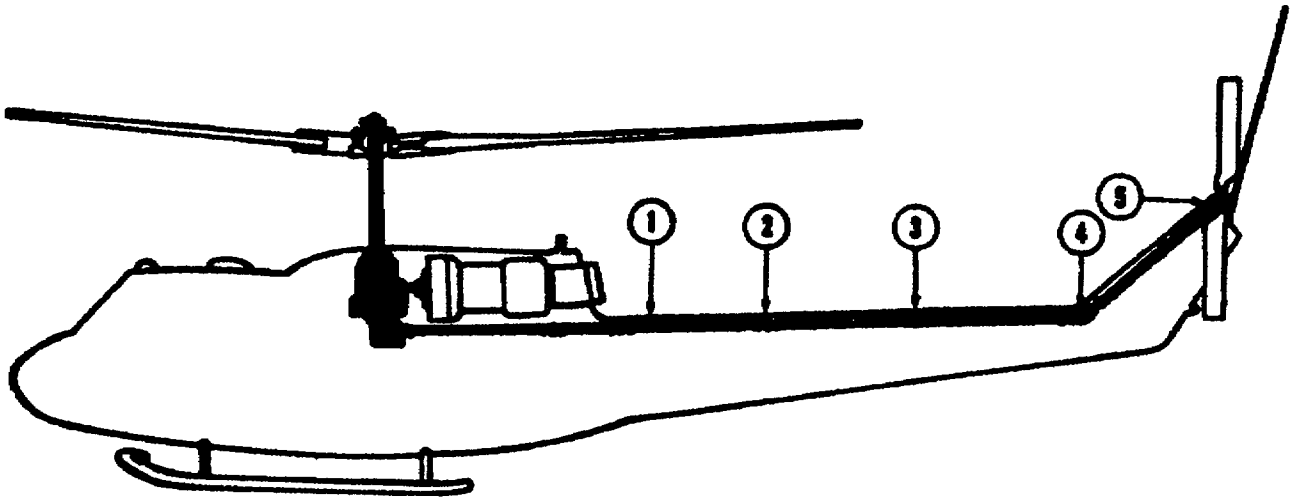
g. Inspect shaft for loss or partial detachment of balance weights which are bonded on the tube near the center.

NOTE

Do not mistake an empty imprint in the bonding material at the end of the balance weight group as an indication of a missing weight. This imprint may result from the removal of a test weight used to inspect for bonding voids. Such imprints are identified by a raised outer corner of the bonding material. If any weight group has an empty weight imprint without a raised corner, the shaft should be removed for overhaul. If a shaft has more than one weight group, the test imprints will be located at the end of each group. Overhauled shafts may have had balance weights removed; identify these shafts in accordance with step h, below.

h. Driveshaft Identification. Serviceable driveshafts are identified as follows:

(1) The -3 shaft has one balance weight group in the center of the shaft and is statically balanced. (When overhauled at depot, the -3 shaft is dynamically balanced and updated to a -7; see step (2), below.)



1. **Tail rotor driveshaft**
2. **Tail rotor hanger**
3. **Curvic coupling**
4. **Intermediate gearbox**
5. **Tail rotor gearbox**

Figure 6-40. Tail Rotor Drive System - Components

NOTE

CCAD decals are now being removed at Depot and are no longer used.

(2) The CCAD overhauled -3 shaft (may have a CCAD decal on either end of the shaft) has two staggered (not in line) weight groups, no test weight imprints, and is dynamically balanced.

(3) The -7 shaft has two in-line weight groups and is dynamically balanced. The factory -7 shafts have test weight imprints with each weight group, but CCAD overhauled -7 shafts have no test weight imprints.

(4) The -5 shafts are the same type as those described in steps (1) and (2), above, and have been dynamically balanced and updated to -9 shafts.

i. Driveshafts identified in step h. above, are serviceable. Unidentified shafts having more than one empty bonding imprint per weight group shall be removed and forwarded to depot for overhaul.

6-162. Removal - Tail Rotor Driveshaft.

a. Open hinged access doors along top of tailboom and vertical fin by releasing fasteners on left side. Also remove tailpipe fairing and vented cover over intermediate gearbox, as necessary.

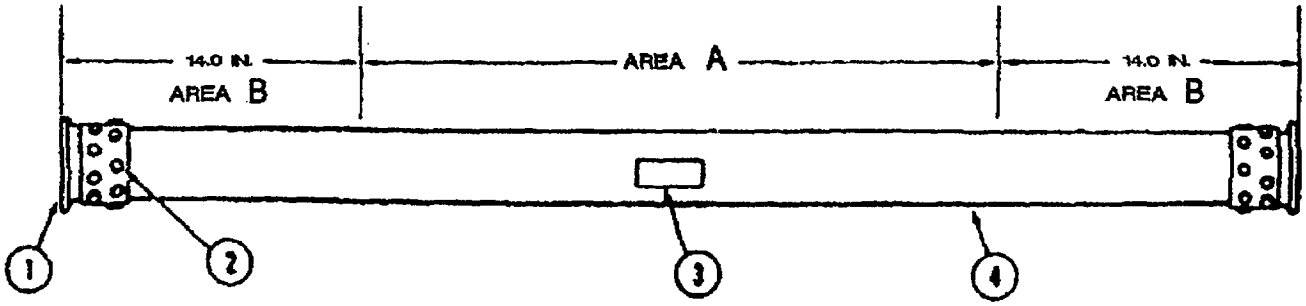
b. Removed clamp set from coupling at each end of shaft. Push shaft against flexible coupling to disengage opposite end, and lift out shaft. Removed other shafts aft of forward bearing hanger in same manner (figure 6-42).

c. To removed forward shaft, open access panel at left side of transmission, and remove clamp set from tail rotor drive quill coupling. With tailpipe fairing removed, remove clamp set from forward hanger coupling, and carefully remove forward hanger assembly (paragraph 6-171). Carefully remove shaft rearward through firewall tunnel.

6-163. Inspection - Tail Rotor Driveshaft (Removed).

a. All inspection limits of paragraph 6-161 apply.

b. Inspect driveshaft using fluorescent penetrant method if cracks are suspected, refer to TM 43-0103. No cracks allowed.



1. **CURVIC COUPLING**
2. **RIVET**
3. **BALANCE WEIGHT**
4. **SHAFT**

Figure 6-41. Tail Rotor Driveshaft - Inspection

c. Inspect shaft for nicks and scratches which exceed negligible limits of paragraph 6-161. Other nicks and scratches can be repaired by polishing out, provided depth of material removed will not exceed **0.008** inch in area A or **0.012** inch in area B (Figure 6-41). If damage exceeds these limits shaft must be replaced.

d. Inspect shaft for corrosion. Corrosion can be removed by polishing, provided depth of material removed will not exceed **0.008** inch in Area A or **0.012** inch in Area B (Figure 6-41).

NOTE

Inspect all areas of the short driveshaft using the criteria for area B.

e. Inspect shaft for grooves worn by mounting clamps to extent that such wear prevents proper clamping.

f. Inspect shaft for damaged or worn curvic coupling teeth. There should be no radial play or backlash between mating teeth when fully meshed and mounting clamps removed.

g. Check shaft for straightness using dial indicator and V-blocks. Total indicated runout must not exceed **0.050** inch for long shafts and **0.020** inch for short shaft. No straightening procedures are allowed.

h. Deleted.

i. Inspect aluminum driveshaft clamps as follows:

(1) Inspect bolt holes for wear, nicks and scratches.

(2) Inspect spot face, lug fillets and internal "V" groove for nicks and scratches in excess of **0.008** inch, and gouges for wear pattern extending into the fillet radius at bottom of internal "V".

(3) Inspect all remaining surfaces for nicks and gouges exceeding **0.010** inch.

(4) Inspect clamps using fluorescent penetrant method if cracks are suspected, refer to TM 55-1500-335-23. No cracks allowed. Alternate inspection method: If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

(5) Inspect clamp bolts for stripped or damaged threads.

j. Replace clamp sets that do not meet inspection requirements.

6-164. Repair Tail Rotor Driveshaft.

a. Replace shafts which do not meet inspection requirements.

b. Nicks or scratches must be polished out with fine abrasive cloth (C 1), provided depth of material removed does not exceed 0.008 inch in area A or 0.012 inch in area B (figure 6-41).

NOTE

Shaft must be checked for balance if total worked surface area of one side exceeds 8 square inches, when compared with other side. Forward shaft to depot for balancing and refinishing.

c. Corrosion must be polished out with fine abrasive cloth, provided depth of material removed does not exceed 0.008 inch in area A or 0.012 inch in area B. Deeper corrosion is cause for rejection.

d. Repair damage to anodized finish and reworked areas with chemical film material (C62).

6-165. Installation — Tail Rotor Driveshaft.

WARNING

Insure that all flexible couplings on replacement components are adequately lubricated prior to installation.

CAUTION

Use new nuts each time clamps are installed.

NOTE

Ensure that new clamp halves contain identical vendor and forging lot numbers. The weight differential of two halves shall not exceed one gram. All bolts and nuts on any one clamp set must be identical parts to maintain balance. Random clamp halves with the same part number may be paired if they meet either of the following criteria: (1) Weight differential of two halves does not exceed one gram, or (2) no excessive high frequency vibrations are introduced during a maintenance test flight when matched with unknown weight difference.

a. Engage shaft couplings with mating fixed and flexible couplings. Install clamp sets at each end, with nuts trailing direction of rotation, and with bolted joints indexed 90 degrees to those of adjacent clamps for balance in operation (figure 6-42).

NOTE

Adjacent clamps may be located within 1/8 inch of 90 degrees apart, measured at perimeter of clamps.

b. To install forward shaft, carefully insert shaft through rear of firewall tunnel. Install forward hanger assembly (paragraph 6-173), Engage shaft couplings with tail rotor drive quill coupling, and forward hanger coupling. Install clamp sets with nuts trailing the direction of rotation, and with bolt joints 90 degrees to those of adjacent clamps for balance in operation (figure 6-42).

c. Install tail rotor clamp set (17, figure 6-42) bolts and nuts as follows:

(1) Start four new nuts onto clamp bolts by hand.

(2) Thread new nuts on bolts to obtain complete thread engagement.

(3) Measure and record drag torque for each nut.

(4) Torque each nut in sequency 30 to 35 inch-pounds above drag torque recorded in preceding step, keeping gaps in ends of clamp set equal to within 0,020 inch.

(5) Tap very lightly around outer surface of clamp with soft mallet and re-check torque. Repeat this procedure until correct torque is retained.

d. Reinstall tailpipe fairing, gearbox cover, and access panel at left side of transmission.

6-166. Alignment — Tail Rotor Driveshaft. (AVIM). The alignment check of the driveshaft consists of two different procedures. Refer to step a. to check alignment of driveshaft hanger supports installed on tailboom. Refer to step b. for alignment check of support installed on center service deck.

NOTE

After installation of a replacement tailboom, check the alignment between the number one hanger support and the tailboom number 3, hanger support. A new tailboom Is considered in alignment.

a. A tailboom alignment check must be made whenever driveshaft misalignment is suspected or when damage to the tailboom structure in the area of the driveshaft hangers support structure requires structural repair or replacement. Vertical alignment of the tailboom driveshaft hanger supports and the 42 degree gearbox may be accomplished as follows:

(1) Fabricate tooling (figure 6-43, sheet 1 through 8).

(2) Prepare for alignment check as follows:

(a) Remove, tail rotor gearbox (paragraph 6-195).

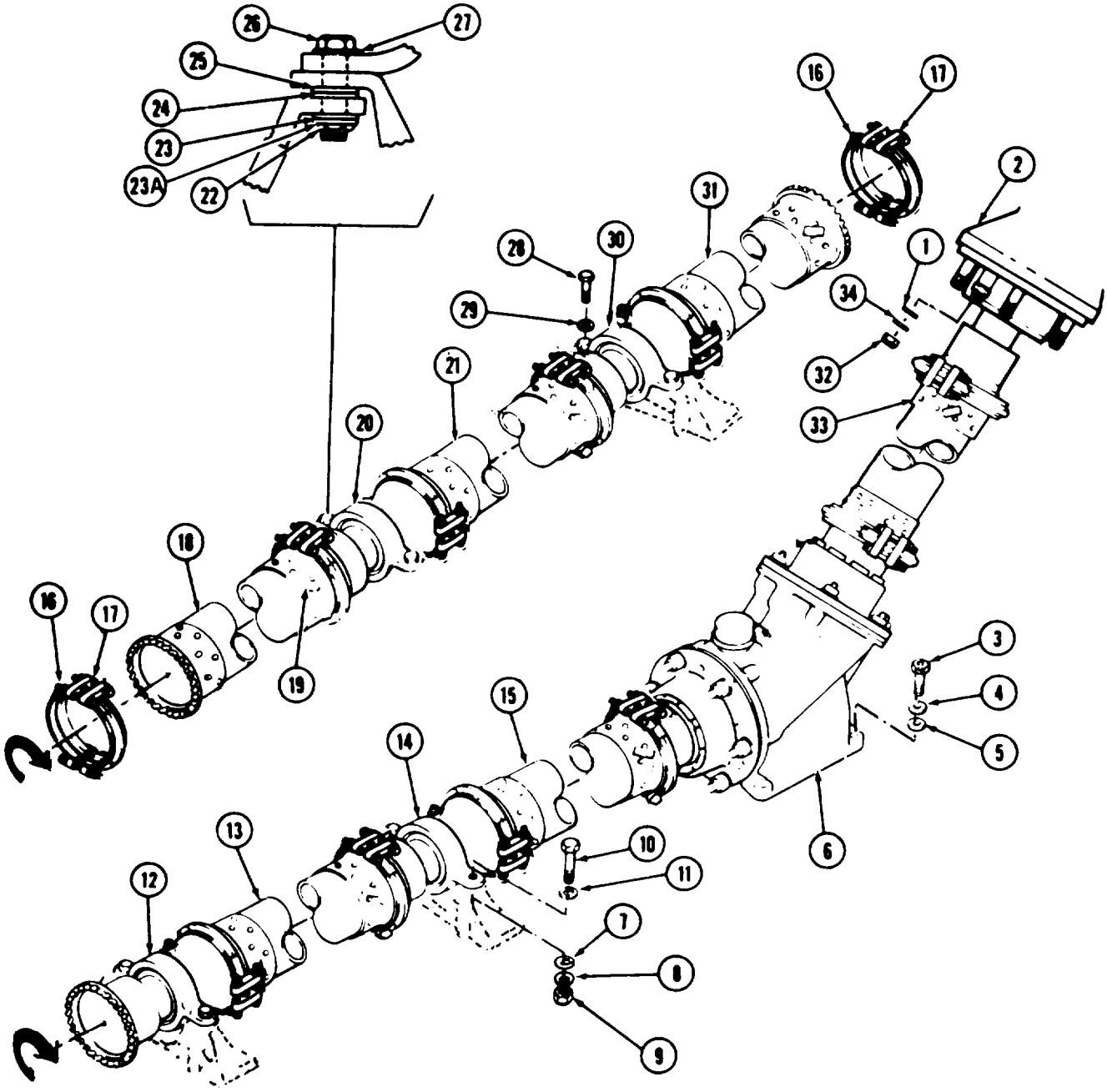
(b) Remove driveshafts (paragraph 6-163).

(c) Remove intermediate gearbox (paragraph 6-184).

(d) Remove tailboom (paragraph 2-282). Support on suitable cradle.

NOTE

Existing shims may be used to obtain alignment. If alignment cannot be attained, however, use new shims in accordance with step 3.

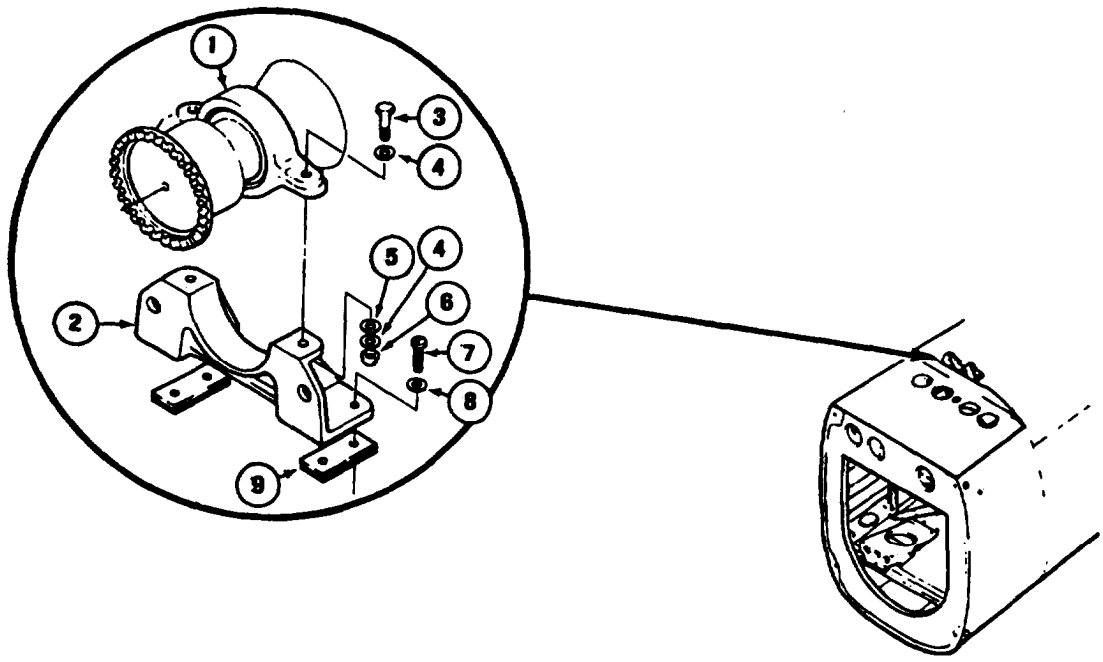


1. Washer
2. Tail rotor gearbox
3. Bolt
4. Flat washer
5. Flat washer
6. Intermediate gearbox
7. Flat washer
8. Flat washer
9. Nut
10. Bolt
11. Flat washer
12. Hanger
13. Shaft
14. Hanger
15. Shaft
16. Nut and bolt
17. Clamp (12)
18. Shaft
19. ID plate (6)
20. Forward hanger
21. Shaft
22. Nut
23. Flat washer
23a. Flat washer
24. Flat washer
25. Flat washer
26. Bolt
27. Flat washer
28. Bolt
29. Flat washer
30. Hangar
31. Shaft
32. Nut
33. Shaft
34. Flat washer

Figure 6-42. Tail Rotor Driveshaft — Installation

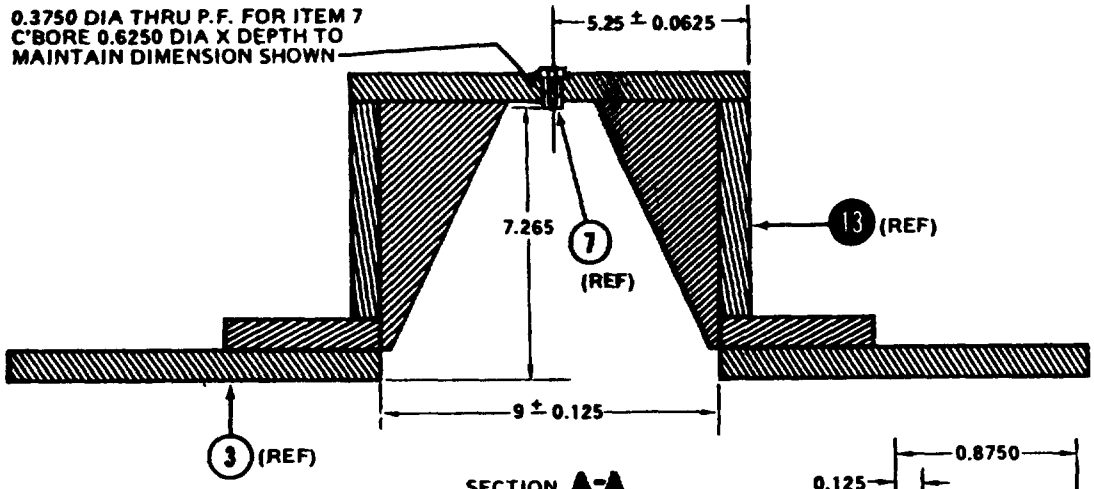
(3) Install tooling on tailboorn (figure 6-43, Sheet 8) using full size shim approximately 0.1876 inch thick under each side of 42 degree gearbox locator, and 1 /2 of standard size shim, approximately 0.090 inch thick, under each leg of bearing hanger supports. Tighten bolts until snug; do not torque to standard values,

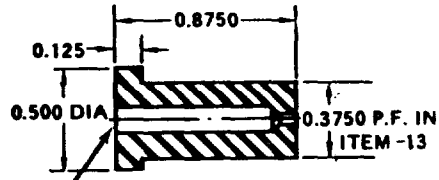
(4) Run 0.020. inch gage wire (C 154) through hole in 90 degree gearbox plug, making sure end of wire is secured to top - side of plug, through bushing in top leg of 42 degree gearbox locater, around pivot pin groove, through bushing in horizontal leg of 42 degree gearbox locater and _



1. Driveshaft hanger assembly
2. Driveshaft hanger support fitting
3. Bolt
4. Washer-thin steel
5. Washer-aluminum
6. Nut
7. Screw
8. Washer-alumunum
9. Shim

Figure 6-42.1. Tail Rotor Driveshaft Support Installation





DRILL NO. 76 (0.0200) DIA THRU CONCENTRIC W/0.3750 DIA WITHIN 0.002. C'DR. 0.125 DIA X 0.750 DEEP

7 BUSHING — 1 REQD
MAT'L: 4130 STEEL H.T. Rc25-32
FINISH: ROUGHTO

NOTE

1. Break all sharp edges and corners
2. This fixture to be used in conjunction with alignment fixture, P/N 66-SSMAC-D-031A

LIST OF MATERIALS (SHEETS 1 THRU 5)

ITEM NO.	QTY. REQD.	PART	DESCRIPTION	SPECIFICATION	NOTES
-20	1	Plate Assembly		Items 3, 7, -13, 18, & 19	
19	6	Soc. Hd. Cap Screw	1/4 -20 N.C. x 1	NAS609-4-16	Or equal
18	4	Dowel Pin	1/4 Dia. x 1-1/4	NAS607-4-10	Or equal
17	2	Base	3/4 x 3 x 4	6061-SO Alum.	
16	2	Gusset	3/4 x 3-/16 x 6-9/16	6061-SO Alum.	
15	2	Leg	3/4 x 3 x 5-13/16	6061-SO Alum.	
14	1	Plate	3/4 x 3 x 10-1/2	6061-SO Alum.	
-13	1	Wire Support Assembly		Items 14 thru 17	H.T. Cond T6 After welding
12	3	Relieved Locator	5/8 Dia. x 1-3/4	4130 Steel	H.T. Rc 26-32
11	3	Locater	5/8 Dia. x 1-3/4	4130 Steel	H.T. Rc 26-32
10	6	Bushing	1/2 Dia. x 1/2	Steel AISI Type 02	H.T. Rc 60-62
9	6	Bushing	3/4 Dia. x 25/32	4130 Steel	H.T. Rc 26-32
8	3	Support	1-1/2 x 2-1/2 x 5-3/8	2024-T4 Aluminum	
7	1	Bushing	1/2 Dia. x 7/8	4130 Steel	H.T. Rc 26-32
6	5	Bushing	1" Dia. x 15/16	4130 Steel	H.T. Rc 26-32
5	1	Bushing	1" Dia. x 15/16	4130 Steel	H.T. Rc 26-32
4	2	Bushing	1" Dia. x 15/16	4130 Steel	H.T. Rc 26-32
3	1	Plate	3/4 x 28 x 39	6061-T6 Aluminum	
-2	3	Hanger Bearing Locater Assembly		Items 8 thru 12	
-1	1	Front Bulkhead Plate Assembly		Items 3 thru 7 and -20	

Figure 6-43. Tools – Alignment Driveshaft Hanger and 42° Gearbox (Sheet 1 of 8)

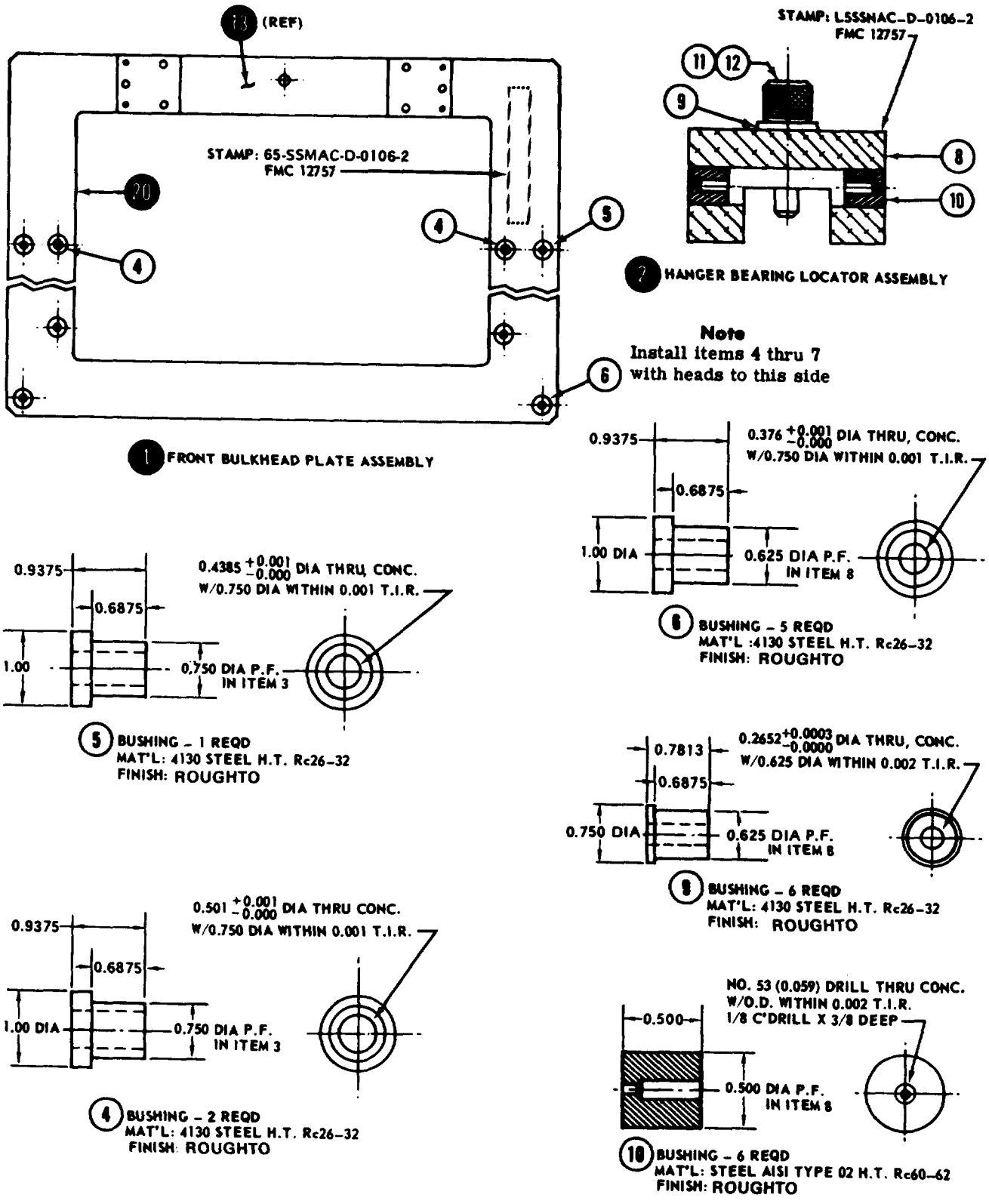


Figure 6-43, Tools – Alignment Driveshaft Hanger and 42° Gearbox (Sheet 2 of 8)

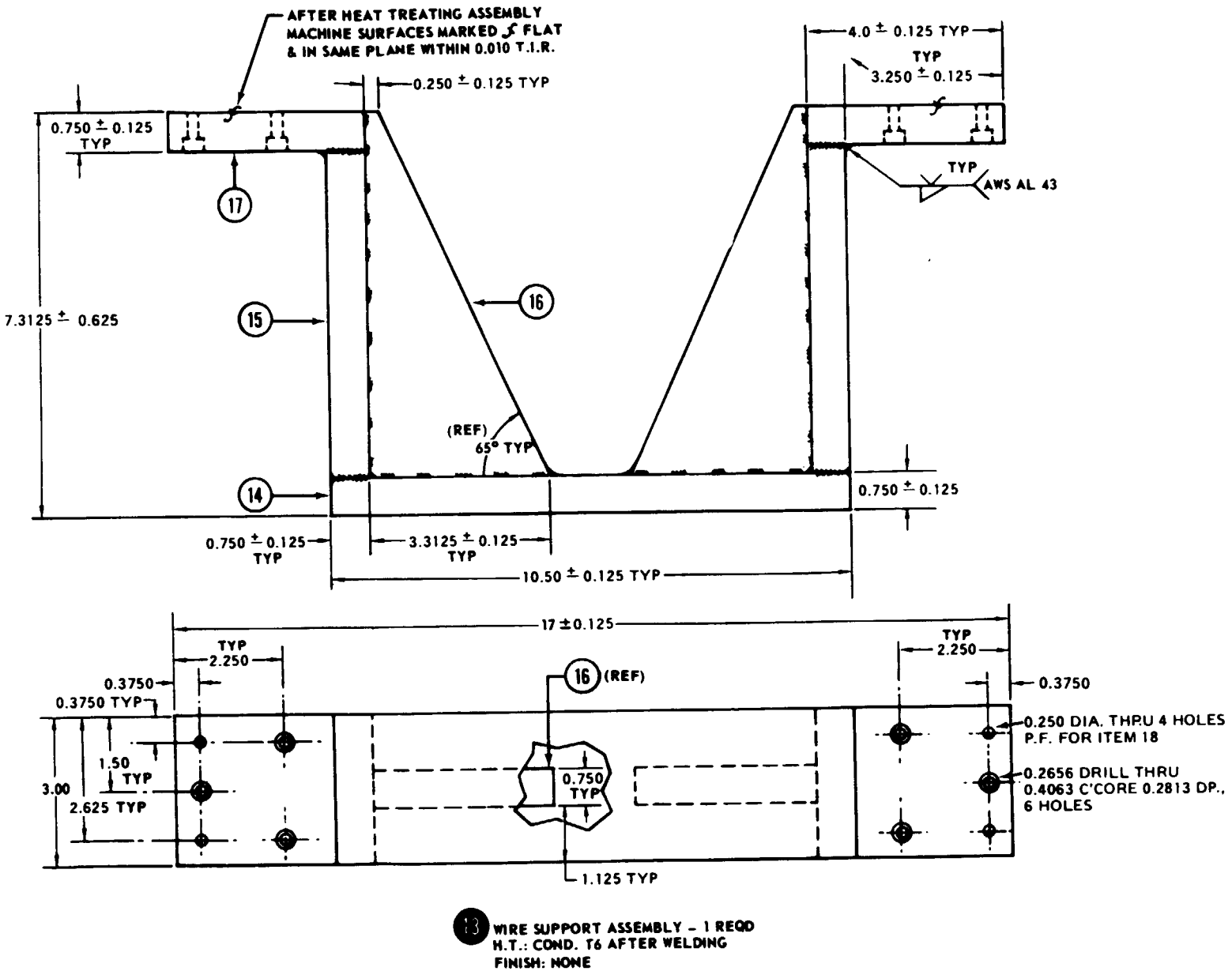


Figure 6-43. Tools — Alignment Driveshaft Hanger and 42° Gearbox (Sheet 3 of 8)

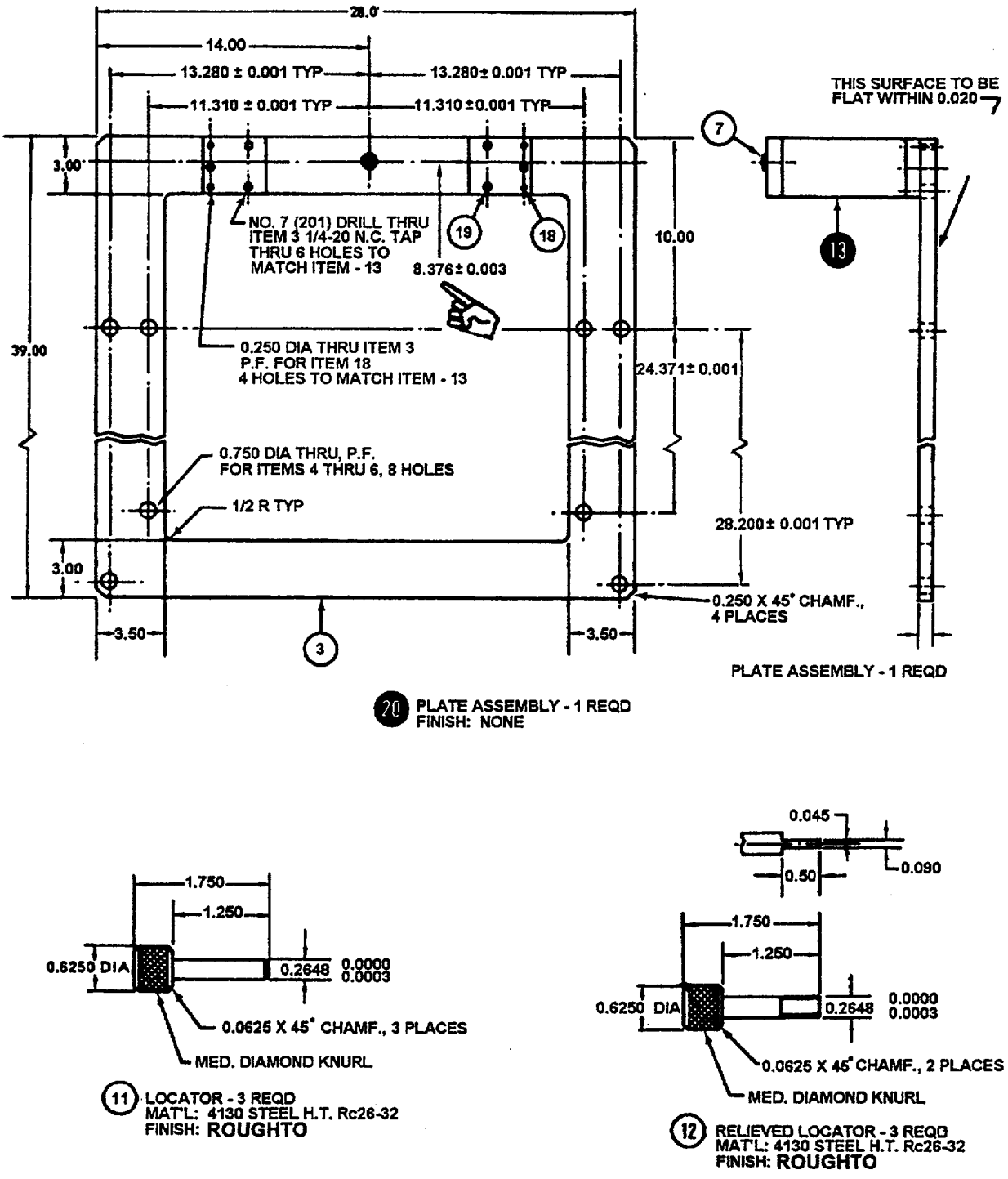


Figure 6-43. Tools - Alignment Driveshaft Hanger and 42° Gearbox (Sheet 4 of 8)

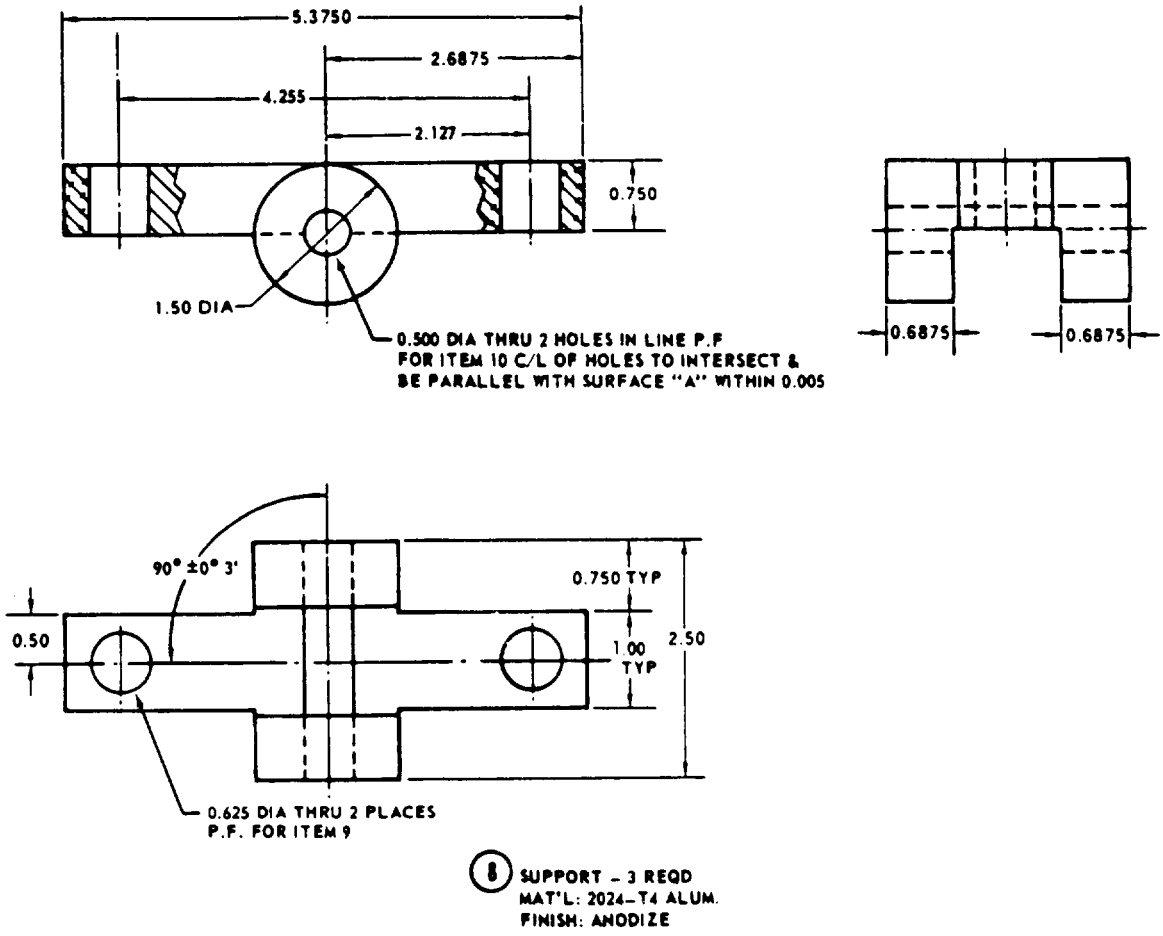
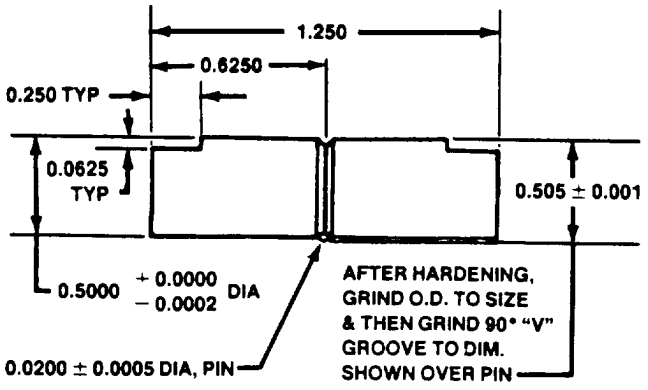
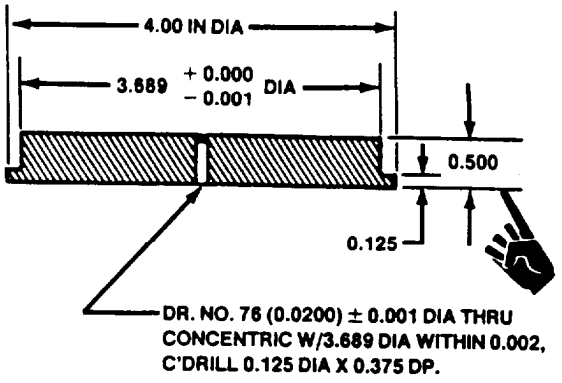


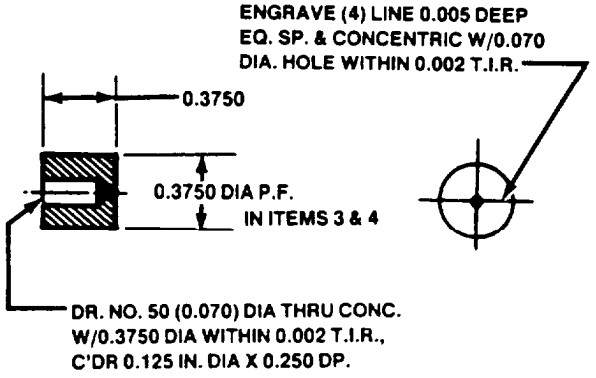
Figure 6-43. Tools – Alignment Driveshaft Hanger and 42° Gearbox (Sheet 5 of 8)



(7) PIVOT PIN — 1 REQD
MAT'L: STEEL AISI TYPE OR H.T. Rc58-62



(9) CENTERING PLATE — 1 REQD
MAT'L: STEEL 4130 H.T. Rc28-34
FINISH: ROUGHTO



(6) BUSHING — 2 REQD
MATL: STEEL AISI TYPE OR H.T. Rc58-62
FINISH: NONE

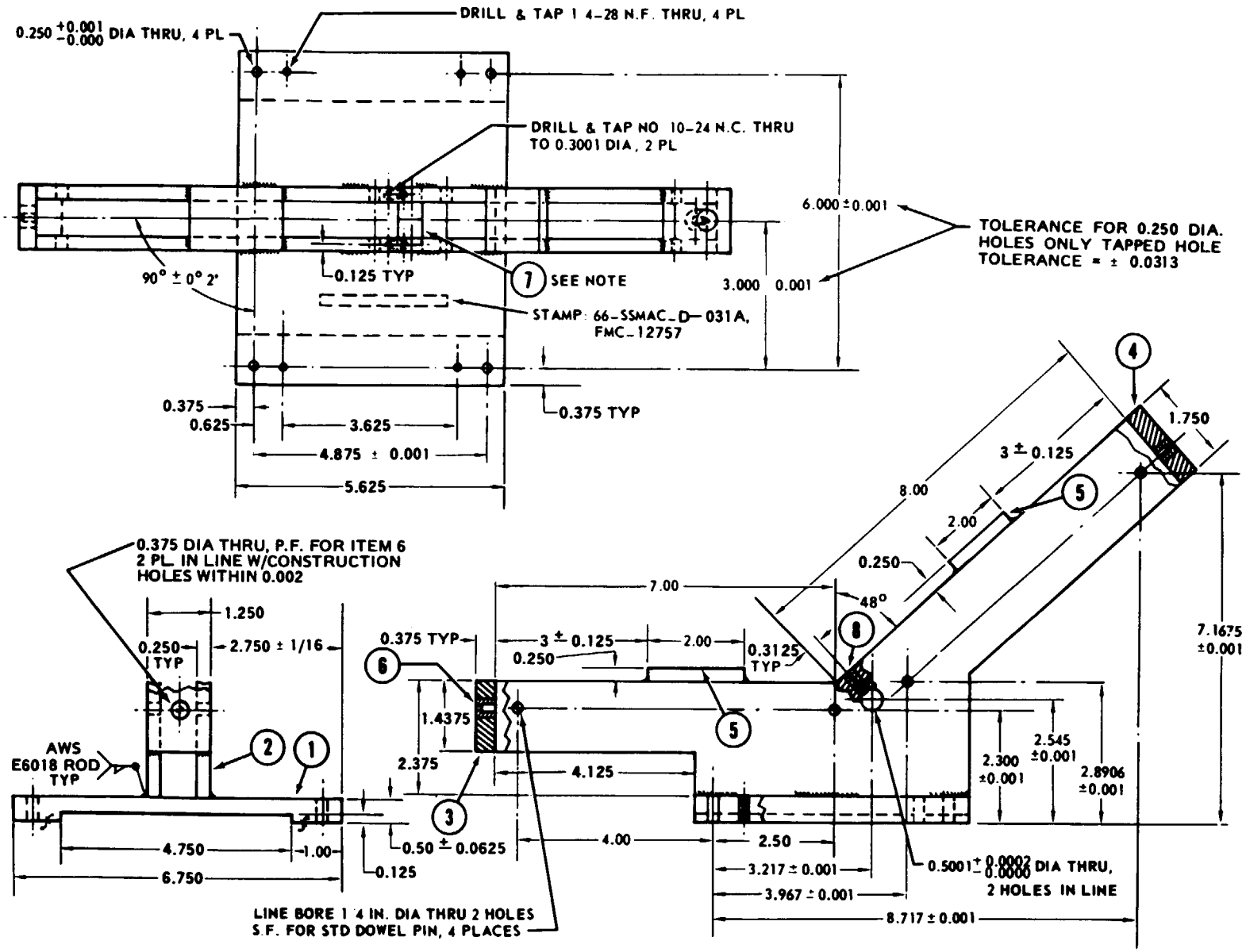
GENERAL NOTES

1. Break all sharp edges and corners.
2. At assembly align center of "V" groove of pivot pin, item 7, on centerline of 0.070 dia. holes in items 6 within 0.002, fasten set screws, item 8, firmly on flats of item 7, and seal set screws with sealing wax.
3. Surface marked "f" must be flat within 0.002.
4. Stress relieve welded assembly before finish machining.
5. This fixture to be used in conjunction with fixture, P/N 65-SSMAC-D-0106.
6. Surfaces marked "f" must be in same plane within 0.002.

LIST OF MATERIALS (SHEETS 6 AND 7)

ITEM NO.	QTY REQD.	PART	DESCRIPTION	SPECIFICATION	NOTES
9	1	Centering Plate	4 Dia. x 1/2	Steel 4130	H.T. Pc 28-34
8	2	Soc. Hd. Set Scr.	No. 10-24 N.C. x 1/2	MS51019-51	Or equal
7	1	Pivot Pin	1/2 Dia. x 1-1/4	Steel AISI Type 02	H.T. Rc 58-62
6	2	Bushing	3/8 Dia. x 3/8	Steel AISI Type 02	H.T. Rc 58-62
5	2	Gusset	1/4 x 1-1/4 x 2	C.R.S.	
4	1	End Plate	3/8 x 1-1/4 x 1-3/4	C.R.S.	
3	1	End Plate	3/8 x 1-1/4 x 1-7/16	C.R.S.	
2	2	Side Plate	1/4 x 7-3/4 x 14-1/8	C.R.S.	
1	1	Base Plate	1/2 x 5-5/8 x 6-3/4	C.R.S.	

Figure 6-43. Tools — Alignment Driveshaft Hanger and 42° Gearbox (Sheet 6 of 8)



ALIGNMENT FIXTURE ASSEMBLY — 1 REQD
FINISH: ROUGHTO

Figure 6-43. Tools — Alignment Driveshaft Hanger and 42° Gearbox (Sheet 7 of 8)

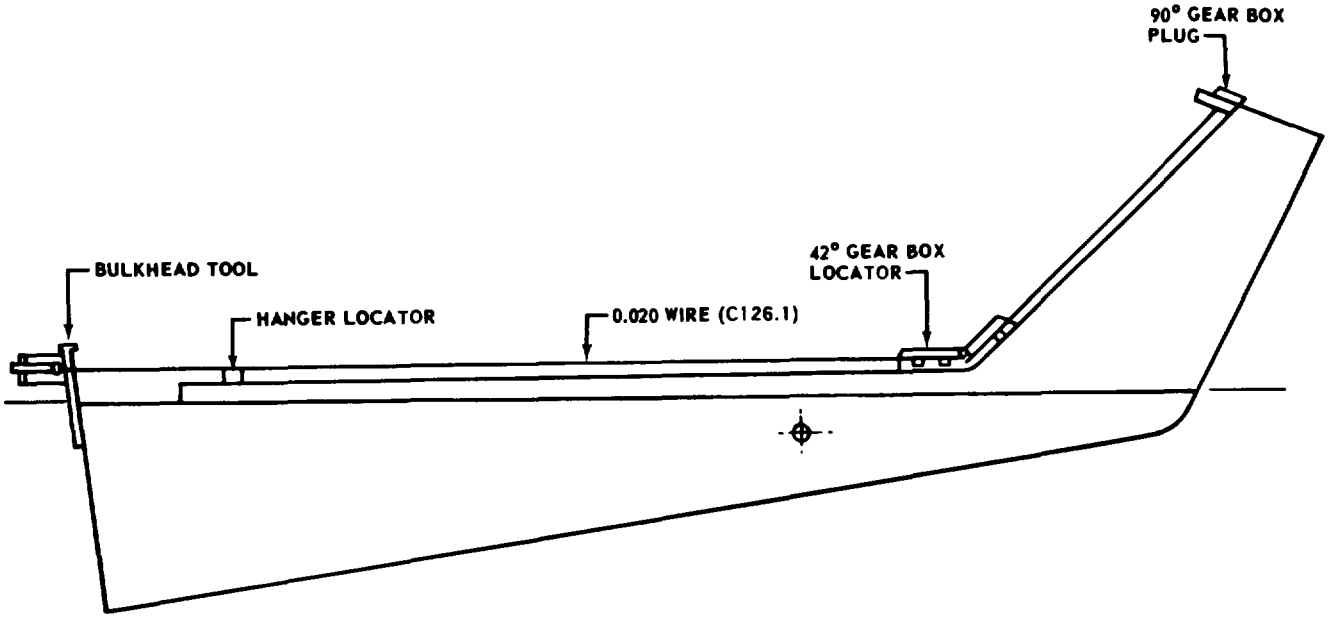


Figure 6-43. Tools – Alignment Driveshaft Hanger and 42° Gearbox (Sheet 8 of 8)

through bushing in bulkhead tool; tighten until all slack is removed from wire. Ensure that no kinks are in wire.

NOTE

Ensure hanger bearing locater is installed between 42 degree gearbox locater and bulkhead tool. If hanger bearings are also to be located, use only one hanger bearing locater and move along wire to successive location. Bulkhead tool, P/N 65-SSMAC-D-106-2 should be used in conjunction with 42 degree gearbox locater, P/N 66-SSMAC-D-031A.

(5) Align 42 degree gearbox locater using shims until wire is approximately centered in bushings located in top and horizontal legs of tool. Jackscrew holes are provided to aid in determining the correct amount of shim to utilize for positioning.

NOTE

It may be necessary to taper 42 degree gearbox shim on some tailbooms.

(6) When proper shim dimension has been determined for the 42 degree gearbox, determine the shim thickness for the driveshaft hanger bearing supports. Support will be correctly located when wire does not touch sides of holes in bearing support locater tool bushings (two bushings per tool). Locate one support at a time.

(7) When proper shim thickness has been established, remove all tooling and permanently bond shims in position on tailboom using adhesive (C29).

(8) Reinstall tailboom and components of tail rotor drive system.

b. A No. 1 hanger bearing alignment check must be made whenever misalignment is suspected or when damage to service deck in the area of hanger bearing support is repaired. Ensure that two consecutive hanger supports are in alignment. Refer to step a. for alignment of No. 2 and No. 3 driveshaft bearing supports.

(1) Fabricate tooling for No. 1 hanger bearing support using the following materials: (Figure 6-44).

(a) Aluminum Alloy Bar Stock
2.5 inches x 12.0 inches 1 each

(b) Hanger, T/R Driveshaft P/N 204-040-617 — 3 each

(c) Ring, Lock P/N RR244C — 3 each

(d) Drill Rod 1.250" x 6" — 1 each

(e) No. 60 Drill — 1 each

(2) Fabricate three alignment sight shells as shown in figure 6-44, detail A.

(3) Fabricate six sight inserts as shown in figure 6-44, detail B and install one in each end of sight shell using loctite on threads.

(4) Obtain three hangers (P/N 204-040-617-5) and press one sight assembly into each hanger. Secure in hanger with retaining ring, P/N RR244C.

(5) Remove tail rotor driveshaft (paragraph 6-163).

(6) Remove driveshaft hangers from No. 1, No. 2 and No. 3 hanger supports (paragraph 6-171).

(7) Install hangers, with sight assemblies, in No. 1, No. 2 and No. 3 hanger supports.

(8) Place a flashlight or any other suitable light source, against the forward hanger support sight shell assembly, allowing the light to be seen through sight shell insert when viewed from the tailboom, looking forward.

(9) Sight from No. 3 hanger support through sight shell inserts to light source. Note any deviation of No. 1 hanger support.

(10) Shim as necessary under No. 1 hanger support until light is clearly visible through all sight shell assembly inserts. Bond shims in position using adhesive (C29).

(11) Remove tooling and reinstall components of tail rotor drive system.

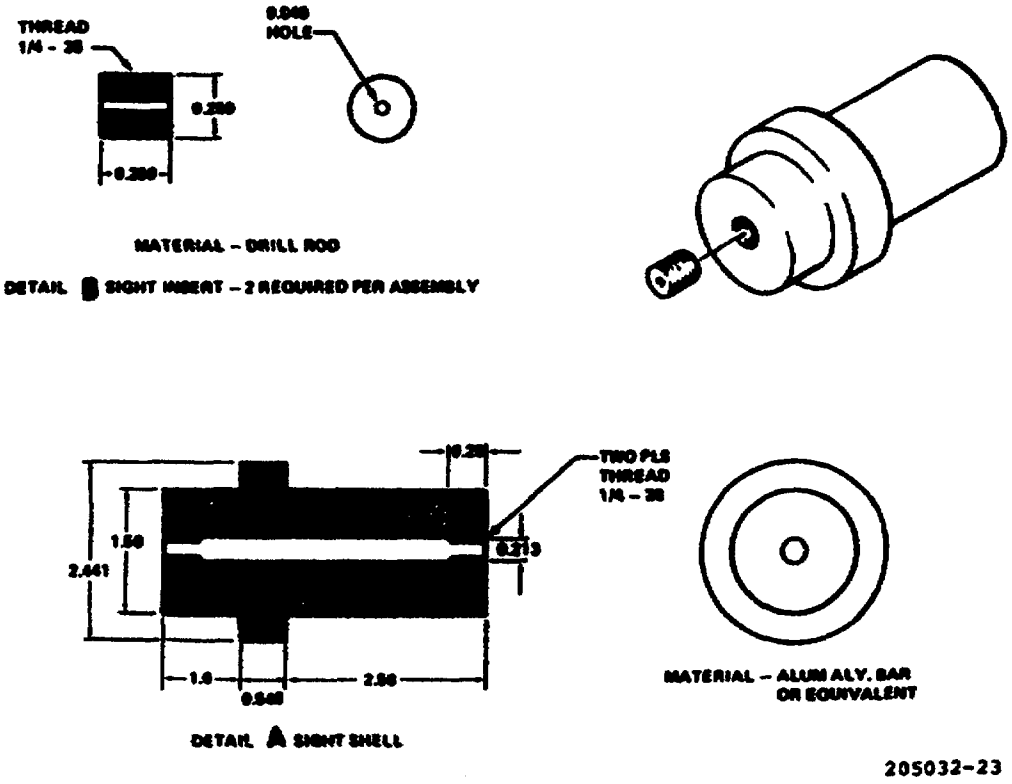


Figure 6-44. Tools - Alignment No. 1 Tail Rotor Hanger Bearing Support

6-167. DRIVESHAFT HANGERS.

6-168. Description - Driveshaft Hangers. Four hanger assemblies are utilized for the driveshaft. Each assembly consists of couplings on a short splined shaft, mounted through a single-row sealed ball bearing in a ring-shaped hanger, equipped with two mounting lugs for attachment on a support fitting.

6-169. Inspection - Driveshaft Hangers (Installed).

a. Inspect hanger assemblies for excessive roughness, binding or corrosion. Corrosion of hanger assembly can be cleaned in accordance with table 2-4.

NOTE

Provided that the depth of material removed does not exceed 0.010 inch, nicks, scratches, and corrosion on the exterior of driveshaft hangers shall be polished out with fine abrasive cloth (1).

(1) Disconnect driveshaft from each end of hanger assembly.

(2) Rotate bearing while pressing in axially on end of hanger while turning. Bearing may feel smooth when turned with no load but rough when loaded by pressing with hand. If the bearing turns smoothly, it may be checked for excessive internal clearance if desired. The maximum allowable radial play is **0.002** inch total indicator reading. Radial play may be measured as follows:

(a) Install tail rotor driveshaft aft of the hanger assembly (the drive shaft forward of the hanger assembly may be either installed or removed).

(b) Mount a dial indicator by clamping the mounting base of the tail rotor drive shaft clamp at the boss for bolts, and position the dial indicator so that the indicating pointer is directly on top of the bearing hanger, and the indicator is positioned to read vertical movement (see figure 6-47.1). Exercise care not to damage the drive shaft clamps.

(c) Hold the tail rotor drive shaft immediately aft of the clamped dial indicator, and move the shaft up and down to check for radial play in the bearing. The total play, indicated by the dial indicator, should not exceed **0.002** inch T. I. R. The maximum force applied to move the shaft should not exceed 10 (ten) pounds, and the drive shaft must not be permitted to rotate while checking play.

(d) If the hanger bearing assembly is not installed on a helicopter, attach wrench assembly T101307 to the aft coupling and mount dial indicator by clamping mounting base to the wrench assembly. Hold hanger bearing assembly by clamping mounting ear of hanger in a vise (exercise care not to damage hanger). Position indicator as shown in figure 6-47.1. Hold forward and aft coupling and move assembly up and down in the same manner as above to check radial play in the bearing. Exercise care to see that the couplings do not rotate and that the indicator pointer stays on the same spot on the hanger while measuring play.

(e) The maximum acceptable radial play in the tail rotor hanger bearing is **0.002** inch total indicator reading. If play exceeds this limit, replace the hanger bearing assembly.

(3) Obvious roughness, catching or binding when turned by hand with no load is cause for replacement.

(4) Inspect the following parts if cracks suspected in accordance with TM 55-1500-335-23. (Refer to figure 6-45). If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

ITEM	NOMENCLATURE
7	Inner (spherical) coupling
8	Forward coupling
11	Rear coupling
10.1	Hanger
10.4	Coupling shaft

(5) Replace couplings (7, 8, and 11) if cracked, chipped, scored, worn, or show evidence of overheating. A maximum of **0.002** inch of wear is allowable on the inner coupling (7) if the diameter in the worn area is not less than 1.587 inches. The worn area must be free of nicks and dents that would affect function of seal (9).

b. Inspect hanger assemblies and adjacent area for evidence of grease leakage. Wetting of adjacent structure by slinging of grease from flex coupling and/or bearings is cause for replacement of hanger assembly. A small amount of grease expelled from around lip of bearing seal indicates slight over-lubrication and is not cause for hanger replacement. Perform an evaluation of hanger as follows:

CAUTION

Do not clean or spray bearing or hanger assembly with any type of solvent during inspection. Use only clean cloths without solvent to clean exterior of hanger.

(1) Wipe grease from seal with clean lint-free cloth.

(2) Record on DA Form 2408-13, indicating bearing by location and keep under observation.

(3) If amount of grease expelled from bearing seal does not decrease after a period of time hanger assembly should be replaced.

c. Inspect hanger assembly and bearing for evidence of overheating as follows:

b. Inspect hanger assemblies and adjacent area for evidence of grease leakage. Wetting of adjacent structure by slinging of grease from flex coupling and/or bearings is cause for replacement of hanger assembly. A small amount of grease expelled from around lip of bearing seal indicates slight over-lubrication and is not cause for hanger replacement. Perform an evaluation of hanger as follows:

CAUTION

Do not clean or spray bearing or hanger assembly with any type of solvent during inspection. Use only clean cloths without solvent to clean exterior of hanger.

(1) Wipe grease from seal with clean lint-free cloth.

(2) Record on DA Form 2408-13-1, indicating bearing by location and keep under observation.

(3) If amount of grease expelled from bearing seal does not decrease after **5 TO 10** hours of operation, hanger assembly should be replaced.

c. Inspect hanger assembly and bearing for evidence of overheating as follows:

(1) Hanger assemblies normally operate at a temperature range of **100 to 160** degrees F (cool enough to touch). Investigate any installed hanger that is too hot to touch.

(2) Indications of overheating such as discoloration of bearing (blue/black in color) or multicolor appearance of couplings and hanger that darkens adjacent to bearing is cause for replacement.

(3) Brown coloring of bearing shield is normal and is not an indication of overheating.

d. Rust colored fretting debris in areas adjacent to bearing OD/ID is cause for replacement.

e. Inspect hanger ring and attachment lugs for cracks, elongated bolt holes, or other obvious damage.

(1) Scratches, nicks, dents, and corrosion on hole surfaces shall not exceed a depth of 0.01 inch and a total damage area of 40 percent after cleanup.

(2) Wear or elongation in hanger-to-fitting attachment holes shall not exceed a diameter of 0.274 inch.

f. Inspect couplings per paragraph 6-200.1. Couplings must be removed and disassembled for inspection.

g. Inspect hanger support fitting on tailboom and engine deck for security of attachment and evidence of cracks and damage. No cracks allowed. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

CAUTION

Do not attempt to remove or change shims under fittings.

6-170. Lubrication - Driveshaft Hangers.

NOTE

Coupling splines may be lubricated with hangers installed on tailboom.

a. Remove retaining ring (1, figure 6-45) while holding seal plate (2) against pressure of spring (3).

b. Remove seal plate (2) and spring (3).

CAUTION

Do not spray hanger bearing or hanger assembly with solvent. If couplings are cleaned with solvent, protect the hanger bearing to prevent dilution of the bearing grease. The hanger bearings are factory packed and cannot be repacked.

NOTE

Solvent (C261) may be used to clean couplings if couplings are removed from the aircraft, completely disassembled, and dried with filtered, dry, compressed air. If couplings are not removed and completely disassembled, solvent shall not be used.

c. Hold couplings at full outward position. Remove old lubricant as thoroughly as possible.

d. Hand pack lubricant (C158) to **0.125** inch depth over top of internal spline teeth.

e. Keep coupling at full outward position. Reinstall spring (3), seal plate (2) and retaining ring (1).

f. Gently push and pull flex coupling to full limits to evenly distribute grease full length of spline teeth.

6-171. Removal - Driveshaft Hangers.

a. Open hinged access doors along top of tailboom by releasing fasteners on left side.

b. Remove tail rotor driveshafts from each side of hanger (paragraph 6-162).

c. Remove bolt (26, figure 6-42) with nut (22) and washers (23), (24), (25) and (27), at each side to detach any hanger assembly from its support fitting.

6-172. Disassembly - Driveshaft and Hangers.

a. Disassemble hanger for inspection as follows:

(1) Remove retaining ring (1, figure 6-45) while holding seal plate (2) against pressure of spring (3).

(2) Remove seal plate (2) and spring (3).

(3) Remove cotter pin (16), nut (15), washers (13 and 14) and plate (12) from retaining bolt (4).

(4) Deleted.

(5) Remove inner coupling (7) and forward coupling (8). Remove seal (9) from forward coupling (8). Remove rear coupling (11).

(6) Deleted.

(7) Deleted.

(8) Remove retaining ring (10.3) and press bearing (10.2) from hanger (10.1). Press shaft (10.4) from hanger bearing. (See figure 6-45).

CAUTION

Do not spray hanger bearing or hanger assembly with solvent. If couplings are cleaned with solvent, protect the hanger bearing to prevent dilution of the bearing grease. The hanger bearings are factory packed and cannot be repacked.

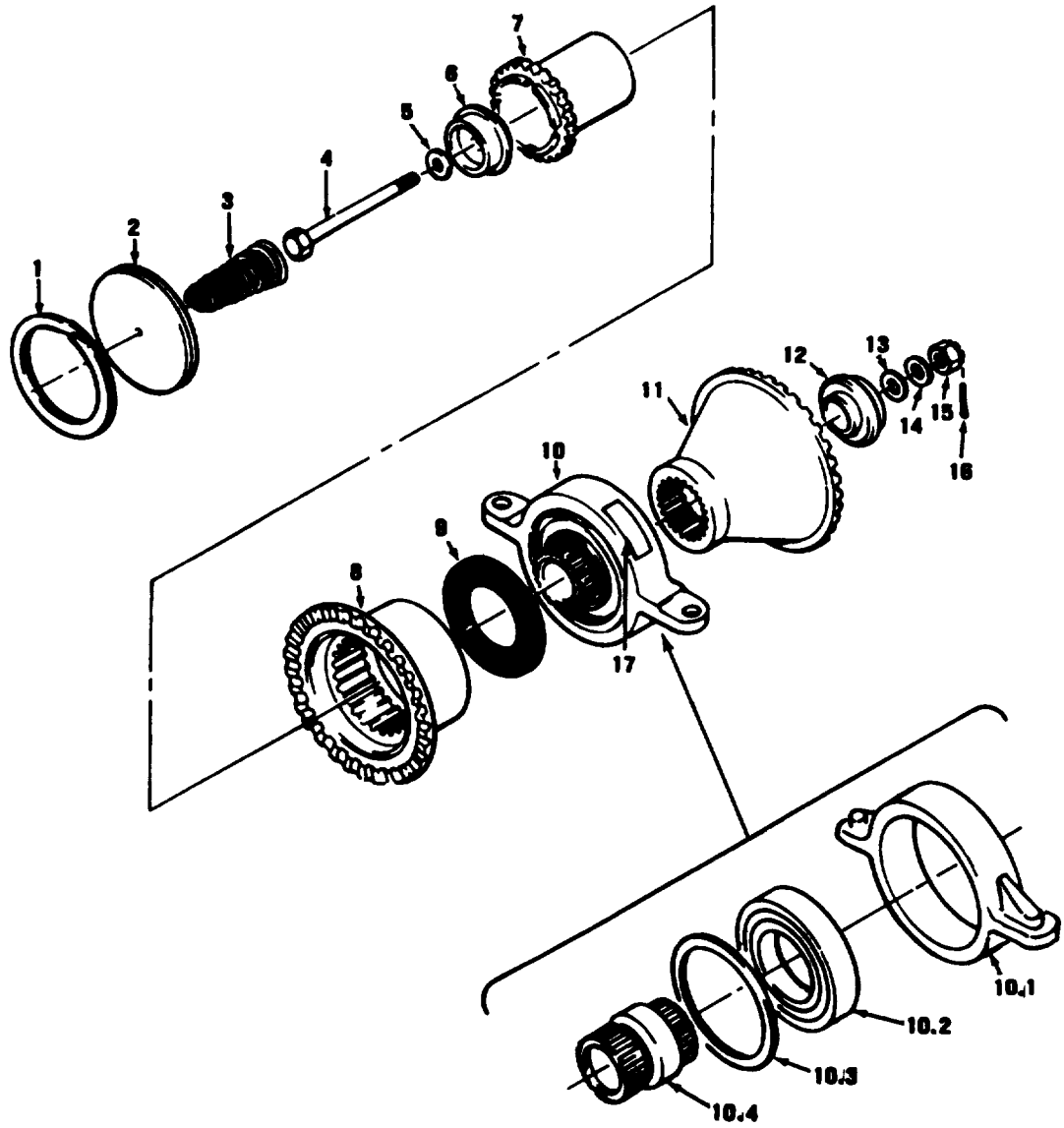
NOTE

Solvent (C261) may be used to clean couplings if couplings are removed from the aircraft, completely disassembled, and dried with filtered, dry, compressed air. If couplings are not removed and completely disassembled, solvent shall not be used.

(9) Clean all grease from couplings.

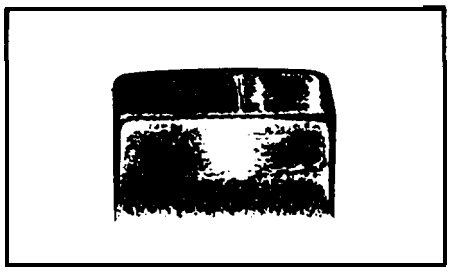
b. Inspect hanger parts for wear and damage:

(1) Inspect forward coupling (8) and inner (spherical) coupling (7) per paragraph 6-200.1.

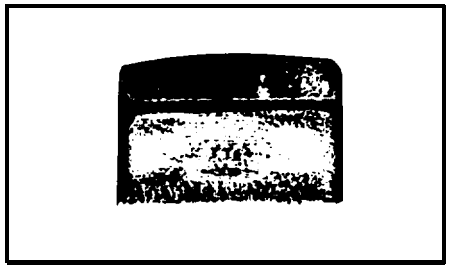


1. Retaining ring
2. Seal plate
3. Spring
4. Retaining bolt
5. Washer (aluminum)
6. Plate
7. Inner (spherical) coupling
8. Forward coupling
9. Seal
10. Bearing and shaft assembly
10.1 Hanger
10.2 Hanger bearing
10.3 Retaining ring
10.4 Coupling shaft
11. Rear coupling
12. Plate
13. Washer (aluminum)
14. Washer (steel)
15. Nut
16. Cotter pin

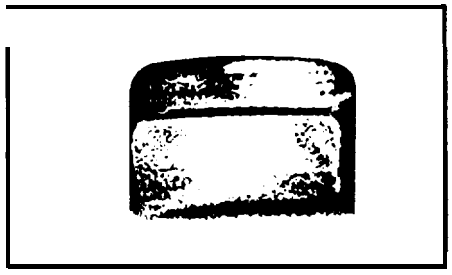
Figure 6-45. Tail Rotor Driveshaft Hanger.



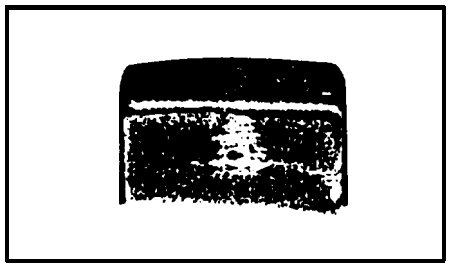
A Acceptable pattern typical of low operating time.



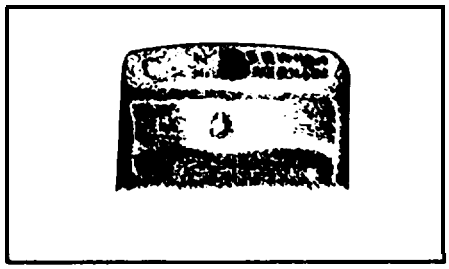
B Acceptable pattern typical of couplings which have operated with normal misalignment for a longer period of time than that shown **in A.**



C Acceptable pattern denoting operation at higher torque than that shown in A and B.



D **Acceptable pattern** showing a pitted tooth. This condition is accepteble on alll teeth.



E **Pattern shows l more sever. condition of tooth pitting than that shown in D. There is no motel projecting l bove the normal face of the tooth, indicating that the pitted l rea is polishing over. This condition may l xist on l ll teeth. Couplings with pits larger than 1 /32 inch diameter should be replaced.**

Figure 6-46. Coupling Teeth Wear Patterns-Typical

(2) Visually inspect all parts for wear. Parts which indicate excessive wear should be measured for limits (figure 6-47).

(3) Inspect bearing for roughness, lack of lubrication, or signs of overheating.

(4) If any parts have wear or damage beyond limits or bearing is defective, replace defective parts.

(5) Inspect retaining ring (1, figure 6-45), seal plate (2), and spring (3) for serviceability.

(6) Inspect centering spring (3) by applying a test load of **5.0** plus or minus **0.5** pounds to compress spring to **1.50** plus or minus **0.10** inches. Spring should return to free length of **2.00** inches plus or minus **0.03** inches.

b.1. If bearing replacement is necessary, proceed as follows:

(1) Press shaft (10.4) from bearing and shaft assembly (10).

(2) Remove retaining ring (10.3) from bearing and hanger (10.1).

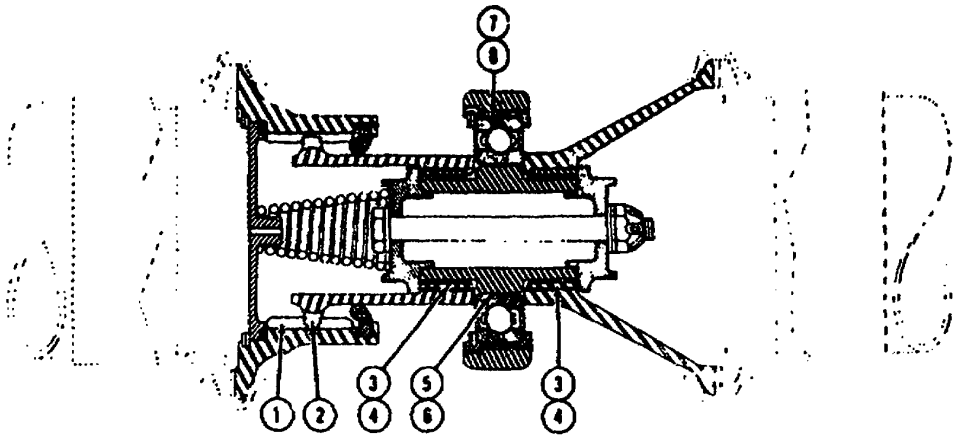
(3) Press bearing (10.2) out of hanger (10.1) through retaining ring end.

b.2. Assemble bearing and shaft assembly as follows:

(1) Press new bearing (10.2) into hanger (10.1) through retaining ring end. Press on bearing outer race only.

(2) Support inner race of bearing (10.2) and press shaft (10.4) into bearing. Bearing journal of shaft must center within 0.003 to 0.016 inch.

(3) Install retaining ring (10.3) in hanger and shaft assembly (10).



ITEM	NOMENCLATURE	MFG. DIMENSION (Inches) MIN.	MAX.	REPLACE
1	OUTER COUPLING - INTERNAL SPLINE (USE 0.1309 INCH DIA. PINS) - NOTE 3	REFER TO PARAGRAPH 6-200.1 FOR WEAR CRITERIA		
2	INNER COUPLING - EXTERNAL SPLINE (USE 0.1080 INCH DIA. PINS) - NOTE 3			
3	INNER COUPLING - INTERNAL SPLINE (USE 0.0720 INCH DIA. PINS) - NOTE 3	1.1251	1.1285	1.1336
4	SHAFT - EXTERNAL SPLINE - NOTE 3 (USE 0.0960 INCH DIA. PINS	1.3502	1.3518	1.3481
5	SHAFT - BEARING SEAT	1.3778	1.3784	1.3776
6	BEARING - INSIDE DIAMETER	1.3775	1.3780	NOTE 2
7	BEARING - OUTSIDE DIAMETER	2.4404	2.4409	NOTE 2
8	HANGER SLEEVE - INSIDE DIAMETER	2.4401	2.4406	2.4409

NOTES

1. **DELETED.**
2. **BEARING IS A STANDARD REPLACEMENT ITEM AT OVERHAUL - ONLY MFG. DIMENSIONS ARE GIVEN.**
3. **THE PINS NEEDED FOR ITEMS 1, 2, 3, AND 4 ARE TO BE LOCALLY MANUFACTURED.**

Figure 6-47. Limits Chart - Tail Rotor Driveshaft Hanger Assembly

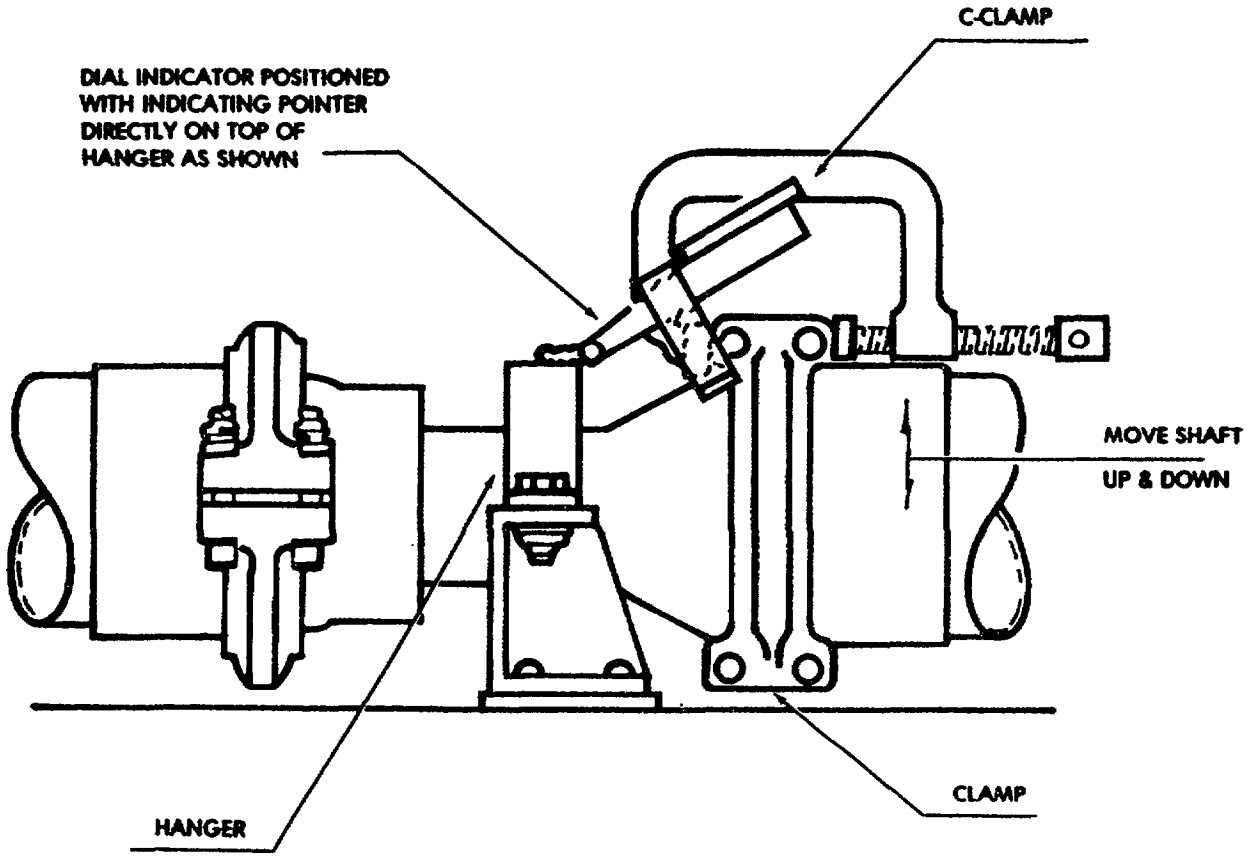


Figure 6-47.1. Hanger Assembly (Radial Play in Bearing)

c. Assemble hanger as follows:

CAUTION

It is possible to erroneously intermix outer coupling, inner coupling, and bearing on the bearing and shaft assembly with similar parts manufactured for other helicopters. Confirm that all driveshaft hanger assembly parts are the correct part number.

(1) Install seal (9, figure 6-45) into groove at small end of forward coupling (8) with seal lip toward flange end of coupling. Use a burnishing tool to seat seal between gear teeth and end of coupling.

(2) Apply lubricant (C158) to splines of inner coupling (7) and insert into forward coupling (8).

(3) Install rear coupling (11). Install inner coupling (7) and forward coupling (8) to the (forward) retaining ring side of bearing and shaft assembly (10).

(4) Install aluminum washer (5) and plate (6) against head of retaining bolt (4) and insert bolt through previously assembled parts.

(5) Install plate (12), aluminum washer (13), steel washer (14), and nut (15) on retaining bolt (4). Torque nut (15) **50 to 70** inch-pounds. Install cotter pin (16).

NOTE

If cotter pin (16) does not engage castellations, one or two steel washers may be added under nut (15) as required.

(6) Hold forward coupling (8) at full outward position. Hand pack lubricant (C158) to **0.125** inch depth over top of internal spline teeth.

(7) Install spring (3). seal plate (2) and retaining ring (1).

NOTE

Reassembly procedures for all tail rotor drive shaft hanger assemblies is the same. After installation of a new tailboom, a hanger alignment check shall be performed.

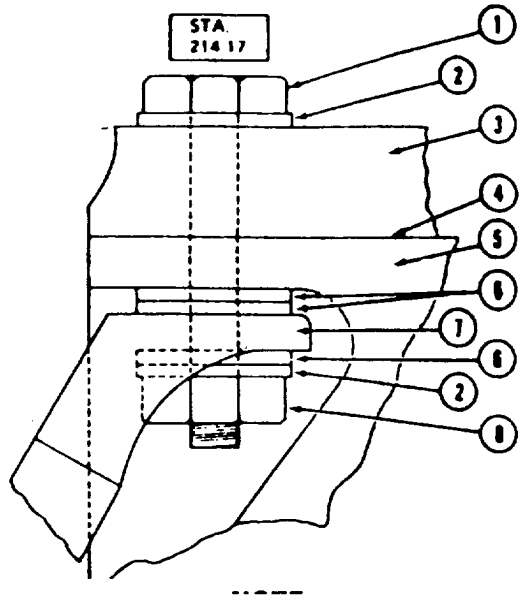
(8) Gently push and pull flex coupling to full limits to evenly distribute grease full length of spline teeth.

6-173. Installation — Driveshaft Hangers.

a. Install pressure sensitive tape (C278) on all supports. Position all hanger assemblies on attaching supports with flexible coupling forward. Position attaching hole boss on hanger facing up (with identification plate (17, figure 6-45) on top).

NOTE

Ensure that **retaining** rtng and flex coupling are both facing **forward.**



NOTE

Add a washer (AN960-416 or AN960-416L) under nut to adjust for grip length that is longer than gripped material thickness.

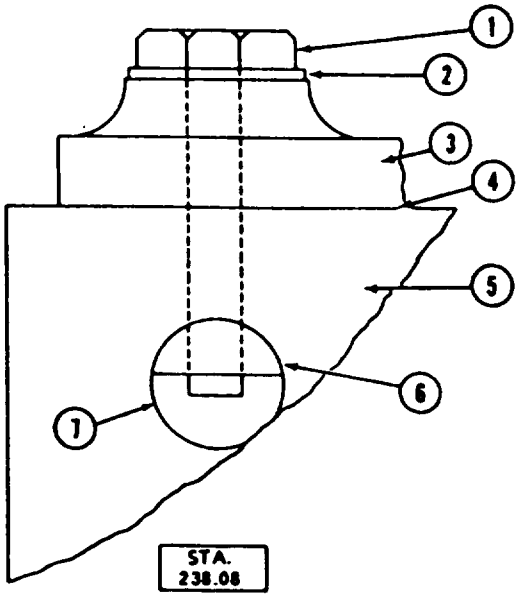
1. **BOLT AN4-13A**
2. **WASHER AN960-416**
3. **HANGER ASSEMBLY 204-040-600**
4. **TAPE PRESSURE SENSITIVE**
5. **SUPPORT 205-030-236**
6. **WASHER NAS1197-416**
7. **BRACE ASSEMBLY 205-030-831**
8. **NUT MS21042L4**

Figure 6-48. DriveShaft Hanger, Fuselage — Installation

b. Install fuselage hanger assembly (figure 6-48) by installing bolt (1) on each side with a thick steel washer (2) next to bolthead. Install two thick aluminum washers (6) between support (5) and brace (7). Install one thick aluminum washer (6) (under brace) and one steel washer (2) under each nut (8) Secure nuts fingertight.

c. Install forward tailboom hanger assembly (figure 6-49) by installing two barrel nuts (6) and retainers (7) in fitting (5). Install bolt (1) on each side with a thin steel washer (2) next to bolthead. Secure bolts fingertight.

d. Install two aft tailboom hanger assemblies (figure 6-50) by installing bolt (1) on each side with a thin steel washer (2) next to bolthead.Under nut (6) install one thick aluminum washer (5) against fitting (7) and one thin steel washer (2) against nut (6). Additional steel washers may be used under nut if bolt grip is too long. Secure nuts fingertight.

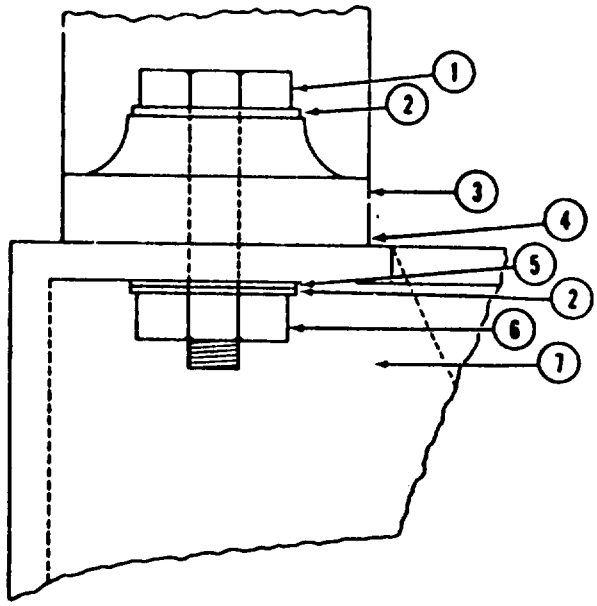


NOTE

Add a washer (AN960416 or AN960-416L) under bolt head when grip length is longer than the gripped material thickness.

1. Bolt AN4-7A
2. Washer AN960-416L
3. Hanger assembly 204-040-600
4. Tape pressure sensitive
6. Fitting 205-031-818
6. 'Barrel nut NAS577-4A
7. Retainer NAS578-4A

Figure 6-49. Driveshaft Hanger, Forward Tailboom — Installation



NOTE:
Additional AN960-416L washers should be used if bolt grip is too long.

1. Bolt AN4-1OA
2. Washer AN960-416L
3. Hanger assembly 204-040-600
4. Tape pressure sensitwe
5. Washer NAS1197-416
6. Nut MS21042L4
7. Fitting 204-030-818

Figure 6-50. Driveshaft Hanger, Aft Tailboom – Installation

e. Install driveshafts (paragraph 6-165].

NOTE

When installed hanger assemblies are being replaced, loosen both ends of driveshaft(s) aft of hanger(s) to allow hanger(s) to seek their natural alignment. Misaligned (cocked) hanger assemblies can result in reduced bearing service life.

f. After driveshafts have been secured in place, torque hanger attaching nuts and/or bolts 60 to 70 inch.pounds.

6-174. TAIL ROTOR DRIVESHAFT SUPPORT FITTING.

6-175. Description — Tail Rotor Driveshaft Support Fitting. The tail rotor driveshaft support fittings mount on the airframe and are used for attachment of the driveshaft hanger assemblies and support the tail rotor driveshaft (figure 6-42.1).

6-176. Removal – Tail Rotor Driveshaft Support Fitting. a. Remove tail rotor driveshaft hanger (paragraph 6-171)

b. Remove screws securing fitting in place

CAUTION

Do not remove shims installed under fitting.

c. Ensure that shims under fitting are bonded in place. If shims are loose, identify for reinstallation in proper place.

6-177. Inspection - Tail Rotor Driveshaft Support Fitting. Inspect fitting for wear, damage, or corrosion (figure 2-62). If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

6-178. Installation - Tail Rotor Driveshaft Support Fitting.

a. Ensure that shims are in place.

b. Secure fitting to airframe with screws and washer.

c. Install driveshaft hanger (paragraph 6-173).

SECTION V. INTERMEDIATE GEARBOX

6-179. INTERMEDIATE GEARBOX.

6-180. Description - Intermediate Gearbox. An intermediate gearbox is located on tailboom, at base of vertical fin. This gearbox provides a 42 degree change in direction of tail rotor driveshaft, with no speed change. Gearbox assembly consists of a case with a gear quill in each end. Case is fitted with an oil filler cap, a vent breather, an oil level sight gage and a magnetic chip detector. On helicopters without ODDS, the chip detector is straight and includes a threaded-stud electrical termination. On helicopters with ODDS, the chip detector is right-angled and includes an electrical receptacle. Chip detector is connected electrically to CHIP DET capsule on caution panel. Input and output quills have flexible couplings for attachment of driveshafts. Access is provided by a vented cover with quick-release fasteners.

6-181. Lubrication - Intermediate Gearbox.

a. Fill gearbox to sight gage level with oil prescribed by servicing points diagram (figure 1-1 and paragraph 1-8).

b. Internal splines of couplings on gearbox are packed with grease during assembly. Coupling splines can be lubricated as described below. This procedure can be accomplished with quills in place on gearbox, with driveshafts disconnected.

CAUTION

Do not intermix parts removed from forward quill with parts removed from aft quill.

(1) Remove retaining ring (1, figure 6-51) from coupling while holding plate (2) against spring pressure.

NOTE

Care must be taken to ensure that the retainer (5) does not become unseated from inner coupling (9).

(2) Remove plate (2) and centering spring (3).

CAUTION

Do not use cleaning solvent inside coupling.

(3) Hold couplings at full outward position. Remove old grease as thoroughly as possible.

(4) Hand pack grease to **0.125** inch depth over top of internal spline teeth. Use lubricant (C158).

(5) Keep coupling at full outward position, ensure retainer(s) and locking spring (4) are properly seated. Reinstall centering spring (3), plate (2) and retaining ring (1).

6-182. Inspection - Intermediate Gearbox.

a. Inspect case assembly (25, figure 6-51) for cracks and damage. If crack is suspected, refer to TM 1-1520-256-23 AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

b. Remove breather vent (27) and make sure it is open and clean throughout. Clean as necessary and reinstall. Remove cap assembly (26), clean, and reinstall.

b.1. Disconnect electrical wire or cable plug from chip detector.

c. Ensure that studs and nuts are tight, with no apparent leakage.

c.1. Press in and turn CCW to remove chip detector probe (31 or 32). Inspect for evidence of metallic debris. Retain debris for analysis. Clean chip detector probe with solvent (C261) and clean cloth. Reinstall and reconnect chip detector.

(a) Inspect the three monuting groves of chip detector (31, figure 6-51). Using a caliper, or similar measuring device, measure the wall thickness at the bottom of the detent. The minimum wall thickness should be 0.030 inch. If the wall thickness of the detent is less than 0.030 inch, replace valve.

(b) Inspect the 3 pins located in the valve (34, figure 6-51). If pins are loose repplace chip detector.

c.2. Refer to paragraph 6-200.3 for inspection of ODDS chip detector assembly PN VM2451001 (Blade type).

d. Inspect sight glass for damage, discoloration, or staining. Inspect gearbox oil for water contamination; the oil is contaminated if it has a dirty, milky appearance. If the oil is contaminated or suspected of contamination, drain and flush until water contamination is removed and reservice the gearbox (paragraph 1-8). Condensation in the inside of the sight glass is acceptable if the oil does not have a dirty, milky appearance.

d.1. Deleted.

e. Inspection of inner coupling (9) and outer coupling (10) must be performed with couplings removed from gearbox. Refer to paragraph 6-200.1 for coupling inspection procedures.

e.1. If chip detector is being inspected following chip light, collect debris for classification (paragraph 6-182.1).

6-182.1. Deleted.

6-183. Removal - Intermediate Gearbox.

a. If the gearbox is to be replaced, drain the operating oil and flush with oil (C166 and C168). Rotate the input quill while flushing to ensure that the gears and bearings are completely wetted.

b. Remove gearbox cover and open tail rotor driveshaft access doors.

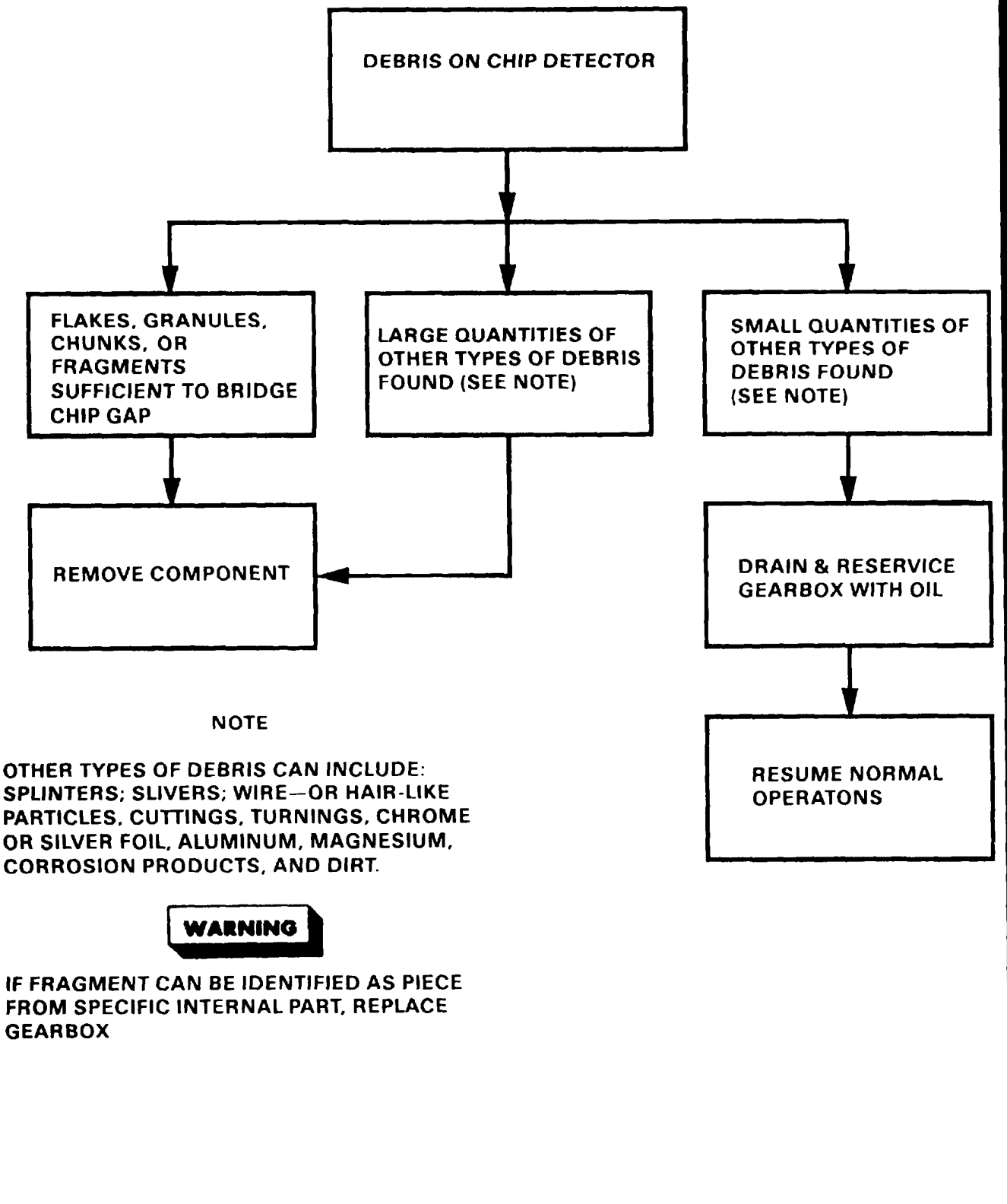
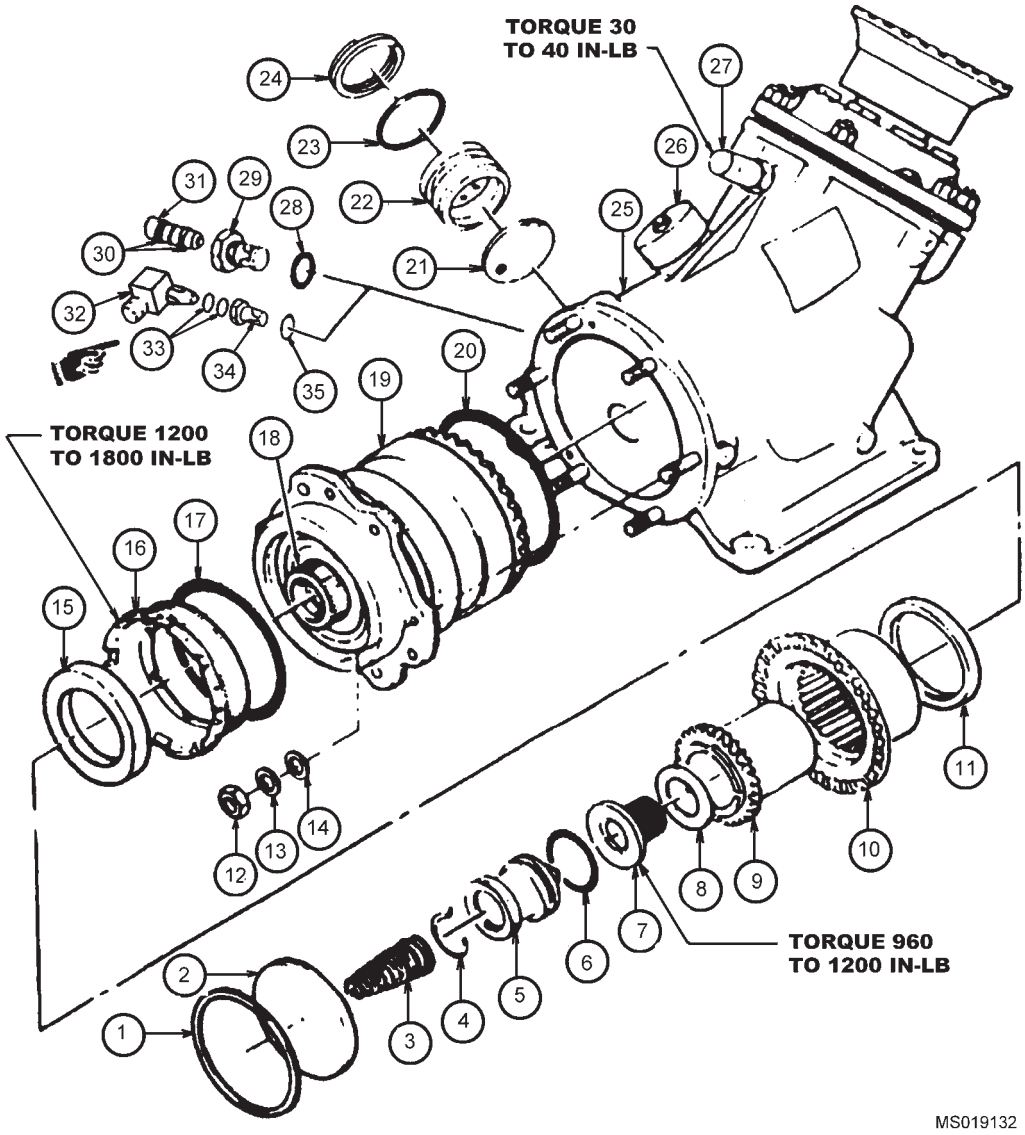


Figure 6-50.1 Intermediate and Tail-Rotor Gearbox Troubleshooting Chart



1. Retaining ring
2. Plate
3. Centering spring
4. Lock spring
5. Retainer
6. Packing
7. Retaining bolt
8. Washer
9. Inner coupling
10. Outer coupling
11. Seal
12. Nut
13. Washer, steel
14. Washer, aluminum
15. Seal
16. Nut
17. Packing
18. Pinion shaft
19. Sleeve
20. Packing
21. Sight indicator
22. Glass
23. Preformed packing
24. Retaining ring
25. Case assembly
26. Cap assembly
27. Breather Vent
28. Gasket
29. Self closing valve
30. Packing
31. Chip detector probe
32. Chip detector probe (ODDS)
33. Packing (ODDS)
34. Valve
35. Packing

Figure 6-51. Intermediate Gearbox (42 degree)

CAUTION

As shafts are disconnected from gearbox, support unattached ends to hold shaft alignment on normal operating axis to avoid damage to hanger bearing or coupling.

c. Remove or disconnect shafts from gearbox input and output couplings (paragraph 6-162).

d. Disconnect electrical wire or cable plug from chip detector.

e. On helicopter with ODDS, if gearbox is to be replaced, remove chip detector from gearbox as follows:

(1) Push in on magnetic chip detector (32) as far as possible and turn ccw to disengage from self-closing valve (34) and pull out. Discard packing (33).

(2) Remove valve (34). Discard packing (35).

(3) Install gasket (28), valve (29), and probe (31) with two packings (30).

f. Remove lockwise and four bolts, with washers, which secure gearbox on tailboom. Lift off gearbox assembly. Do not attempt to remove shims from mounting points.

6-184. **Disassembly — Intermediate Gearbox.**

Premaintenance requirements for disassembly — intermediate gearbox

Conditions	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T33), (T54), (T30), (T60)
Test Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C11), (C261)
Special Environmental Conditions	None

a. Remove gearbox and drain oil (paragraph 6-183).

NOTE

Either gear quill of intermediate gearbox can be removed to replace seals on quill sLeeves in case of oil leakage. Replacement of either or both gear quills is possible, though not recommended as routine procedure since troubles usually would affect other parts, and records of serial-numbered components will be simplified if completegearbox is replaced.

b. Remove nuts (12, figure 6-51) and washers (13 and 14) from studs in case assembly (25). Cut sealing compound from around outside of quill sleeve flange and jackscrew holes.

CAUTION

When using jackscrews to remove quill assembly, the following procedures must be followed: Three jackscrews must be screwed in evenly, exerting equal pressures on quill sleeve to prevent damage to flanges. Do not use force by prying to remove quill. In the event quill cannot be removed using this procedure, heat case, then use jackacrews. Do not use torch or open frame to heat the case.

c. Use three jackscrews (T33) (or bolts of suitable length with 5/16-18 NC thread) through threaded holes in sleeve flange to pull gear quill evenly from case.

NOTE

Do not attempt to remove shims from quill sleeve or from gearbox case.

d. Cover quill port opening to prevent entry of foreign material.

e. Disassemble quill for seal replacement as follows:

(1) Remove retaining ring (1, figure 6-51) from outer coupling (1 O).

(2) Remove plate (2), centering spring (3), lock spring (4), retainer (5), and packing (6) from inner coupling (9).

(3) Remove packing (6) from retainer (5). Tag retainer for reassembly in same location.

(4) Use wrench (T30) to hold outer coupling (10), use a square adapter through wrench and remove retainer bolt (7) and washer (8) from pinion shaft (18).

(5) Remove inner coupling (9) and outer coupling (10) from splines of pinion shaft (18). Remove inner coupling from outer coupling.

(6) Press seal (11) from outer coupling (10).

(7) Cut and remove lockwire securing nut (16).

(8) Use fixture (T54) to hold sleeve (19) with pins engaged through sleeve flange. Use wrench (T60) to remove nut (16).

(9) Remove packing (17) from nut (16).

(10) Remove packing (20) from sleeve (19).

(11) Press seal (15) from nut (16).

f. Cut lockwire and remove vent cap (127).

g. Unfasten safety. Remove filler cap assembly (26).

h. Remove magnetic detector assembly from intermediate gearbox as follows:

(1) Push in on magnetic chip detector (31 or 32) as far as possible and turn counterclockwise to disengage from self-closing valve (29 or 34) and pull out.

(2) Remove self-closing valve (29 or 34).

6-185. Cleaning - Intermediate Gearbox.

a. Wipe inner and outer couplings (9 and 10, figure 6-51) with clean cloths.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

b. (AVIM) Clean other parts in solvent (C261). Dry with filtered compressed air.

c. Clean vent cap (27) as follows.

(1) Wash vent cap in dry cleaning solvent (C261).

(2) Flush breather passage with cleaning solvent (C261).

(3) Dry with filtered compressed air.

6-186. Inspection - Intermediate Gearbox.

a. (AVIM) Inspect gearbox case assembly for mechanical damage and corrosion (figure 6-51.1). If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

b. Inspect inner coupling (9) and outer coupling (10) for wear, damage, pitting or corrosion. Refer to limits chart (figure 6-47), for typical coupling dimensions. Superficial corrosion (removable with abrasive pads (C11), is the only corrosion repair allowed). Corrosion pits are causes for rejection. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

c. (AVIM) Inspect gear for cracks, nicks or galling. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

d. (AVIM) Check bearings for smooth rotation. Bearings are to be checked prior to quill disassembly.

e. (AVIM) Check inside of case for ferrous metal articles that indicate bearing failure.

f. Inspect centering spring (3) by applying a test load of **5.0 ± 0.5** pounds to compress spring to **1.500 ± 0.10** inches. Spring should return to free length of **2.00 ± 0.03** inches.

NOTE

External leakage of seal is not permitted. A small amount of seepage, however, is normal. Continuous dripping is excessive and requires seal replacement.

g. (AVIM) Inspect seals for leakage.

h. Inspect intermediate gearbox sleeve and pinion shaft. If crack is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance Manual (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

6-187. Repair - Intermediate Gearbox.

a. Replace unserviceable filler cap assembly (26, figure 6-51) or vent cap (27).

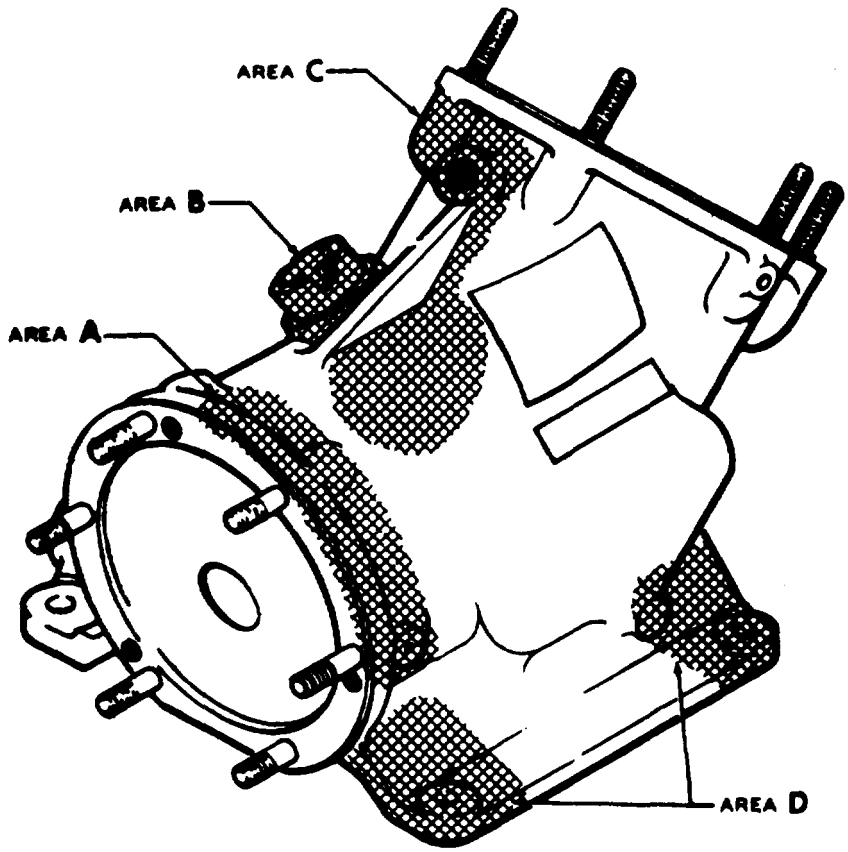
b. (AVIM) Replace seals if leaking.

c. (AVIM) Replace packing during assembly.

CAUTION

DO NOT INTERMIX OIL LEVEL INDICATOR DISK P/N 204-040-508-1 WITH THE 90 DEGREE GEARBOX INDICATOR DISK P/N 204-040-508-9.

d. Replace oil level sight gage as follows:



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

AREA	LIMITS
All	**No cracks allowed.**
A.	**Nick.s, dents, scratches, and corrosion are acceptable if depth after rework does not l xcood 0.016. Rework in accordance with general** instructions **below. Total reworked** area **must not exceed** 30 **percent of Area A. Maximum** area **for any one full depth repair is one inch square.**
B.	**Nicks, dents, scratches, and corrosion on filter neck boss are acceptable if depth** after **rework does not exceed 0.040. Rework In accordance with general instructions below** **Nlcks dents, scatches,** and **corroslon where boss intersects case wall are acceptable if depth after rework does not exceed 0.030. Rework in accordance with general instructions below.**

Figure 6-51.1 Intermediate Gearbox Case-Damage Limits (Sheet 1 of 3)

c. Nicks, dents, scratches. l nd corrosion are acceptable if depth after rework does not exceed 0.040 in light area or 0.060 in heavier areas. Rework in accordance with general instructions below.

Nicks, dents, scratches, and corrosion in mesa adjacent to case wall l re l cceptable if depth after rework does not exceed 0.030. Rework in l ccordance with general instructions.

Nicks, dents, scratches, and corrosion in machinedareas are acceptable if depth after rework does not exceed 0.005. Rework by polishing out damage with 400 grit abrasive cloth (Cl or C6). Reworked area must not exceed 6 percent of machined area. Reworked area for any one repair must not exceed 0.020 in length or width and must not exceed 0.040 inch square. No sealing surface may be reworked if it will allow passage of oil.

D. Mechanical damage and/or corrosion in legs or scratches on the flanges are acceptable if depth l ftar rework does not exceed 0.01 S. Rework in accordance with general instructions below. Reworked l rea must not exceed 20 percent of any one leg or flange.

Corrosion pitting on upper machined face at mounting bolt is acceptable if depth after rework does not exceed 0.020. Rework in l ccordance with general instructions below. Reworked area must not exceed 20 percent of total surface area. Reworked eras must not exceed 10 percent of l ras under washer. Minimum thickness of flange in unfitted area is 0.300 after rework.

UNDESIGNATED AREAS

Nicks. dents, scratches. and corrosion on thin wall areas l re l cceptable if depth after rework does not exceed 0.030. Rework in accordance with general instructions below. Reworked area for l ny one repair must not exceed 0.7 inch square. Total rework l res must not exceed 30 percent of area.

Fretting or chafing of machined surface is acceptable if depth does not exceed 0.002 l nd does not exceed 15 percent of any one mounting foot area.

All mounting points in same plane within 0.003.

Nicks, dents, scratches. and corrosion in heavy flanges are acceptable if depth after rework does not exceed 0.080. Rework in l ccordance with general instructions below. Reworked l rea must not exceed 0.060 length or 0.10 width l nd must not l xtend into thin case wall **areas.**

Nicks, dents, scratches and corrosion in other thin well case sections l re l cceptable if depth after rework does not exceed 0.030. Rework in accordance with general instructions below. Reworked area must not exceed 30 percent of total designated l rea. Reworked ares for l ny one repair must not exceed one inch square.

Mounting bolt hole elongation is l cceptable if hole size does not exceed 0.292 diameter.

Figure 6-51.1 Intermediate Gearbox Case — Damage Limits (Sheet 2 of 3)

Inspect for corrosion in threads between studs and case before removing studs. Evidence of structural damage to threads is cause to send case to next higher level of maintenance.

Treat reworked areas in accordance with general instructions below.

Penetrant inspect for cracks after an rework TM-55-1500-344-23) and treat with chromic acid (C64) (TM 55-1500-344-23). No cracks allowed.

STUDS

Remove broken. bent, damaged, or loose studs.

Inspect case for cracks after studs are removed or any rework is completed. No cracks allowed.

Evidence of damage or corrosion deeper then one thread is cause to send case to next higher level of maintenance.

If stud hole damage is limited to first thread:

(1) Machine or drill out damaged thread. Clean-out diameter must not exceed major diameter of internal thread.

(2) Break all sharp edges except in area of threads. Treat reworked surfaces with chemical film solution (C63) (TM 55-1500-344-23).

(3) Clean out small bleed hole in bottom of threaded hole.

(4) Apply primer (C214) to threads of replacement studs.

(5) Install replacement studs to a height of 0.970 inch, using 50 **to 70** inch-pounds driving torque. If proper stud height cannot be obtained with driving torque specified, use next oversize stud. Measure stud height from face of case assembly. (Refer to TM 55-1520-210-23P for applicable oversize studs if required.)

(6) Fill counterdrill holes with sealer (C244) until filled flush with top surface of case.

GENERAL INSTRUCTIONS

1. Polish out mechanical or corrosion damage to remove all traces of damage. Use sandpaper and/or crocus cloth. Blend repair "in with surrounding surface and make minimum radius 0.250 inch. Use 400 grit abrasive cloth (Cl or C9) to make repair area surface 63 RMS or better. Inspect to ensure that depth and/or area of repair does not exceed acceptable limits specified for the various areas above. Treat reworked areas for corrosion protection with DOW treatment. Refer to TM 55-1500-344-23 for additional corrosion protection procedures. Prime with polyamide epoxy primer (C206) and paint all areas that were painted prior to repair to match existing finish.

2. Evidence of corrosion damage under shims where quill is attached to case is cause to send case to next higher level of maintenance.

3. Evidence of corrosion damage around base of studs is cause to send case to next higher level of maintenance.

4. Evidence of structural damage to threads in case is cause to send case to next higher level of maintenance.

Figure 6-51.1 Intermediate Gearbox Case — Damage Limfts (Sheet 3 of 3)

(1) Remove oil level sight gage retaining ring (24), glass (22), packing (23), and sight indicator (21) to clean, inspect, or replace.

(2) Reinstall, place sight indicator in port with indexing tab in notch of inner lip. Place packing in groove around glass, install glass with flat side out, secure with spiral retaining ring.

e. Replace coupling (9 and 10) if pitted, corroded, damaged, or worn beyond limits.

f. Replace gearbox assembly if indications of bearing failure are found.

g. (AVIM) Replace gearbox assembly if gears are scuffed, scored, nicked, scratched, or galled.

6188. Assembly" Intermediate Gearbox.

Premaintenance requirements for assembly" intermediate gearbox

Conditions	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T30), (T54), (T60)
Test Equipment	None
Support Equipment	None
Minimum Personnel Required	One
Consumable Materials	(C158), (C166),(C166A), (C206), (C155), (C244), (C219)
Special Environmental Condition	None

a. Place filler cap assembly (26, figure 6-51) on port of case assembly (25). Secure chain of cap by safety pin through drilled hole in case rib at right of filler neck.

CAUTION

DO NOT Interchange filler caps of the 42 degree gearbox and 90 degree gearbox. The 42 degree gearboxes are marked with a black dot on the case and a corresponding black dot on the filler cap. The 90 degree gearboxes and filler caps have white dot markings. Ensure the 42 degree gearbox filler cap Is not vented. To determine that the 42 degree gearboxes filler caps are not vented, look for a solid plug without a hole through the center.

b. Install vent cap (27) in case assembly (25) using new gasket. Torque 30 to 40 inch-pounds. LockWire (Cl 55) to drilled hole in case rib.

c. (AVIM) Assemble quill as follows:

(1) Apply a bead of sealant (C242) to outer surface I of new seal (15, figure 6-51) and press new seal into nut (16). Wipe excess sealant from seal and nut.

(2) Install new packing (17) on nut (16).

(3) Lubricate seal Ii 15), packing (17) and threads of nut (16) with oil (C166 or C166A).

(4) Install nut (16) into sleeve (19). Use fixture (T54) to hold sleeve (19 . Use wrench (T60) and torque nut (16) 1200 to 1800 inch-pounds. Lockwire (Cl 55) nut to gear case.

(5) Carefully apply a bead of sealing compound (C244) around mating joint of nut (16) and sleeve 19). Smooth sealing compound.

(6) Wipe out all old lubricant from couplings. install seal (11) in groove in outer coupling (1 O). Use a burnishing tool to seat seal between gear teeth and end of coupling.

NOTE

Ensure seal (11) is free of installation damage and is seated In coupling (10) groove.

(7) Apply Iubricant (Cl 58) to teeth of inner coupling, and install inner coupling (9) and outer coupling (1 O) with new seal (11) on pinion shaft (18).

(8) Install washer (8) on retainer (7).

(9) Install retainer bolt (7) in pinion shaft (18). Use wrench (T30) to hold outer coupling (1 O). Use a square adapter and torque retainer bolt (7) 960 to 1200 inch-pounds.

(10) Repack coupling with lubricant (Cl 58) to 0.125 inch above teeth of female outer coupling.

(11) Install new packing (6) on retainer (5).

CAUTION

Use retainer P/N 204-040-607-1 in input coupling. Use retainer pin P/N 204-040-607-3 in output coupling; do not interchange.

(12) Lubricate packing with grease from coupling and install retainer (5) and packing (6) to inner coupling (9) and install lockspring (4).

(13) Install centering spring (3), and plate (2), and secure retaining ring (1).

(14) Gently push and pull the flex coupling to its full limits to distribute grease evenly the full length of the spline teeth.

d. (AVIM) Install packing (20) on sleeve (19).

e. (AVIM) Remove gearbox port cover.

f. (AVIM) Ensure that input drive quill is installed in forward port of gear case, and output drive quill is installed in aft port of gear case.

NOTE

Output drive quill has conical oil collector projecting from center of gear.

g. (AVIM) Heat gearbox case with heat lamp. Lubricate sleeve (19) and packing (20) with oil (C166). Carefully align holes in sleeve of mounting flange with studs on gearbox and install quill in gearbox.

h. (AVIM) Install thin aluminum alloy washer (14), thin steel washer (13) and nut (12) on each stud. Manually check meshing of gears while tightening nuts evenly to seal quill sleeve flange on gear case.

i. (AVIM) Check gears for freedom of operation by manually turning input coupling.

NOTE

A measurement of gear backlash is not required, however, backlash must be evident. This may be checked by visually observing gears through filler neck while holding output coupling and rocking input coupling back and forth. This check for backlash could possibly reveal serious assembly error. Proper mounting of gears to have 0.004 to 0.013 inch backlash in assembly has been established during manufacture by means of shims permanently installed on mounting faces of gear case and gear quill sleeve flange.

j. (AVIM) Carefully apply a bead of sealing compound (C244) around flange of gear quill sleeve and gearbox at mating joint. Fill jackscrew holes. Smooth sealing compound.

k. Install magnetic chip detector assembly in intermediate gear box as follows: (Helicopters without ODDS)

(1) Install new gasket (28) on self-closing valve (29) and install in intermediate gear box. Torque valve **120 to 150** inch-pounds.

(2) Install new packings (30) on chip detector (31) and insert chip detector (31) into self-closing valve (29), press and turn clockwise to engage locking pins.

(2.1) Visually confirm that magnetic plug pins are visible in the hole provided on nut portion of chip detector housing P/N B752G.

(3) Lockwire (C155) self-closing valve (29).

l. Install magnetic chip detector in intermediate gear box as follows: (Helicopters with ODDS)

CAUTION

Do not overtorque valve (34). Overtorque can distort or crush light metal housing.

(1) Install new packing (35) on self-closing valve (34) and install in gear box. Torque valve to **90 - 110** inch-pounds and lockwire (C155).

(2) Install new packing (33) on chip detector probe (32) and install chip detector probe.

6-189. Installation - Intermediate Gearbox.

a. Check condition and security of shims of gearbox location on tailboom just ahead of vertical fin.

CAUTION

Do not attempt to remove or change shims installed on tailboom under gearbox, as any resulting misalignment could cause excessive stresses, vibration, wear, and possibly eventual failure of components in tail rotor drive train.

WARNING

Insure that all flexible couplings on replacement components are adequately lubricated prior to installation.

b. Position intermediate gearbox, with oil service fittings at right side, on tailboom shims.

NOTE

Gearbox shall be installed with wet unthinned zinc chromate primer applied to mating surfaces in accordance with paragraph 2-14e.

c. Using aluminum alloy washers next to gear box housing and steel washers next to head of bolts, install four bolts through the corners of the gear box housing into the nut plates on the tail boom. Torque all four bolts **50 TO 70** inch-pounds. Lockwire (C155) attachment bolts and drain plug.

Cover the four mounting bolt heads with Proseal 890 (244) to prevent moisture from standing or entering the bolt holes.

d. Connect driveshafts to intermediate gearbox (paragraph 6-166).

NOTE

Substitute AN960-416 washer for AN960-416L washer when thin shims allow AN4H12A bolt shank to bottom against nut plate.

e. If gearbox is replacement for helicopter with ODDS, install ODDS chip detector as follows:

(1) Remove probe (31, figure 6-51), packings (30), valve (29), and gasket (28).

(2) Install valve (34) and packing (35). Torque valve to **90-110** inch-pounds and lockwire (C155). Install probe (32) and packing (33) by pushing and turning cw.

(3) Refer to paragraph 6-200.2 for installation of chip detector assembly PN VM2451001 (Blade type).

f. Perform continuity check of chip detector. Connect electrical wire to chip detector.

g. Service gearbox (paragraph 1-8 and figure 1-1).

SECTION VI. TAIL ROTOR GEARBOX

6-190. TAIL ROTOR GEARBOX

6-191. Description - Tail Rotor Gearbox. Gearbox at top of tailboom vertical fin provides 90 degree change in direction of drive and 2.6:1 speed reduction between input driveshaft and its output shaft on which tail rotor is mounted. Gearbox consists of mating input and output gear quill assemblies set into a gear case provided with a vented oil filter cap, an oil level sight gage, and a magnetic chip detector. On helicopters without ODDS, the chip detectors straight and includes a threaded stud electrical termination. On helicopters with ODDS, the chip detector is right-angled and includes an electrical receptacle. Chip detector is connected electrically to CHIP DET capsule on the caution panel. Input quill has a flexible coupling for attachment of driveshaft.

6-192. Lubrication - Tail Rotor Gearbox.

a. Fill gearbox to sight gage level with oil prescribed by servicing points diagram (figure 1-1 and paragraph 1-8).

b. Internal splines of coupling on gearbox are packed with grease during assembly. Coupling splines can be lubricated as described below. This procedure can be accomplished with quills in place on gearbox, with driveshafts disconnected.

(1) Remove retainer ring (21, figure 6-52) from coupling while holding seal plate (22) against spring pressure.

(2) Remove centering spring (20) and spacer (18).

NOTE

Care must be taken to ensure that the retainer plug (17) does not become unseated from inner coupling (13).

CAUTION

Do not use cleaning solvent inside coupling.

(3) Hold couplings at full outward position. Remove old grease as thoroughly as possible.

(4) Hand pack grease **0.125** inch depth over top of internal spline teeth. Use lubricant (C158).

(5) Keep coupling at full outward position, ensure retainer plug (17) and lock spring (19) are properly seated. Reinstall spacer (18), centering spring (20), seal plate (22) and retainer ring (21).

6-193. Inspection - Tail Rotor Gearbox.

a. Inspect gearbox case for cracks and damage. If crack in gearbox is suspected, refer to TM 1-1520-256-23, AVUM/AVIM NDI procedures for UH-1 helicopter series.

a.1. Inspect sight glass for damage, discoloration, or staining. Inspect gearbox oil for water contamination; the oil is contaminated if it has a dirty, milky appearance. If the oil is contaminated or suspected of contamination, drain and flush until water contamination is removed, and reservice the gearbox (paragraph 1-8). If the contamination cannot be removed, replace the gearbox. Condensation on the inside of the sight glass is acceptable if the oil does not have a dirty, milky appearance.

NOTE

External leakage of seal is not permitted. A small amount of seepage, however, is normal. Continuous dripping is excessive and requires seal replacement.

b. Inspect quill for oil and grease leakage.

c. Check oil filler cap and packings for serviceability.

d. Inspect chip detector for accumulation of metal particles. Remove chip detector as follows:

(1) Disconnect electrical wire or cable plug from chip detector.

(2) Press in and turn counter-clockwise to remove chip detector probe (37 or 38).

(a) Inspect the three mounting grooves of chip detector (38, figure 6-52). Using a caliper, or similar measuring device, measure the wall thickness at the bottom of the detent. The minimum wall thickness should be 0.030 inch. If the wall thickness of the detent is less than 0.030 inch replace valve.

(b) Inspect the 3 pins located in the valve (40, figure 6-52). If pins are loose replace chip detector.

(3) Inspect for magnetic particle buildup. Retain debris. Clean, install and connect the probe.

Refer to paragraph 6-200.3 for inspection of ODDS chip detector assembly PN VM2451001 (Blade type).

(4) If chip detector is being inspected following a chip light, identify particles using information in Figure 6-14, Figure 6-14.1, Figure 6-50.1).

e. Move coupling in and out (fore and aft) with a rotational (clockwise and counter-clockwise) preload

and feel for smoothness. If resistance is felt, it is an indication of improper lubrication. Check the female coupling for a wear groove in line with the teeth of the male coupling (**0.005** inch maximum wear). Replace coupling if wear exceeds limits.

f. Inspect gearbox breather filler cap as follows:

(1) Inspect to determine that the cap is still tightly filled with aluminum wool by slightly compressing the wool by pressing the retaining washer.

(2) If cap is properly filled with wool; the wool will return the retaining washer against the retaining ring when pressure is released.

g. Inspect gearbox input sleeve flange for protrusion of sealant in jackscrew holes. Inspect mating surface of tailboom fin casting for areas of sealant remaining on casting.

g.1. If crack in sleeve is suspected, refer to TM 1-1520-256-23, Technical Manual Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual Nondestructive Inspection Procedures for UH-1 helicopter series.

h. Inspect sight gage for damage or stains and for discoloration of paint on indicator.

i. Deleted.

j. Check bearings for smooth operation (no roughness allowed).

k. Check to make sure that the predrilled hole in area D, figure 6-52.1, is sealed properly with Proseal (C244).

l. Inspect filler cap adapter for damage from filler cap pin; maximum allowable damage is **0.060** inch.

6-193.1. Inspection - Tail Rotor Gearbox (Installed). Inspect output shaft for dry film lubricant condition.

a. Inspect for evidence of fretting between the mating surfaces of the tail rotor gearbox and the tail rotor gearbox support fitting. A gray residue will be an indication of fretting. Remove gearbox if residue is present, refer to removal step.

b. Check to ensure that hold-down studs have proper torque on nuts, refer to installation steps for torque values and procedures.

6-193.2. (AVIM) Replacement -Tail Rotor Gearbox Input Quill Seal (Gearbox Installed on Helicopter).

a. Remove self-closing valve (35, figure 6-52) and drain oil from tail rotor gearbox.

b. Open access cover on front of vertical fin.

WARNING

Wind may cause uncontrolled tail rotor system rotation when the driveshaft is disconnected. To prevent Injury to personnel and damage to equipment, secure the tail rotor blades before disconnecting the driveshaft.

c. Remove driveshaft (paragraph 6-162).

d. Remove curvic coupling from gearbox as follows (figure 6-52):

(1) Remove retaining ring (21), plate (22), centering spring (20), and spacer (18). Thread a 1/4-20 bolt into the center of retainer plug (17), and pull retainer plug together with lockspring (19) and packing (16) from inner coupling (13).

(2) Hold outer coupling (30) with wrench (T30) and use a square drive extension to remove retaining bolt (15) and washer (14).

(3) Remove inner and outer couplings (13 and 30).

(4) Remove inner coupling (13) from outer coupling (30), and remove seal (29) from outer coupling.

e. Remove lockwire from retaining nut (27), and use special socket (T72.2) to remove retaining nut.

f. Remove packing (26) from retaining nut (27).

g. Press seal (28) from retaining nut (27).

NOTE

Replace all removed seals, packings, and gaskets with new items.

h. Apply a bead of sealing compound (C237) to outer surface of seal (28) and press new seal in retaining nut (27). Wipe excess sealing compound from seal and nut.

i. Install packing (26) on retaining nut (27).

NOTE

Lubricate lip of seal (28), packing (26) and threads of retainer nut (27) with oil (C166) before installing in sleeve (24).

j. Using special socket (T72.2), install retaining nut (27) and torque **100 TO 150** foot-pounds. Lockwire (C155) retaining nut (27) to sleeve (24), and apply a bead of sealer (C242) around mating joint of nut and sleeve.

k. Lubricate outside diameter of seal (29) with grease (C158), and press seal into outer coupling (30) with lip seal facing coupling splines.

l. Place a small amount of grease (C158) in internal splines of outer coupling (30), on lip of seal (29), and mating surface of inner coupling (13). Insert inner coupling into outer coupling.

NOTE

Large end of spacer goes toward gearbox.

m. Install inner and outer couplings (13 and 30) on splines of pinion shaft (25).

n. Place washer (14) on bolt (15) and thread bolt into pinion shaft (25).

o. Hold outer coupling (30) with wrench (T30), position square drive extension through wrench, and torque bolt (15) **80 TO 100** foot-pounds.

p. Place packing (16) on retainer (17) and insert retainer into bolt (15). One hole in the rim of retainer (17) must align with a notch in the inner coupling (13). If not, remove retainer, rotate it 90 degrees, and reinstall; repeat as necessary to obtain alignment, then install lockspring (19).

q. Extend outer coupling (30) so that seal (29) is against the teeth of inner coupling (13). Coat internal spines of outer coupling with grease (C158) to **0.125** inch depth over top of spline teeth.

NOTE

Small end of centering spring (20) faces boss of plate (22).

r. Install spacer (18), spring (20), plate (22), into coupling assembly, and secure with retaining ring (21). Gentlv push and pull the coupling to the full limits of its travel to distribute the grease evenly over the spline teeth.

s, Install driveshaft (pargraph 6-165).

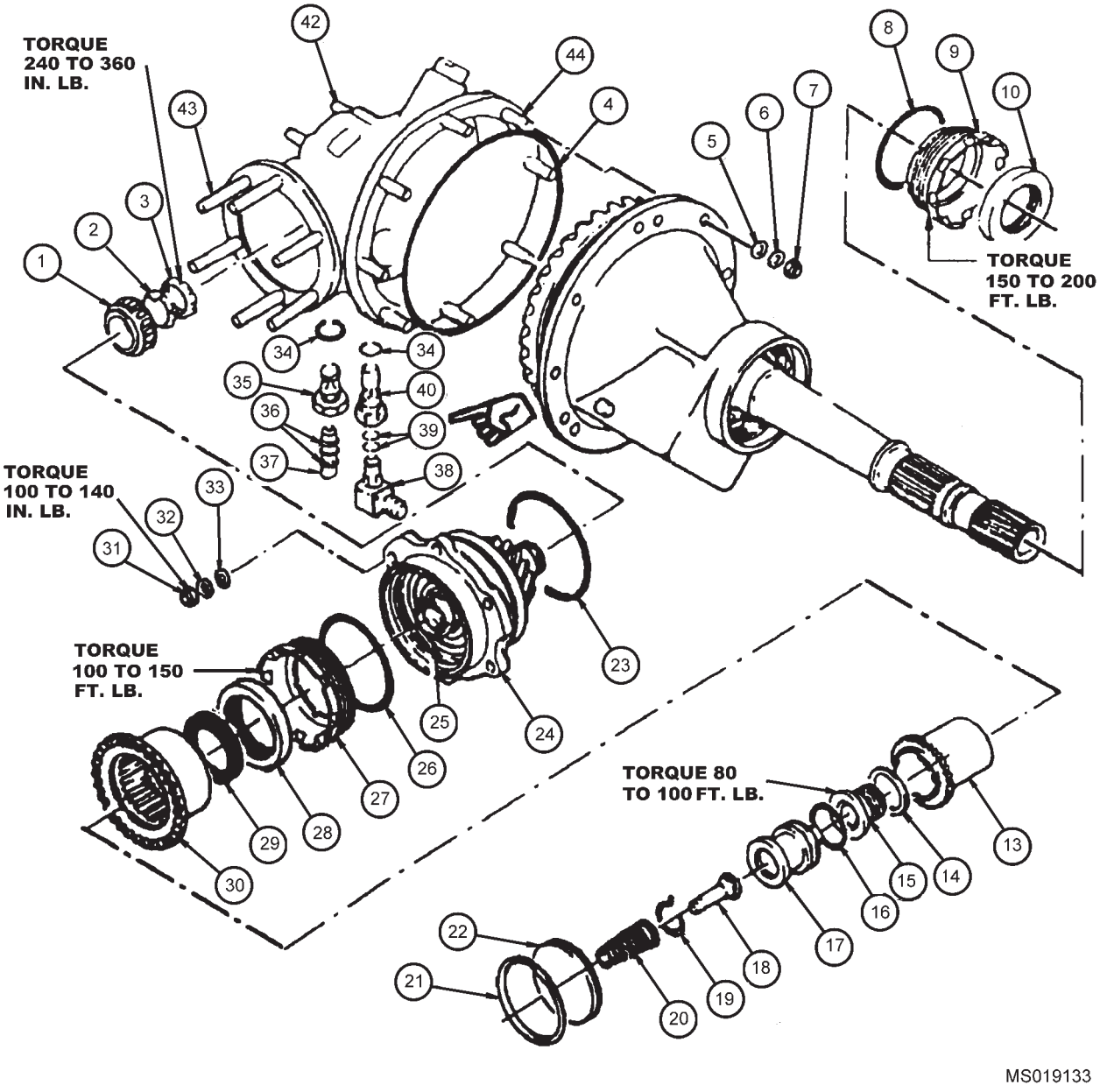
t. Install gasket (34) and setf-closing valve (35).

u. Service gearbox with the appropriate oil (C166, C166A, or C168)tothe oil level mark on the sight gage.

v. Close access cover on vertical fin.

6-194. Removal Tall Rotor Gearbox.

a. If the gearbox is to be replaced, drain the operating oil and flush with oil (C166. C166A, or Cl 66). Rotate the input quill while flushing to ensure that the gears and bearings are completely wetted.



1	BEARING	12	SHAFT	23	PACKING	34	GASKET
2	WASHER	13	INNER COUPLING	24	SLEEVE	35	SELF CLOSING VALVE
3	NUT	14	WASHER	25	SHAFT	36	PACKING
4	PACKING	15	RETAINER BOLT	26	PACKING	37	CHIP DETECTOR PROBE
5	WASHER, ALUMINUM	16	PACKING	27	NUT	38	CHIP DETECTOR PROBE
6	WASHER, STEEL	17	RETAINER PLUG	28	SEAL		(ODDS)
7	NUT	18	SPACER	29	SEAL	39	PACKING (ODDS)
8	PACKING	19	LOCKSPRING	30	OUTER COUPLING	40	VALVE (ODDS)
9	NUT	20	CENTERING SPRING	31	NUT	41	DELETED
10	SEAL	21	RETAINER RING	32	WASHER, STEEL	42	STUD
11	SLEEVE	22	SEAL PLATE	33	WASHER, ALUMINUM	43	STUD
44	STUD						

Figure 6-52. Tail Rotor Gearbox

b. Remove tail rotor hub and blade assembly (paragraph 5-92).

c. Remove pitch control mechanism (paragraph 11-146).

NOTE

Detach cover from fin structure and chain from control cables if replacement of gearbox or output gear quill is required.

CAUTION

To avoid damage to gearboxes or couplings, either remove clamp set from both ends of driveshaft before removing either end of shaft from its mating curvic coupling. or support unattached end of shaft to hold shaft aligned on normal operating axis while gearbox is removed.

d. Open hinged access door on front of vertical fin and remove or disconnect driveshaft from input coupling of gearbox (paragraph 6-162).

e. Disconnect electrical wire or cable plug from chip detector.

f. On helicopter with ODDS, if gearbox is to be replaced, remove chip detector from gearbox as follows.

(1) Push in on chip detector (38) as far as possible and turn ccw to disengage from self-closing valve (40) and pull out. Discard packing (39).

(2) Remove valve (40). Discard packing (41).

(3) Install gasket (34), valve (35) and probe (37) with two packings (36).

g. Detach gearbox from support casting on vertical fin by removing nuts and washers from six mounting studs around input coupling. Lift off gearbox assembly.

h. Reinstall nuts with suitable spacers on two opposite studs to secure input gear quill in case during handling or shipping.

6-195. Disassembly - Tail Rotor Gearbox.

Premaintenance requirements for disassembly - tail rotor gearbox

Conditions	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T33), (T30), (T2), (T54), (T60), (T31), (T35), (T52)
Test Equipment	None
Support Equipment	None
Maximum Personnel Required	One
Consumable Materials	(C163), (C166), (C166A) (C261), (C309)
Special Environmental Conditions	Dust Free

a. Remove gearbox and drain oil (paragraph 6-194).

NOTE

Replacement of either input or output drive quills is possible; though not recommended as routine procedure since troubles would usually affect other parts. Records of serial-numbered components will be simplified if complete gearbox is replaced.

b. Remove input quill as follows:

(1) Remove nuts (31, figure 6-52) and washers (32 and 33) from studs. Cut sealing compound from around outside of quill sleeve flange and jackscrew holes.

CAUTION

When using jackscrews to remove quill assembly, following procedures must be followed: Three jackscrews must be screwed in evenly exerting equal pressure on quill sleeve to prevent damage to flanges. Do not use force by prying to remove quill, in the event quill cannot be removed by using jackscrews, heat case then use jackscrews. Do not use torch or open flame to heat the case.

(2) Using three jackscrews (T33), (or suitable bolts with 5/16-18 NC thread) through threaded sleeve flanges (24, figure 6-52) pull input quill evenly from gearbox case.

NOTE

Do not attempt to remove shims from quill sleeve or gearbox case.

(3) Cover quill port opening immediately to prevent entry of foreign matter.

(4) If quill is to be replaced, straighten tangs of washer (2). Hold quill with wrench (T30) and remove nut (3) using spanner wrench (T2). Remove washer (2) and bearing (1).

c. Disassemble input quill for seal replacement as follows:

(1) Remove packing (23) from quill sleeve (24).

(2) Remove retainer ring (21), seal plate (22), centering spring (20), and spacer (18).

(3) Remove lockspring (19), retainer plug (17) and packing (16).

(4) Using fixture (T54) to hold quill assembly, install wrench (T30) to hold outer coupling (30).

(5) Loosen coupling retainer bolt (15) with a square drive extension. Remove retainer bolt (15) and washer (14).

(6) Remove outer coupling (30) and inner coupling (13). Remove seal (29) from outer coupling.

NOTE

Use special tool (T52) to remove retaining nut when quill is installed in gear box.

(7) Cut lockwire and remove retaining nut (27) using wrench (T60).

(8) Press seal (28) from retaining nut (27). Remove packing (26) from nut (27).

d. Remove output quill as follows:

(1) Remove nuts (7, figure 6-52) and washers (5 and 6) holding output quill. Cut sealing compound from around outside of quill sleeve flange and jackscrew holes.

CAUTION

When using jackscrews to remove quill assembly the following procedures must be followed: Three jackscrews must be screwed in evenly exerting equal pressures on quill sleeve to prevent damage to flanges. Do not use force by prying to remove quill. In the event quill cannot be removed using this procedure, heat case, then use jackscrews. Do not use torch or open flame to heat case.

(2) Using three jackscrews (T31) (or suitable bolts with 1/4-28 NF thread) through threaded inserts in sleeve flange, pull gear quill evenly from gearbox case.

NOTE

Do not remove shim plates from quill sleeves or gearbox ports:

(3) Cover quill port opening to prevent entry of foreign matter.

(4) Remove packing (4) from quill sleeve.

e. Disassemble output quill for seal replacement as follows:

(1) Assemble fixture (T35) on gear end of quill.

(2) Cut and remove lockwire. Using wrench (T52), remove retaining nut (9) from outer end of quill sleeve (11).

(3) Remove packing (8) from retaining nut (9).

(4) Press seal (10) from retaining nut (9).

f. Remove magnetic chip detector assembly from tail rotor gearbox as follows:

(1) Push in on magnetic chip detector probe (37 or 38) as far as possible and turn ccw to disengage from self-closing valve (35 or 40) and pull out.

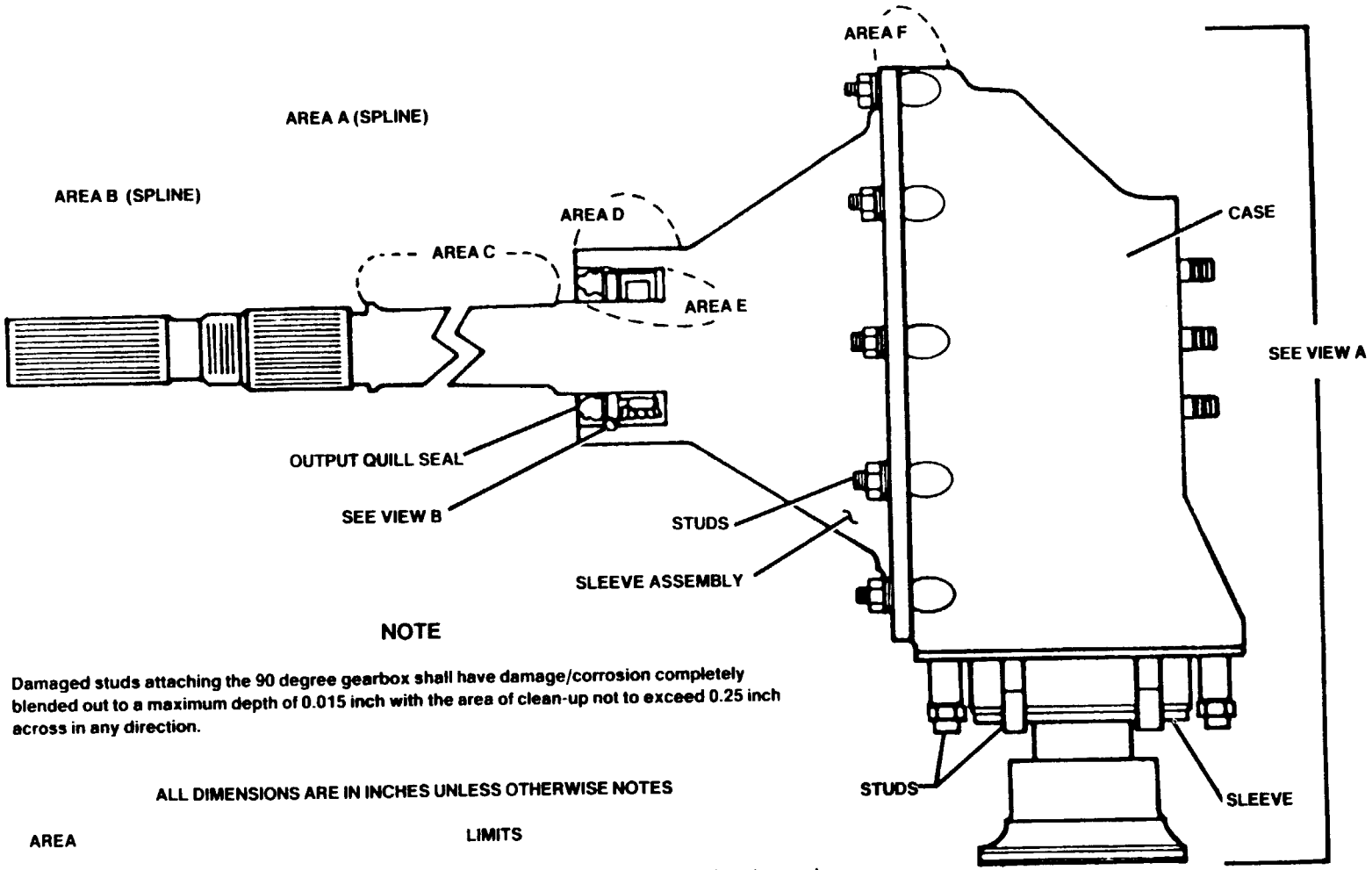
(2) Remove self-closing valve (35 or 40).

6-196. Cleaning -Tail Rotor Gearbox.

a. Wipe coupling (13 and 30, figure 6-52) with clean cloths.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.



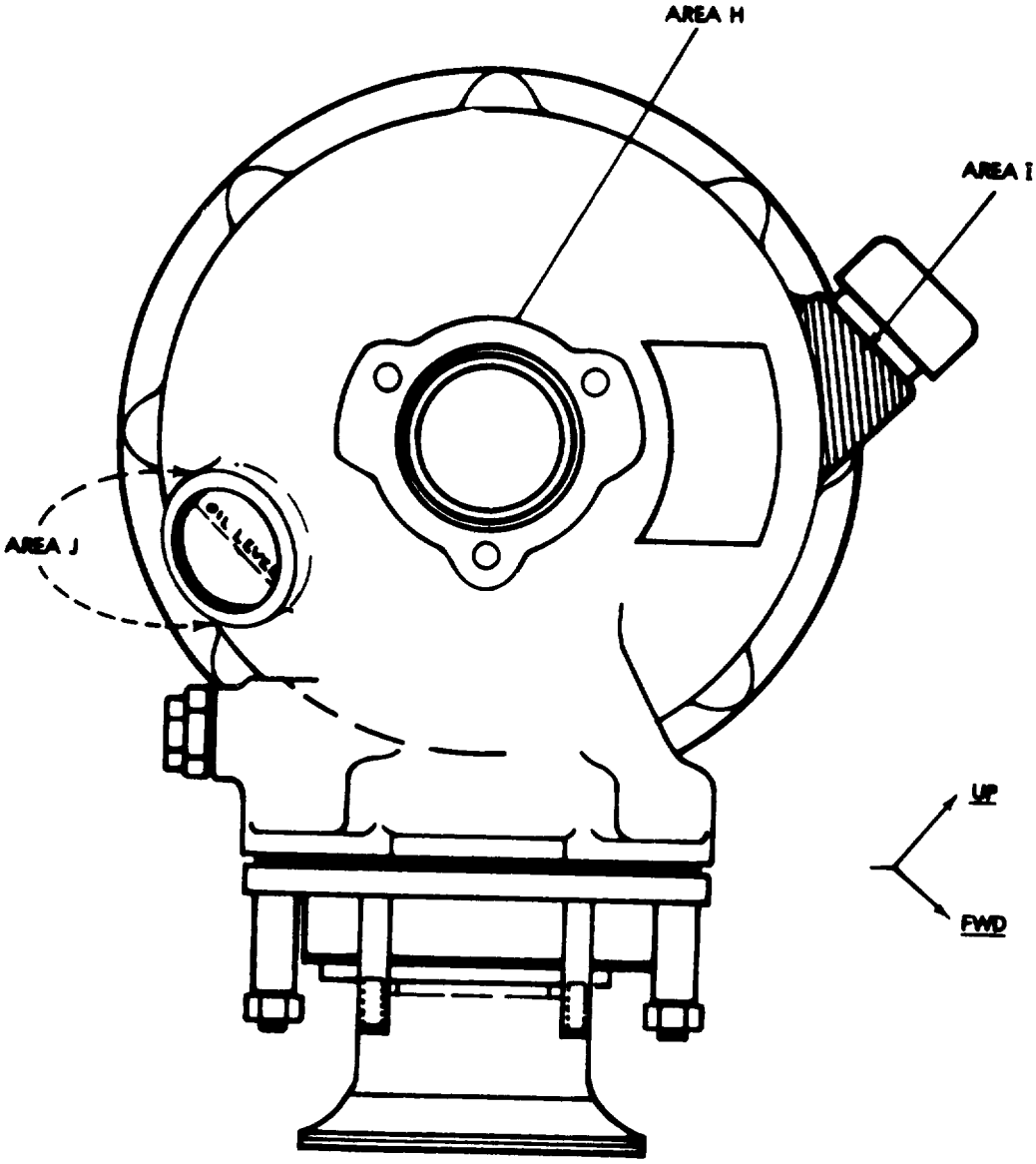
NOTE

Damaged studs attaching the 90 degree gearbox shall have damage/corrosion completely blended out to a maximum depth of 0.015 inch with the area of clean-up not to exceed 0.25 inch across in any direction.

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTES

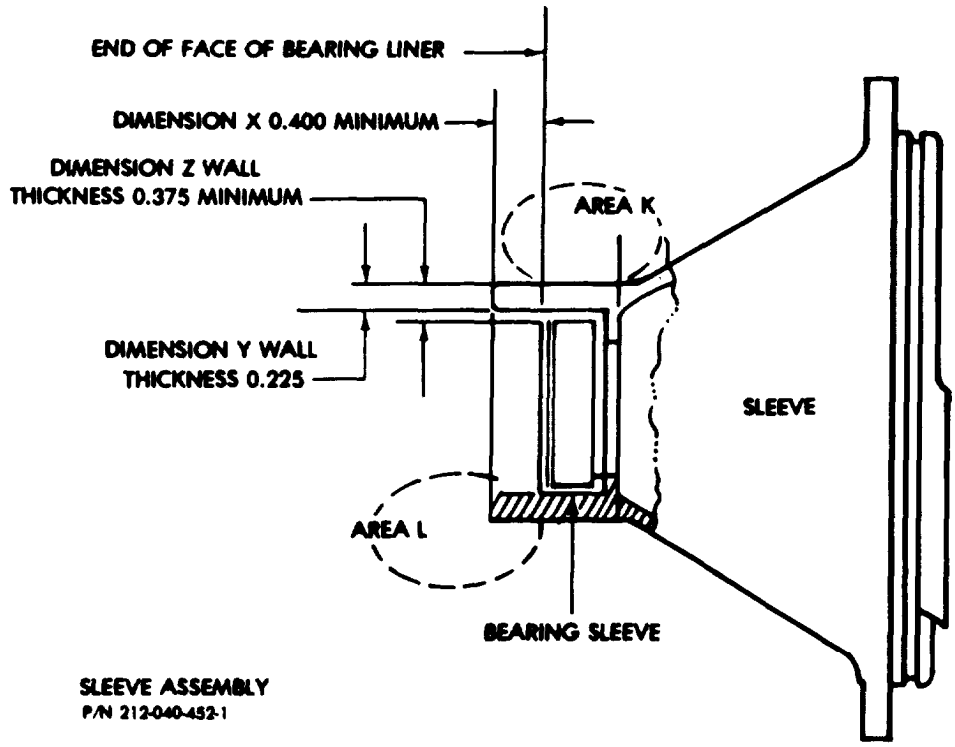
AREA	LIMITS
A	Damage of 0.005 inch in depth such as nicks, burrs, scratches or corrosion pits may be blended out (provided no more than 0.001 inch total is removed from surface) with a fine India stone (C207). No more than 4 splines, (no two adjacent) with less than 60% of spline area affected, may be repaired.
B	Same as "A" with the exception that only 3 splines may be affected.

Figure 6-52.1. Damage Limits — Tail Rotor Drive Gearbox (Sheet 1 of 5)



VIEW A

Figure 6-52.1. Damage Limits- Tail Rotor Drive Gearbox (Sheet 2 of 5)



VIEW B

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

NOTES:

1. **Minimum acceptable wall thickness (dimension Y) in area L is 0.225 at any location after rework is complete.**
2. **Minimum acceptable wall thickness (dimension Z) in area K is 0.375 at any location after rework is complete.**
3. **Minimum acceptable dimension X is 0.400 at any location after rework is complete.**

Figure 6-52.1. Damage Limits-Tail Rotor Drive Gearbox (Sheet 3 of 5)

AREA	LIMITS
ALL	No cracks allowed.
C	Nicks, dents, scratches. and corrosion up to 0.005 inch deep are acceptable if polished out with 400 grit emery cloth to blend with surrounding area and have a bottom radius of 0.50 inch. Area C is the outer diameterof the portion of the shaft outside the gearbox between the diameter of the oil seal and the shoulder adjacent to the splines.
D	Nicks, dents, and scratches up to 0.030 inch deep are acceptable if polished out and treated in accordance with general instructions. Corrosion damage up to 0.030 inch deep after clean-up, is acceptable. Treat in accordance with general instructions. Mechanical and corrosion damage maximum area after polishing out is forty percent of the area within one square inch and/ortwenty percent of the total area. Also, minimum wall thickness and dimension X specified in notes 1, 2, and 3 in view B must be maintained.
E	Wear limit on the shaft in the area contacted by the output quill seal is 0.002 inch or a minimum shaft diameter of 1.430 inch. Check prior to instailing a new output quiii seal. Corrosion damage up to 0.005 inch deep is acceptable on the case in the area contacted by the output quiil seai if poiished out to twice the depth of the corrosion and treated in accordance with generei instructions. Mechanical damage up to 0.010 inch deep is a acceptable on the case in the area contacted by the output quili seal if poiishad out and treated in accordance with general instructions. Aiso lubricating oil must not ieak past the seal after installation. Mechanical and corrosion damage maximum area a fter polishing out is twenty percent of the total area contacted by the output quill seai. Also, minimum wall thickness and dimension X specified in notes 1, 2. and 3 in view B must be maintained. When output quill seal is removed, bearing sieeve shown in view B may be inspected. Evidence of corrosion between bearing sleeve and the sleeve and/or a loose bearing sleeve is cause for replacement of the gearbox.
F	Mechanical and corrosion damage limits area the same as the limits for Area D except that evidence of corrosion under shims and round base of studs is cause to replace gearbox.
G	Smail nicks, burrs, and scratches on couplings are acceptable if they are blended out with fine India stone (C264).
H	Mechanical and corrosion damage limits area the same is limits for Area D with the exception that no damage is permissibie in the following areas 1. Adjacent to studs. 2. Adjacent to control mount buttings. 3. Inside case bore where pitch change control shaft seai housing pilots.
I	Nicks, dents, and scratches up to 0.040 inch deep are acceptabia if polished out and treated in accordance with gerneral instructions.

Figure 6-62.1. Damage Limits — Tail Rotor Drive Gearbox (Sheet 4 of 5)

AREA	LIMITS
I	Corrosion damage up to 0.040 inch deep, after clean-up, is acceptable. Treat in accordance with general instructions. Mechanical and corrosion damage maximum area after polishing out is thirty percent of the total area.
J	Mechanical damage in machine d area of case, where oil level sight gage is installed, up to 0.010 inch deep is acceptable if polished out to form a smooth contour and treated in accordance with general instructions. Also, lubricating oil must not leak past sight gage. Corrosion damage limits in area J are 0.010 inch after clean-up. Corrosion prevention treatment and lubricating oil leakage requirements are the same as noted for mechanical damage limits.
All areas of the case and sleeve except areas previously designated D, E, etc.	Nicks, dents, and scratches up to 0.010 inch deep are acceptable if polished out and treated in accordance with general instructions. Corrosion damage up to 0.010 inch deep, after clean-up, is acceptable. Treat in accordance with general instructions. Mechanical and corrosion damage maximum area after polishing out is forty percent of the area within one square inch and/or twenty percent of the total area.
Studs	Remove broken, bent, damaged or loose studs. Inspect case for cracks after studs are removed or any rework is completed. No cracks allowed. Evidence of damage or corrosion deeper than one thread is cause to send case to next higher level of maintenance. If stud hole damage is limited to first thread: (1) Machine or drill out damaged thread. Clean out diameter shall not exceed major diameter of internal thread. (2) Break all sharp edges in area of threads. Treat rework surfaces with chemical film solution (C63) (TM 1-1500-344-23). (3) Clean out small bleed hole in bottom of threaded hole. (4) Apply primer (C206) to threads of replacement studs. (5) Install replacement studs (figure 6-52).

PORT	STUD SIZE	STUD HEIGHT	INCH-POUNDS TORQUE
Input (43)	5/16 Inch	2.035 + 0.010 In	100 to 225
Output (44)	1/4 Inch	0.970 + 0.010 In	50 to 95
Pitch Change (42)	1/4 Inch	0.947 + 0.010 In	85 to 95

Figure 6-52.1. Damage Limits — Tall Rotor Drive Gearbox (Sheet 5 of 6)

(6) If proper stud height cannot be obtained with driving torque specified, use next oversized stud. Measure stud height from face of case assembly. (Refer to TM 55-1520-210-23P for applicable oversize studs if required).

(7) Fill counter drill holes with sealer (C244) until filled flush with top surface of case.

GENERAL INSTRUCTIONS

1. Repair mechanical and corrosion damage to case and sleeve as follows:

a. Polish to remove corrosion damage. Use sandpaper and/or crocus cloth (C118). Blend repair in with surrounding surface and make minimum radius 0.250 inch. Use 400 grit crocus cloth (C68) to make repair area surface 63 micro-inches or better. Inspect to ensure that depth and/or area of repair does not exceed acceptable limits specified for the various areas above. Treat reworked areas for corrosion protection with chromic acid (C64). Refer to TM 1-1500-344-23 for additional procedures. Prime with polyamide epoxy primer (C206). Paint all areas that were painted prior to repair to match existing finish. Refer to TM 55-1500-345-23 for paint information.

b. Polish out mechanical damage to remove all traces of the damage. Complete repair in same manner prescribed for corrosion damage in step a.

2. Evidence of corrosion damage around base of studs is cause to replace the gearbox. Structural damage to threads in case is not acceptable.

3. Evidence of corrosion damage under the shims where quills are attached to case is cause to replace the gearbox.

Figure 6-52.1. Damage Limits Tail Rotor Drive Gearbox (Sheet 6 of 6)

A

Typical shape, size and location of gear tooth pattern.

B

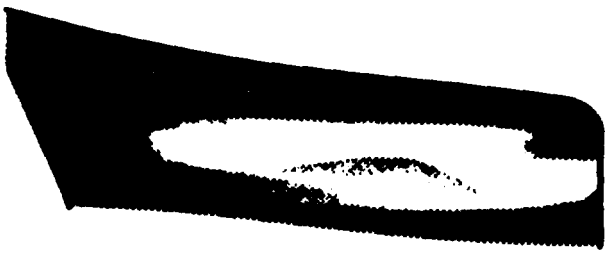
Pattern is narrow back from toe but acceptable.

C

Pattern shape good, **pattern is back from toe, acceptable.**

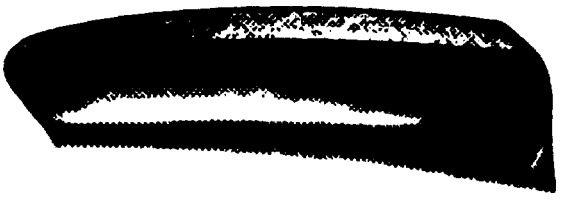
D

This pattern is the minimum acceptable in location and shape.



E

***Pattern is typical if gears exposed to the loads associated with turbine compressor stalls. There is light scuffing in the root area. This condition is not acceptabel and both gear and pinion should be replaced.**



F

***Pattern is typical of coast side of gear. Not acceptable.**

***Abnormal gear wear patterns (Views E & F) found in the 90-degree tail rotor gear box as a result of a turbine compressor stall, will require replacement of 90-degree tail rotor gear box and a gear wear pattern inspection of the 42-degree intermediate gear box. If abnormal gear wear pattern is found in the 42-degree intermediate gear box, this will require replacement of gear box and a gear wear pattern inspection of the tail rotor drive quill.**
If inspection of tail rotor drive quill reveals an abnormal gear wear pattern, this will require replacement of the tail rotor drive quill and inspection of transmission.

Figure 6-53. Toll Rotor Gearbox Gear Wear **Pattern**

b. (AVIM) Wash other parts in solvent (C261). Dry with filtered compressed air.

6-197. Inspection -Tail Rotor Gearbox.

a. Inspect gearbox case for cracks, corrosion, or damage. No cracks allowed. General pitting throughout the case is acceptable, when the pitting depth does not exceed **0.030** inch. Pitting in machined areas not exceeding **0.010** inch is acceptable, provided that it does not allow seals to leak. Pitting in the mounting flange of **0.020** inch is permitted provided it does not extend through the bolt/stud hole. The standard wear criterion (high side of dimension **+0.005** inch) would apply. Treat all corrosion in accordance with TM 55-1500-344-23. If crack in gearbox case is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

b. (AVIM) Inspect inside of gear case for metal particles that might indicate bearing failure.

c. (AVIM) Inspect gears for cracks, nicks, galling, or scuffing. No cracks allowed.

d. (AVIM) Check gear pattern for abnormal wear (figure 6-53).

e. (AVIM) Check bearings for smooth operation (no roughness allowed).

f. (AVIM) Inspect inner coupling (13) and outer coupling (30) refer to paragraph 6-200.1. If crack is suspected, refer to TM 1-1520-256-23, AVUM/AVIM nondestruction inspection procedures for UH-1 helicopter series.

g. Inspect centering spring (20) by applying a test load of **5.0** plus or minus **0.5** pounds to compress spring **1.500** plus or minus **0.10** inches.

h. Inspect shaft (12) and coupling (13) in seal contact area for wear or roughness which would cause seal leakage.

i. Inspect shaft (12) splines for nicks and scratches (figure 6-52.1).

j. Inspect shaft (12) for looseness.

6-198. (AVIM) Repair - Tail Rotor Gearbox.

a. Replace gearbox assembly if indications of bearing failure are evident.

b. (AVIM) Replace gearbox assembly if gears are scuffed, scored, nicked, scratched or galled or if abnormal gear pattern is evident as shown in figure 6-53.

CAUTION

DO NOT INTERMIX OIL LEVEL INDICATOR DISK P/N 204-040-508-9 WITH THE 42 DEGREE GEARBOX INDICATOR DISK PIN 204-040-508-1.

c. (AVIM) Replace input or output quill if damaged or if shafts (12) and coupling (13 figure 6-52) are worn or damaged in the seal contact area.

d. Replace couplings (13 and 30) if excessively pitted, corroded, damaged or worn.

e. (AVIM) Replace leaking seals during assembly.

f. (AVIM) Replace packings during assembly.

g. Replace oil level sight gage as follows:

(1) Remove oil level sight gage retaining ring, glass packing, and indicator disk to clean, inspect, or replace parts.

(2) To reinstall, place indicator disk in pert with indexing tab in notch of inner lip. Place packing in groove around sight glass, install glass with flat side out, and secure with spiral retaining ring.

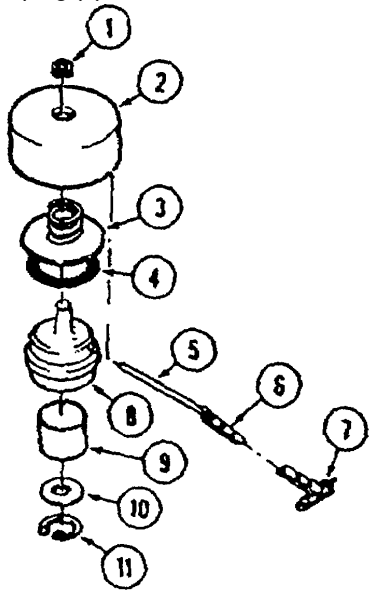
CAUTION

DO NOT interchange filler caps of intermediate gearbox and tail rotor gearbox. The 90 degree gearboxes are marked with a white dot on the case and a corresponding white dot on the filler cap. The 42 degree gearboxes and filler caps have black dot markings. Ensure the 90 degree gearbox has a vented filler cap. To determine that 90 degree gearboxes filler caps are vented, look for presence of retaining ring (11, figure 6-54), packing (aluminum wool) (9) visible through washer (10).

h. Replace unserviceable oil filler cap or packing. If filler cap contains an insufficient amount of aluminum wool replace as follows:

(1) Remove pin (5, figure 6-54) from cap (2). Replace chain (6) or pin (7) if damaged.

(2) Remove retaining ring (1), cap (2), and spring assembly (3) from plug (8).



1. RETAINING RING
2. CAP
3. SPRING ASSEMBLY
4. PACKING (RUBBER)
5. PIN
6. CHAIN
7. PIN (SAFETY)
8. PLUG
9. PACKING (ALUMINUM WOOL)
10. WASHER
11. RETAINING RING

Figure 6-54. Tail Rotor Gearbox Oil Filler Cap

(3) Remove packing (4) from plug (8). Discard packing.

(4) Remove retaining ring (11), washer (10), and packing (9), from plug (8). Discard packing (9).

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of advent vapors.

(5) Clean all parts with solvent (C261).

(6) Fill plug (8) with new aluminum wool packing (9) (C309) and place washer (10) in plug. Check to determine whether correct amount of aluminum wool is installed. Push washer (10) in want 0.06 inch. If washer springs back to its original position, the correct amount of aluminum wool is installed. Add or remove aluminum wool as required. Secure washer (10) in place with retaining ring (11).

(7) Coat packing (4) with oil (C166 or C166A) and position packng on plug (8).

(8) Install spring assembly (3), cap (2), and retaining ring (1) on plug (8). Insert pin(5) through cap (2) and bend end of pinto secure.

L Reapply dry film lubricant (C163) to output shaft (12, figure 6-52) as required.

6-199. Assembly — Tail Rotor Gearbox.

Premaintenance requirements for assembly. tail rotor gearbox

Conditions	Requirements
Model	All
Part No. or Serial No.	All
Special Tools	(T33), (T30), (T2), (T54), (T60), (T31), (T35) (152)
Test Equipment	None
Support Equipment	None
Condltlons	Requlrements
Minimum Personnel Required	One
Consumable Materials	(C158), (C166), (C166A) (C206), (219), (C244)
Special Environmental Condtions	Dust Free

a. (AVIM) Assemble output quill as follows

(1) Apply a bead of sealing compound (C237) to outer surface of seal (10, figure 6-52) and press new seal into retaining nut (9). Wipe excess sealing compound from seal and nut.

(2) Install new packing (8) on retainer nut(9).

(3) Lubricate packing and seal lip with oil (C166 or C166A),

(4) Install retainer nut (9), new packing new seal (10)on shaft(12) and in gear sleeve (11).

(5) Use wrench (T52), toque remaining nut (9)150 to 200 foot-pounds end check gear for freedom of operation by manually turning input shaft. Lockwire (C155) nut (9) to sleeve (l).

(6) Carefully apply ahead of sealing compound (C237) around mating surface of nut (9) and sleeve (11). Smooth sealing compound.

b. Install output quill as fallows:

(1) Heat gearbox case at output drive quill port using a heat lamp.

Do not use torch or open flame to heat the case.

(2) Install new packinng (4) on quill sleeve (11). Lubricate packing and mating surfaces of sleeve and case with oil (C166 or C166A). Install quill.

CAUTION

Use cars to engage teeth properly to avoid damage.

(3) Install aluminum washers (5), steel washers (6), and nut (7) on each stud. Tighten nuts evenly to standard torque.

NOTE

A measurement of gear backlash is not required, however, it is necessary that the gears have backlash. This may be checked by holding the output shaft and rocking the input coupling back and forth to feel and hear backlash. Allowance must be made for backlash in input couplings. This check for backlash could possibly detect some serious assembly error. Proper mounting of gears to have 0.004 TO 0.010 inch backlash in assembly, has been established during manufacture by means of shims permanently installed on mounting faces of gear case and gear quill sleeve flange.

(4) Apply a bead of seating compound (C244) around gearbox case gear mounting flange mating loint and fill jackscrew holes. Smooth sealing compound.

c. (AVIM) Assemble input quill as follows:

(1) install new packing (26, figure 6-52) on retainer nut (27).

(2) Apply a bead of sealing compound (C237) to outer surface of seal (28) and press new seal in retaining nut (27). Wipe excess sealing compound from seal and nut.

(3) Lubricate lip of seal (28), packing (26) and threads of retainer nut (27) with oil (C1 66).

(4) Install nut (27) into sleeve (24). Torque 100 TO 150 foot-pounds using wrench (T60). Lockwire (Cl 55) nut to sleeve.

(5) Carefully apply a bead of sealing compound (C242) around mating joint of nut (27) and sleeve (24). Smooth sealing compound.

WARNING

Use of incorrect inner coupling on pinion shaft may cause tail rotor failure. Install inner coupling (204-040-603-7) on pinion shaft.

(6) Lubricate new seal (29) with grease (C158). Install new seal (29) in groove in outer coupling (30). Use a burnishing tool to seat between gear teeth and end of coupling. Apply lubricant (158) to teeth of inner coupling (13) and install inner coupling and outer coupiing (30) on pinion shaft (25).

NOTE

Ensure seal (29) is free of installation damage and is seated in coupling (30) groove.

(7) Install washer (14), on coupling retainer bolt (15). Screw retainer bolt into pinion shaft (25).

NOTE

Use special tool (T52) to install retaining nut when quill is installed in gearbox.

(8) Use fixture (T54) to hold quill assembly, install wrench (T30) to hold outer coupling (30). Torque retaining bolt (15) 80 TO 100 foot-pounds.

(9) Repack coupling with grease (C158) to 0.125 inch above teeth of outer female couptirg.

(10) Install new packing (16) on retainer plug (17). Lubricate packing with grease from coupling and install retainer plug. Install lockspring (19).

(11) Install spacer (18), centering spring (20) and seal plate (22), secure with retainer ring (21).

NOTE

Ensure seal of plate (22) is free of installation damage.

(12) Gently push and pull the flex coupling to its full limits to distribute grease evenly the full length of the spline teeth.

d. Install input quill as follows:

(1) Install bearing (1), washer (2), and nut (3) on quill. Using wrench (T2) torque nut (3) 240 TO 360 inch-pounds. Bend tang of washer (2) to secure nut (3).

(2) Install new packing (23) on input drive quill sleeve (24).

(3) Heat gearbox case at input quill port with a heat lamp. Lubricate packing and mating surfaces of sleeve and case with oil (C166 or C166A), and install input quill. Use care to engage gear teeth and roller bearing, property to avoid damage. Install aluminum washer (33), steel washer (32) and nut (31) to studs of gearbox and tighten evenly.

NOTE

A measurement of gear backlash is not required; however, some backlash must be evident. This may be checked by holding the output shaft and rocking the input coupling back and forth to feel and hear backlash. Allowance must be made for backlash in input couplings. This check for backlash could possibly detect some serious assembly error. Proper mounting of gears, to have 0.004 TO 0.010 inch backlash in assembly, has been established during manufacture by means of shims permanently installed on mounting faces of gear case and gear quill sleeve flange.

(4) Check gearbox for freedom of operation by turning input coupling.

(5) Apply a bead of sealing compound (C244) around gearbox case and quill sleeve flange mating joint. Fill jackscrew holes. Smooth sealing compound.

e. Install Magnetic Chip Detector Assembly in Tail Rotor Gearbox as follows: (Helicopters without ODDS).

(1) Install new gasket (34) on self-closing valve (35) and install in tail rotor gearbox housing. Torque valve **120 TO 150** inch-pounds.

(2) Install new packings (36) on chip detector and insert chip detector (37) into self-closing valve (35), press and turn clockwise to engage locking pins. Visually confirm that magnetic plug pins are visible in hole provided on nut portion of chip detector housing, P/N B752G.

(3) Lockwire (C155) self-closing valve (35).

f. Install chip detector in tail rotor gearbox as follows: (Helicopters with ODDS).

CAUTION

Do not overtorque valve (40). Overtorque can distort or crush light metal housing.

(1) Install new packing (41) and self-closing valve (40) in gearbox housing. Torque valve **90 TO 110** inch-pounds and lockwire (C155).

(2) Install new packing (39) on chip detector probe (38) and install probe in valve.

(3) Perform continuity check of chip detector. Connect electrical wire to chip detector.

(4) Service gearbox (paragraph 1-8 and figure 1-1).

(5) Refer to paragraph 6-200.1 for installation of chip detector assembly PN VM2451001.

6-200. Installation - Tail Rotor Gearbox.

a. Check gearbox input quill for excess sealant in jackscrew holes. If sealant protrudes above surface of jackscrew holes, trim off excess sealant. Remove any uneven areas of sealant remaining on tailboom fin casting. Any cleaned area that penetrates to the bare metal should be protected with epoxy polyamide primer (C206).

b. Inspect 90 degree gearbox support fitting on tailboom for wear and damage limits (figure 2-63).

c. Remove nuts and shipping spacers from studs at input gear quill flange.

c.1. Apply coat of PC (C86) on shank of studs and in holes of adapter.

WARNING

Insure that all flexible couplings on replacement components are adequately lubricated prior to installation.

NOTE

Gearbox shall be installed with wet unthinned zinc chromate primer applied to mating surfaces in accordance with paragraph 2-14e.

d. Position gearbox with studs though support casting at top of vertical fin. Install nuts with steel washers under nuts, and aluminum washers between steel washers and support casting. Using a star pattern, torque nuts evenly **100 TO 140** inch-pounds. Apply a bead of sealant (C244) around the outside of the joint between the gearbox and support casting to prevent moisture from accumulating and causing corrosion.

NOTE

Repeat the torquing pattern until all the nuts retain the torque value that was initially applied to the first nut within the pattern. The torque value of the first nut will decrease as the other nuts are torqued. Following the final torque, apply a bead of sealant (C244) over the gearbox mounting stud washers and around the stud threads protruding through the nuts to prevent moisture penetration into stud holes.

e. Install driveshaft and connect to input coupling of gearbox (paragraph 6-165).

e.1. If gearbox is replacement for helicopter with ODDS, install ODDS chip detector as follows:

(1) Remove probe (37, figure 6-52), packings (36), valve (35), and gasket (34).

(2) Install valve (40) and new packing (34). Torque valve to **90 to 110** inch-pounds and lockwire (C155). Install probe (38) and packing (39).

f. Connect electrical wire to chip detector.

g. Install pitch control mechanism (paragraph 11-152).

h. Install tail rotor hub and blade assembly (paragraph 5-98).

i. Check chip detector for continuity and connect electrical wire.

j. Service gear box with oil (paragraph 1-8 and figure 1-4).

k. Rig tail rotor (paragraph 11-110).

6-200.1. Inspection - Tail Rotor Drive Shaft Coupling and Spherical Coupling.

NOTE

Couplings must be disassembled from Tail Rotor Drive Quill, Hanger Assembly, 42 Degree Gearbox, or Tail Rotor Gearbox before proceeding with inspection of the couplings.

a. Inspect coupling teeth for pitting and unusual wear patterns (figure 6-46).

b. Inspect coupling teeth for overheating.

NOTE

Blackening of spline teeth and grease often occurs and is NOT a result of overheating. Overheating will be evidenced by heavy spline wear, presence of many steel particles in the grease, and/or very heavy corrosion formation in splines.

c. Inspect couplings for evidence of corrosion. Superficial corrosion (removable with abrasive pads (C11), is the only corrosion repair allowed).

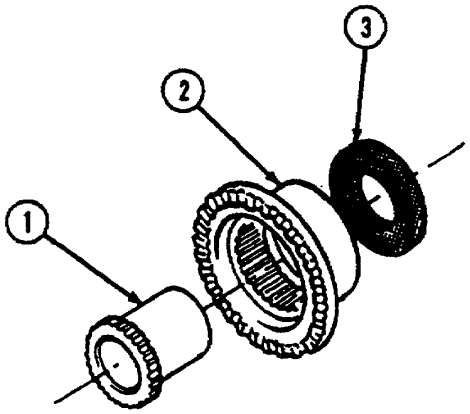
d. Inspect external splines of Spherical Coupling for wear.

(1) Secure spherical coupling (1, figure 6-54.1) in vise or other suitable fixture being careful not to damage coupling. The seal (3) may remain installed on driveshaft coupling (2) to aid in alignment of the spherical coupling during inspection.

(2) Using the driveshaft coupling as an inspection aid, slide driveshaft coupling onto spherical coupling and position in unworn area as shown in figure 6-54.2, view A.

(3) Rotate driveshaft coupling as shown in figure 6-54.2 to take out all play between splines being careful to keep couplings in line (avoid cocking driveshaft coupling).

(4) Insert wire gage (T106) between the back side of spherical coupling splines and the driveshaft coupling splines, approximately half-way between the root and top of splines as shown in figure 6-54.2. Record size of largest wire which can be inserted. Repeat this procedure in three locations, approximately 120 degrees apart.



1. SPHERICAL COUPLING
2. DRIVESHAFT COUPLING
3. SEAL

Figure 6-54.1 Driveshaft/Spherical Couplings

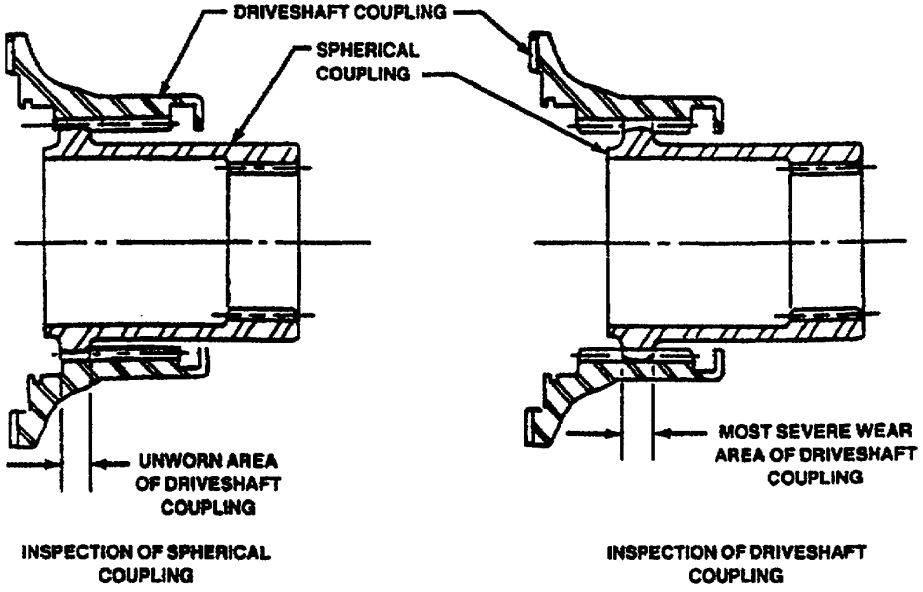


Figure 6-54.2 Coupling Inspection (Sheet 1 of 2)

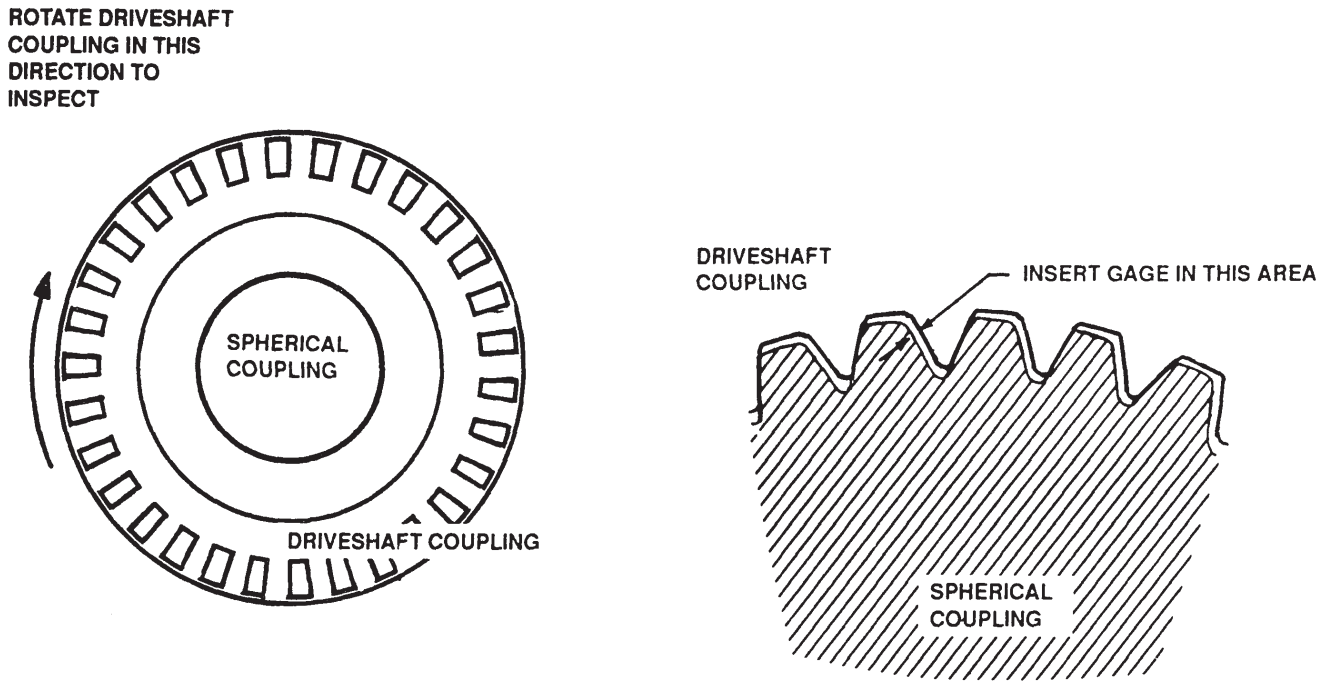


Figure 6-54.2 Coupling Inspection (Sheet 2 of 2)

6-200.2. Installation Chip Detector Assembly PN VM2451001 (Blade type)**.**

(a) Install the chip detector valve (1, figure 6-54.3) with gasket (2) into the appropriate port on the tail rotor or intermediate gearbox. Torque the valve **65 TO 70** inch pounds.

NOTE

Do not lockwire the valve at this time.

NOTE

Chip detector probe magnetic capability will attract FOD. Take care in laying probe down on work bench or the like. Ensure chip detector probe is clean prior to installation.

(b) Install the chip detector probe (3) into the valve by lining up the blades (4) on the probe with slot in the valve. Push the probe into the valve until it will rotate in the clockwise direction. Rotate the probe 90 degrees clockwise until the probe snaps back and locks into place. Without pushing down, try to rotate the probe in either direction. The probe should be locked in place and move only slightly.

(c) Check to make sure the probe's connector (5) is orientated in the 12 to 3 or 6 to 9 o'clock position (see figure 6-54.3, view A) on the gearbox in order to facilitate the wiring harness installation.

(d) If the probe detector is not orientated in the 12 to 3 or 6 to 9 o'clock position, remove the probe from the valve by pushing it into the valve until it will rotate in the counterclockwise direction. Rotate the probe 90 degrees until it releases itself from the valve. Decide which position would require the minimal amount of torque on the valve (clockwise direction only) in order to bring the probe connector into the correct position.

WARNING

The valve must be torqued to a minimum of 65 inch pounds. This torque may be increased in regulated increments up to 150 inch pounds in order to bring the probe into the correct position. DO NOT reduce torque below 65 inch pounds in order to achieve correct position.

(e) Apply the minimal amount of torque necessary to valve to bring probe into correct position. Install probe and check position and wire harness connection. Adjust as required in accordance with preceding steps.

(f) Disconnect wiring harness and remove probe from valve. Lockwire (C155) valve to aircraft.

(g) Install probe and perform continuity check. Connect wire harness to probe.

(h) Service gearbox (paragraph 1-8 and figure 1-1).

6-200.3. Inspection Chip Detector Assembly PN VM2451001 (Blade type)**.**

NOTE

Refer to paragraph 6-200.2 for removal and installation of chip detector probe.

(a) Inspect for magnetic particle buildup. Retain debris.

(b) If chip detector is being inspected following a chip light, identify particles using information in figure 6-14 figure 6-14.1 and figure 6-50.1.

(c) Inspect blades (4, figure 6-54.3) and chip detector valve (1) locking surface for wear. If less than 0.027 inches replace worn blades or valve.

(d) Clean and reinstall chip detector probe.

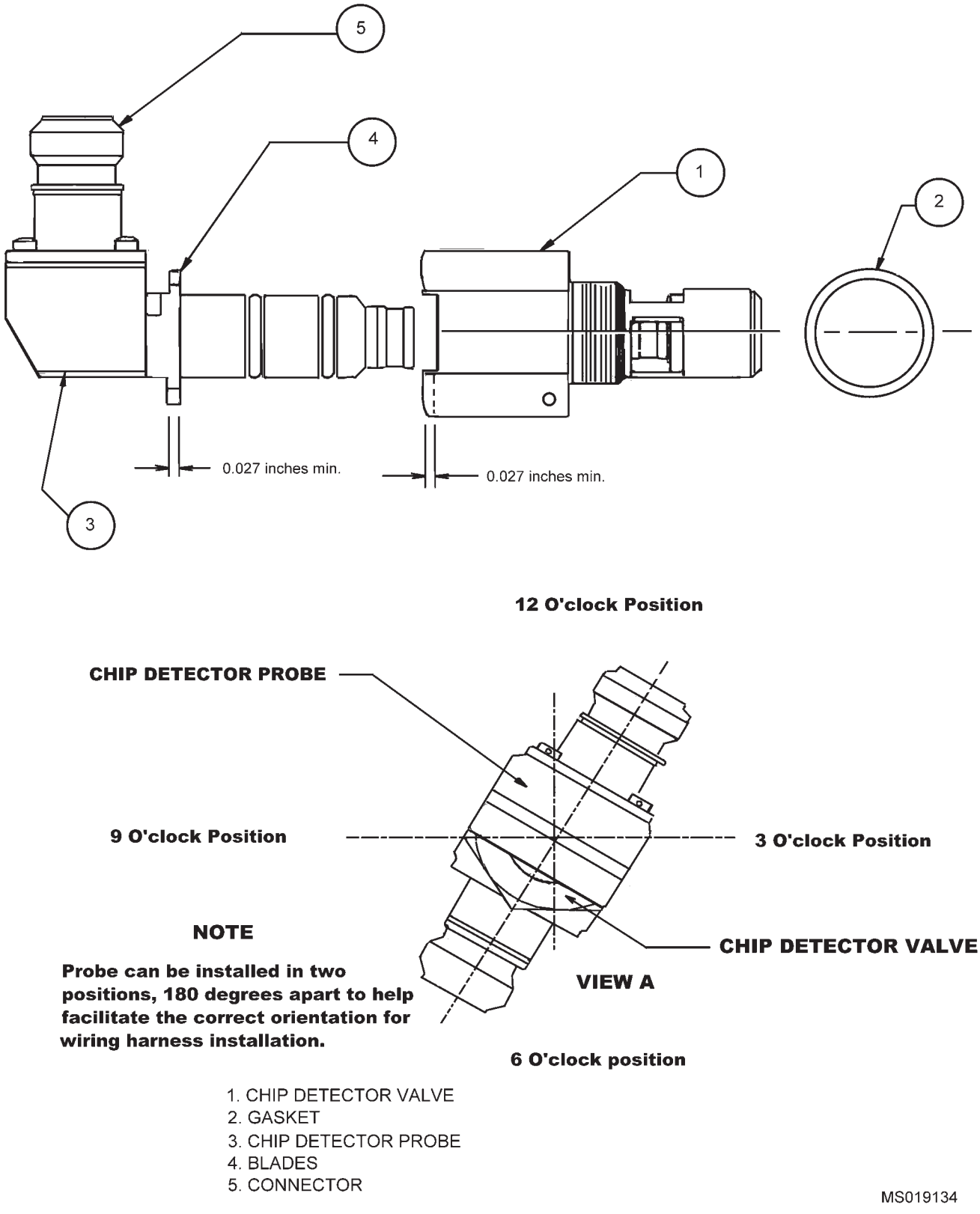


Figure 6-54.3 Chip Detector Assembly Part Number VM2451001

SECTION VII. OIL SYSTEMS

6-201. TRANSMISSION OIL SYSTEM.

6-202. Description - Transmission Oil System.

a. The transmission oil system consists of an external oil filter, thermal (bypass) valve, drain valves, oil cooler, and connecting lines and hose assemblies.

NOTE

Oil system related parts that are contained in the transmission are covered in Section III of this chapter. This includes such items as the transmission oil pump, filter, relief valve, sight gages, magnetic plug and electric chip detector, oil jets, pump screen, pressure switch and transmitter, thermoswitch, and temperature bulb.

b. The transmission oil system is independent of the engine oil system, except that the oil coolers for both systems are mounted side by side and use the same bleed-air driven blower.

c. In helicopters without ODDS, oil supply from the transmission oil pump through the transmission filter is circulated under pressure to the thermal (bypass) valve and oil cooler. The thermal valve allows oil to bypass the cooler until normal operating oil temperatures are reached. Return oil from the thermal valve through an external oil filter or the transmission mounted inlet manifold as shown in figure 6-55.

d. In helicopters with ODDS, oil from pump flows through debris monitor and is circulated under pressure to thermal (bypass) valve and oil cooler. The thermal valve allows oil to bypass cooler until operating temperature is normal. Oil from thermal valve and cooler is returned to transmission through a 3-micron external filter to the transmission mounted inlet manifold as shown in figure 6-55.

e. The primary benefit of the ODDS system is improved filtration of the engine and main transmission lubrication system. The ODDS system is designed to provide early identification of potential component failures, Fine filtration (3 micron) increases system life by removing oil-borne particles which cause wear in the component. Analysis shows that catastrophic failure modes that are detected through spectrometric oil analysis (SOA)/AOAP will be detected by odds system chip detectors, The ODDS equipped engine and main transmission do not require routine oil sampling. Spectrometric oil analysis measures concentrations of wear metal debris in the three to ten micron range. Not enough of significant size particles exist to allow an accurate indication of wear metal concentration by spectrometric analysis. Therefore routine oil sampling is not required or authorized.

Although routine oil sampling of the engine and main transmission of ODDS equipped aircraft is not required or authorized, samples may be taken in the event of a chip light, and provided along with chip detector debris to an AOAP lab for analysis using ferrography or similar techniques. The results of this will be used with oil debris classification chart guidelines to determine the serviceability of the component.

Replacement of the ODDS equipped engine and main transmission external oil filters are performed “on condition” as required by maintenance actions (such as bypass buttons or major component change). Since operation of fine filtration cleans the lubricant in the component, do not replace lubricant when replacing filter. Flushing and filtering of lubricant of the odds system is not required or authorized. Flushing and filtering of lubricant is only done during replacement of engine and/or main transmission.

During the modification of aircraft I.A.W. MWO 1-1520-242-50-2 (ODDS) chip detectors in the 42- and 90-degree gearboxes were changed, they are not part of the ODDS filtering system and still require SOA/AOAP samples and inspections.

f. Service transmission oil system in accordance with paragraph 1-6.

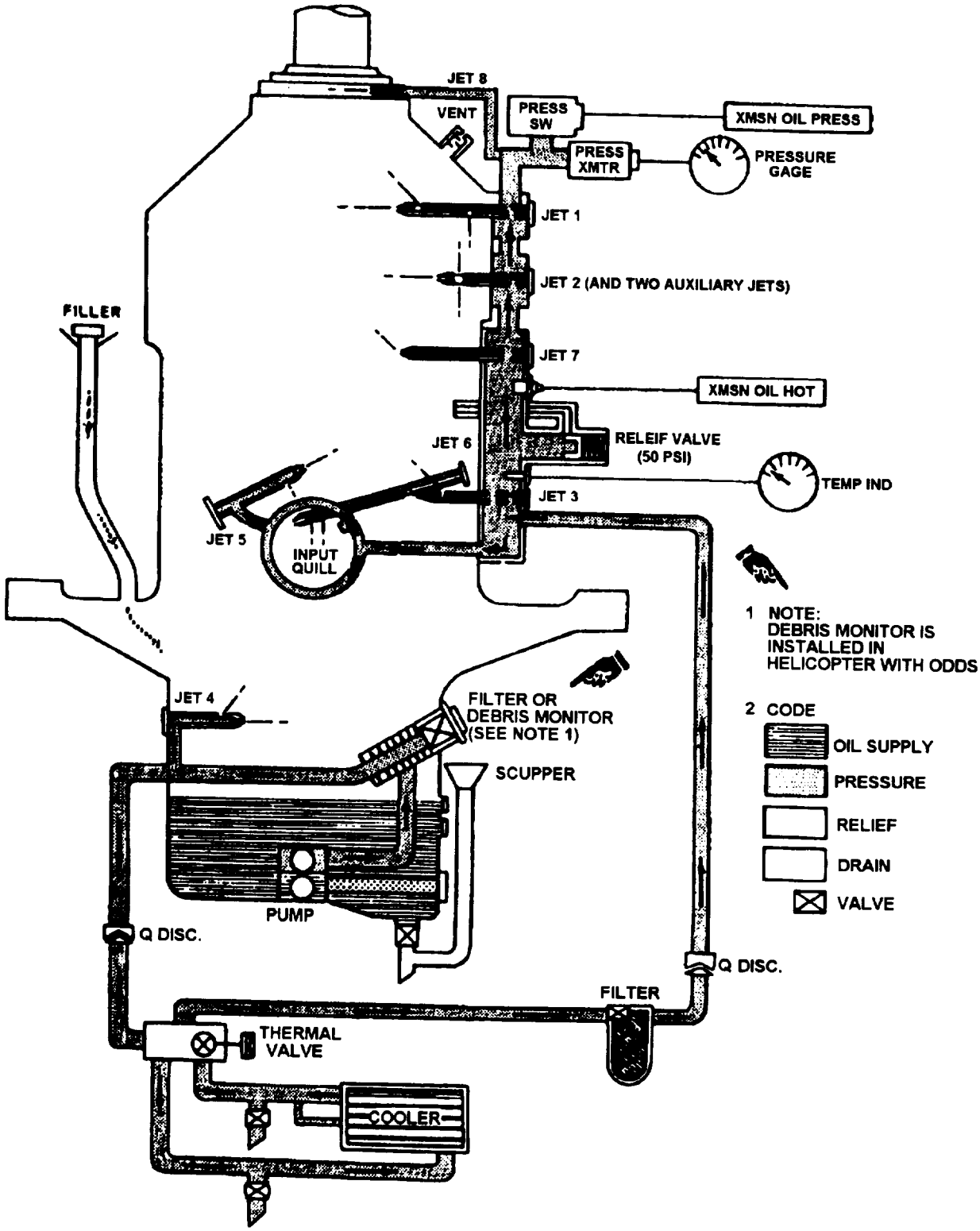


Figure 6-55. Transmission Oil System - Schematic

6-203. Flushing — Transmission Oil System.

NOTE

If the transmission oil system is known to have been contaminated with metal particles (figure 6-14), the external oil filter element and oil cooler shall be replaced, and all lines flushed thoroughly.

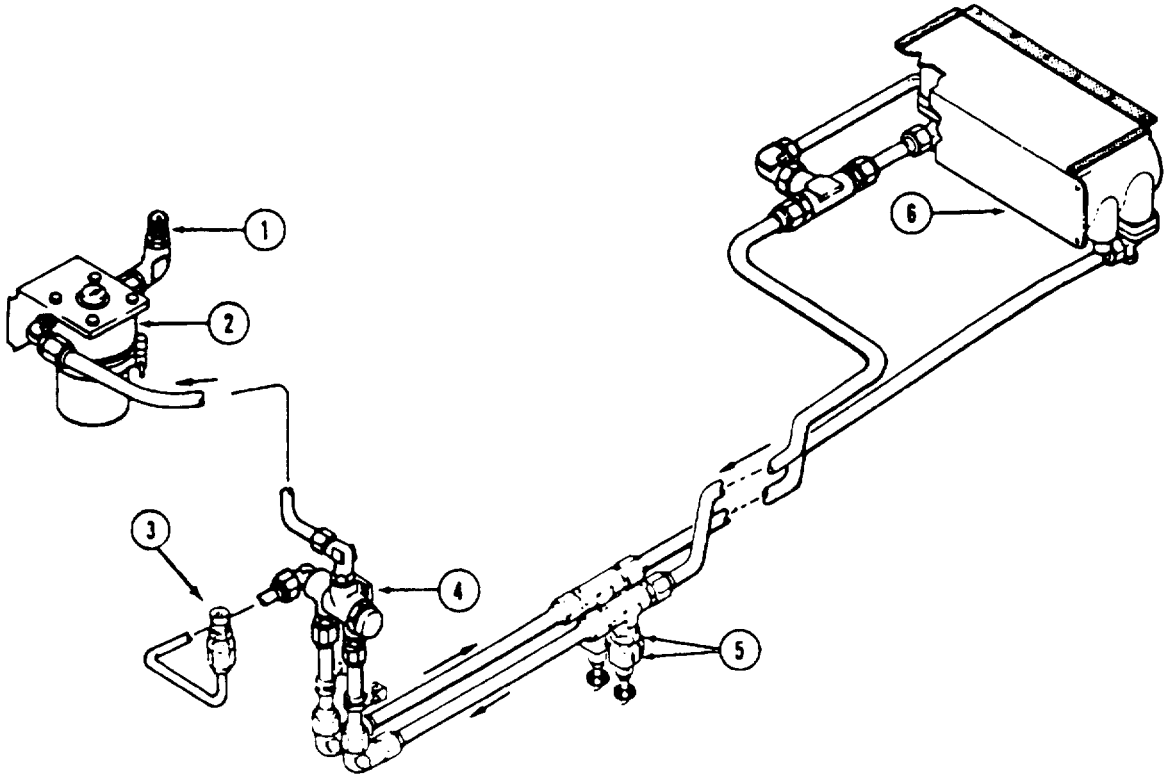
a. Open two drain valves (5, figure 6-56) and drain valve on bottom of transmission sump. Drain oil into a clean container. Check oil for contamination, close valves.

b. Remove external filter (2), clean filter assembly and replace element (paragraphs 6-206 and 6-207 or 6-210.3, 6-210.4, and 6-210.5)

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

c. Inspect and flush oil cooler (6) in accordance with paragraph 6-220,6-221 and 4-95.



1. Coupling half (to inlet manifold)
2. External filter
3. Dram coupling half [from sump outlet)
4. Thermal valve
5. Drain valves
6. Oil cooler

Figure 6-56. Transmission Oil System

d. Flush all hoses, lines, valves, and fittings between external filter (2, figure 6-56) and oil cooler (6) with warm solvent (C261). Continue flushing operations until solvent runs clear,

e. Repeat step d., flushing system using oil (C166,C166A, or C168) until oil runs clean.

f. Install external filter (2) with new element (paragraph 6-210 or 6-210.7).

g. If transmission does not require replacement due to contamination; remove inspect and dean the following:

(1) Transmission oil filter (paragraphs 6-43 through 6-49).

(2) Pump screen, magnetic plug and electric chip detector (paragraphs 6-83 through 6-89)

h. Service transmission (paragraph 1-6)

6-204. EXTERNAL OIL FILTER. (Helicopters Without ODDS)

6-205. Description — External Oil Filter.

a. External oil fitter (2, figure 6-56) is located in cargo-sling compartment on right-hand wall, and is connected into external oil line between cooler thermal valve outlet and inlet of oil manifold on transmission main case.

b. Unit contains a pleated-paper type filter element and incorporates a bypass valve set to open at 18 to 22 psig differential pressure to assure oil flow if fitter element should become clogged.

6-206. Removal — External Oil Filter. a. Obtain access to filter through hole at bottom of cargo-sling well or by opening soundproofing blanket and removing door on front of pylon island in cabin.

b. Disconnect transmission inlet oil hose from filter outlet coupling half (1) on right wall and transmission outlet hose from coupling (3) on bracket on left wall of compartment. Cover opening couplings.

c. Place a container under external filter (2) to catch spilled oil.

d. To remove filter element:

(1) Loosen coupling nut and open coupling (3, figure 6-57).

(2) Remove filter body (7) and element (6) downward. Pull element out of body and discard preformed packings (4 and 5).

e. To remove filter head (2) from mounting brackets:

(1) Disconnect oil line tube from external filter inlet fitting. Cap open line.

(2) Remove coupling half from outlet elbow.

f. Remove lockwire and four bolts with washers and spacers to detach filter head (2) from bracket. Remove head assembly downward.

WARNING

Cleaning materials are flammable and toxic. Avoid skin contact and breathing of solvent vapors.

6-207. Cleaning — External Oil Filter. Clean filter body and head assembly if removed, with dry cleaning solvent (C261). Dry with filtered compressed air.

CAUTION

Do not attempt to clean filter element for reuse.

6-208. Inspection — External Oil Filter. a. Inspect element for foreign particles. If foreign particles are evident, accomplish the requirements of paragraph 6-30 and figure 6-14.

b. Inspect all parts of filter for corrosion or damage.

c. Check for an extended bypass indicator (1, figure 6-57). If the indicator is extended, replace the filter element (6) and reset the indicator. Perform maintenance operation check for leaks and proper operation at first run up (TM 55-1520-210-10).

6-209. Repair — External Oil Filter. Repair is limited to polishing out minor nicks or scratches with fine stone (C263) or 264) and replacing filter element on assembly.

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6-210. Installation - External Oil Filter.

a. If removed, reinstall filter head (2, figure 6-57) assembly as follows:

(1) In outlet part of head (2), check installation of union, nut and preformed packing.

(2) In inlet port of head (2), check installation of elbow pointing 10 degrees inboard with nut and preformed packing.

(3) Position head (2) to mounting brackets, with inlet elbow forward and pointing inboard, and with outlet elbow aligned to hole in aft bracket.

(4) Install four bolts through bracket into head (2) using a spacer between filter head and bracket and a thin aluminum alloy washer under head of each bolt. Lockwire (C155) bolt heads.

(5) Install quick-disconnect coupling half (1, figure 6-56) on outlet elbow at aft bracket.

(6) Connect oil tube from thermal valve (4) to filter inlet elbow.

b. Install new filter element (6, figure 6-57) and body (6).

(1) Install new preformed packing (5) on boss in bottom of filter body (7).

(2) Place filter element (6) in body (7), seated firmly on boss.

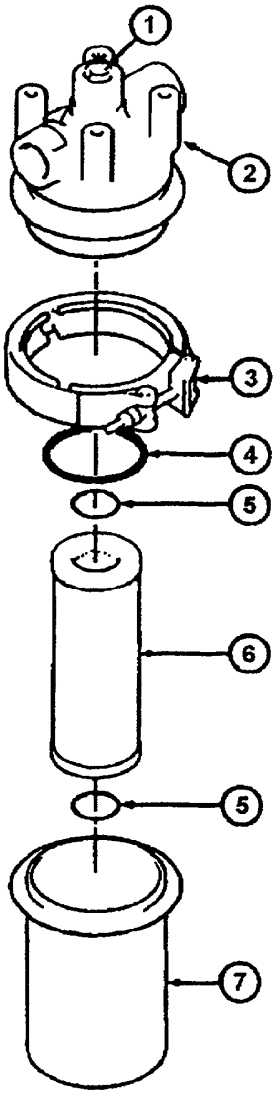
(3) Install preformed packing (4) around upper lip of body (7), next to flange.

(4) Install second preformed packing (5) around center boss in underside of filter head (2).

(5) Install filter assembly into filter head (2), pressing upward to seat.

(6) Install V-band coupling (3) around mating flanges of filter head (2) and body (7). Torque coupling nut to **50 inch-pounds**.

c. Connect transmission inlet hose to filter outlet coupling (1, figure 6-56), and transmission outlet hose to drain coupling (3) on opposite wall of compartment.



1. Bypass indicator
2. Head
3. Coupling
4. Preformed packing
5. Preformed packing
6. Element
7. Body

Figure 6-57. External Oil Filter - Transmission (Helicopter without ODDS)

6-210.1. EXTERNAL OIL FILTER. (Helicopters with ODDS).

6-210.2. Description - External Oil Filter.

a. External oil filter (2, figure 6-56) is in cargo-sling compartment (Hell Hole), on right bulkhead. The filter is connected into external oil line between thermal valve outlet of oil manifold on transmission main case.

b. Filter contains disposable 3-micron pleated-paper element and includes bypass valve. Valve is set to open at 20 to 24 psi and reseat at 18 psi to ensure oil flow if filter is clogged. A differential pressure indicator pops out to indicate bypass. Filter design prevents re-entry of trapped debris into system during bypass.

c. Filter is accessed through opening to cargo-sling well or by peeling up soundproofing on front of pylon island in cabin and removing access panel.

d. Drain valve on bottom of filer can be used to drain the filter for removal. Filter head is marked TRANSMISSION.

6-210.3. Cleaning - External Oil Filter. Clean filter bowl and head with cleaning solvent (C261). Dry with compressed air.

CAUTION

Do not attempt to clean filter element for reuse. Oil system performance can be seriously degraded.

6-210.4 Inspection -External Oil Filter.

a. Make sure filter head (3, figure 6-57.1) is marked TRANSMISSION.

NOTE

The effected chip detector should also be removed and inspected whenever the impending bypass indicator button is extended.

b. Check bypass indicator. Reset if extended. If reset, check for proper operation at next runup.

c. Inspect filter head and bowl (6) for corrosion, cracks, and evidence of leaks.

d. Replace cracked or corroded parts. Correct leaks.

6-210.5. Replacement of Element or Bowl - External Oil Filter. Proceed as follows: (figure 6-57.1)

NOTE

Replacement of the ODDS equipped engine and main transmission external oil filters are performed "On Condition" as required by maintenance actions (such as bypass buttons or major component change). Since operation of fine filtration cleans the lubricant in the component, do not replace lubricant when replacing filter. Flushing and filtering of lubricant of the ODDS system is not required or authorized. Flushing and filtering of lubricant is only done during replacement of engine and/or main transmission.

a. Place container below filter to catch oil. Remove lockwire from cap of drain valve (8). Remove cap to drain oil.

b. Remove lockwire and coupling clamp (4).

c. Remove filter bowl (6) and element (5) downward.

d. Remove packing (1) from filter head (2).

e. Clean head (2) and bowl (6). Use cloths and cleaning solvent (C261). Inspect bowl for cracks and serviceability.

f. Install new packing in head.

g. Install new or serviceable element in filter bowl.

CAUTION

Ensure V-band coupling is properly seated for the full circumference of the filter bowl and filter head flange. The V-band coupling should not appear cocked. Improperly installed clamps will result in damage to the filter head, filter bowl, coupling, and will cause leaks.

h. Position bowl in head.

i. Install and tighten coupling clamp. Torque coupling nut to **40-50 inch-pounds.** Lockwire (C155) clamp.

j. Install packing (9) and cap of drain valve (8) and torque cap to **20-25 inch-pounds.** Lockwire (C155) cap.

k. Service system with oil (paragraph 1-6).

6-210.6. Replacement of Drain Valve - External Oil Filter. Proceed as follows: (figure 6-57.1)

a. Place container below filter to catch oil. Drain oil using drain valve (8).

b. Remove body of drain valve (8) and packings (7) and (9) from bowl (6).

c. Install body of drain valve (8) and new packing (7) in bowl. Torque body to **16-20 inch-pounds.** Lock-wire body (C155).

d. Install new packing (9) on body.

e. Install cap on drain valve. Torque cap to **20-25 inch-pounds**. Lockwire (C155) cap.

f. Service the system with oil (paragraph 1-6).

6-210.7. Removal - External Oil Filter. Proceed as follows:

a. Place container below filter to catch oil. Remove lockwire from cap of drain valve (8, figure 6-57.1). Remove cap to drain oil.

b. Disconnect transmission inlet oil hose (5, figure 6-57.2) from filter outlet coupling (6). Disconnect by-pass outlet tube (14) from elbow (15). Cover openings.

c. Remove four bolts (4), washers (3), and spacers (1) (below bracket) and remove filter. Inspect filter head and bowl for serviceability.

d. If filter or head will be replaced, remove fittings and packings (6 through 13 and 15 through 17) from IN and OUT ports. Discard packings.

6-210.8. Replacement of Filter Head -External Oil Filter. (See figure 6-57.1).

a. Remove filter (paragraph 6-210.7).

b. Remove lockwire and coupling clamp (4).

c. Remove filter bowl (6) and element (5) downward. Remove and discard packing (1) from head. Inspect element.

CAUTION

Make sure replacement filter head is marked TRANSMISSION. Otherwise, oil system performance will be degraded and pressure bypass mechanism will not function as required.

d. Install new packing (1) on replacement head (2).

e. Install serviceable element and bowl.

f. Install and tighten coupling clamp (4). Torque coupling nut (10) to **40-50 inch-pounds**. Lockwire (C155) clamp.

g. Install filter (paragraph 6-210.9).

6-210.9. Installation - External Oil Filter. Proceed as follows: (figure 6-57.2)

NOTE

If bracket (2) is remove/replaced install bracket using existing hardware. Lockwire bolts (C155).

a. If filter or head is a replacement, install fittings as follows:

(1) Install packing (17), nut (16), and elbow (15) in IN port.

(2) Install packing (13), nipple (12), nut (11), packing (10), elbow (9), packing (8), two nuts (7), and coupling half (6) in OUT port.

b. Position oil filter below bracket (2), IN port forward.

CAUTION

Make sure filter head is marked TRANSMISSION and that filter is installed with IN port forward. Otherwise, oil system performance will be degraded and pressure bypass mechanism will not function as required.

c. Install four bolts (4), washers (3), and spacers (1) (below bracket). Torque bolts to **87-93 inch-pounds**. Lockwire (C155) bolts.

d. Connect hose (5) to coupling half (6).

e. Connect tube (14) to elbow (15).

f. Install packing (9, figure 6-57.1) on body of drain valve (8).

g. Install cap on drain plug. Torque cap to **20-25 inch-pounds**. Lockwire (C155) cap.

h. Service system with oil (paragraph 1-6) and perform maintenance operational check for leaks and proper operation at first runup (TM 55-1520-210-10).

1. Packing
2. Filter head
3. Bypass indicator
4. Coupling clamp
5. Element
6. Filter bowl
7. Packing
8. Drain valve
9. Packing
10. Nut

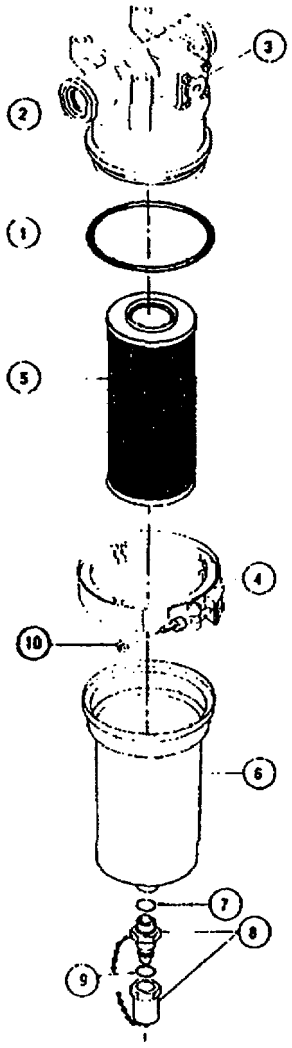
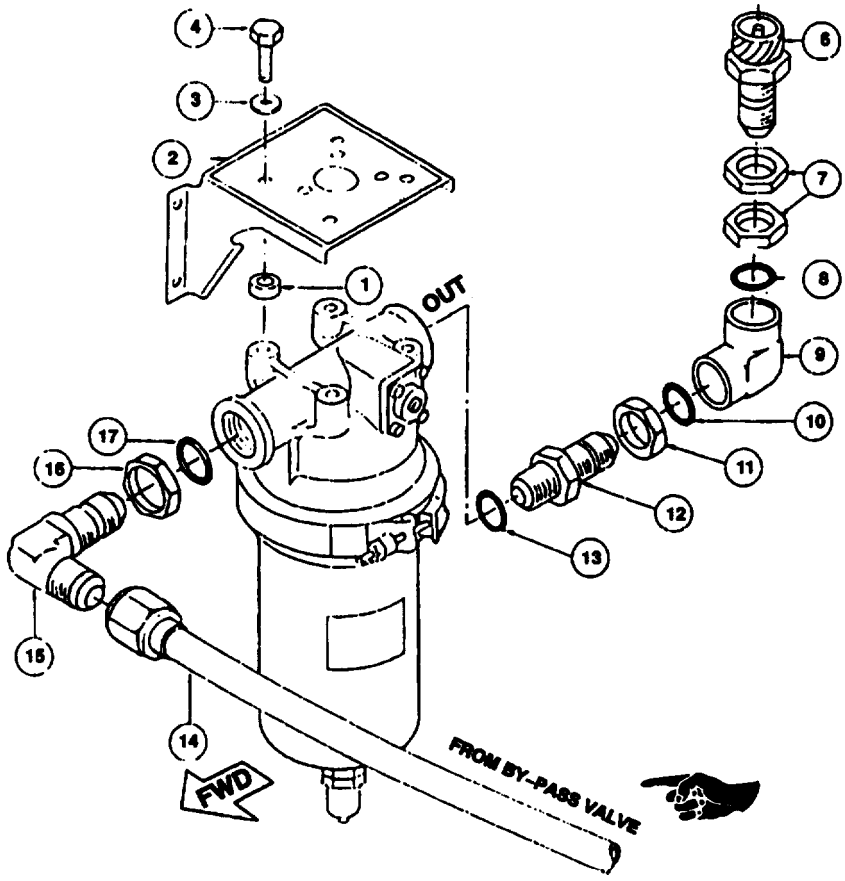


Figure 6-57.1. Disassembly of Transmission External Filter (Helicopters with ODDS)



1. Space
2. Bracket
3. Washer
4. Bolt
5. Hose
6. Coupling Half
7. Nut
8. Packing
9. Elbow
10. Packing
11. Nut
12. Nipple
13. Packing
14. Tube
15. Elbow
16. Nut
17. Packing

Figure 6-57.2. Transmisslon External Oil Filter Installation (Helicopter with ODDS)

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6-211. THERMAL VALVE.

6-212. Description — Thermal Valve. Thermal (bypass) valve (4, figure 6-56) for transmission oil system is located on rear wall, Station 155 bulkheadof cargo-sling compartment below transmission. The bypass valve opens and allows oil to bypass the oil cooler until operating temperature is reached, then closes for normal flow. Two manual drain valves (5) are provided in lines between cooler and valve.

6-213. Removal — Thermal Valve. a. Enter cargo-sling compartment through hole at bottom.

b. Disconnect transmission oil inlet and outlet hoses at quick-disconnect couplings (1 and 3, figure 6-56).

c. Place a container under thermal valve (4) to catch trapped oil.

d. Disconnect oil lines from thermal valve fittings. Cap lines.

e. Remove two screws and washers to detach valve body from mounting bracket.

f. When necessary for cleaning or replacement, cut lockwire and remove thermal valve from body.

6-214. Inspection — Thermal Valve. Visually inspect thermal valve for damage, clogging, or malfunction.

6-215. Repair — Thermal Valve. Replace thermal valve (without repair) if corroded, clogged or not working.

6-216. Installation — Thermal Valve. a. If thermal valve was removed from body, install a new spacer ring, apply anti-seize compound (C47) to threads and tighten element in valve body. Torque 1400 inch-pounds and lockwire (C155). Check for proper installation of fittings in four ports of body.

b. Position thermal valve (4, figure 6-56) on mounting bracket located approximately on vertical centerline of rear bulkhead in compartment below transmission, head of valve should be toward left side.

c. Secure with two screws and thin aluminum washers, through valve body into plate nuts of bracket.

d. Connect oil cooler lines on two lower fittings of valve body, filter inlet line to upper fitting, and line from coupling on left wall to fitting on right end of valve assembly.

e. Connect transmission oil outlet hose to quick-disconnect coupling (3) on left wall of compartment, and inlet hose to filter outlet coupling (1) on right wall.

f. Service transmission (paragraph 1-6).

g. Perform maintenance operation check for leaks and proper operation at first runup (TM 55-1520-210-10) or (TM 55-1520-247-10).

6-217. OIL COOLER ASSEMBLY.

6-218. Description — Oil Cooler Assembly. Transmission oil system cooler (6, figure 6-56) is mounted in bottom of rear fuselage compartment, in same opening as engine oil cooler and served by same turbo blower and air duct.

6-219. Removal — Oil Cooler Assembly. Remove engine and transmission oil coolers as a unit in accordance with paragraph 4-93.

6-220. Inspection — Oil Cooler Assembly.
a. Visually inspect oil cooler support for cracks.

b. Inspect lines and fittings for stripped threads and serviceability.

c. Inspect oil cooler for damage, clogging and malfunction.

d. Inspect all openings in core assembly for foreign matter inside cooler.

e. Inspect the oil cooler for distortion in air fins and passages, damaged and bulged plates, cracked castings, broken welds, stripped threads and core assembly for foreign matter, leakage and scoring.

f. Inspect the lockwire installed on bolts and fittings for breaks.

6-220A. Cleaning — Oil Cooler Assembly. Clean in accordance with paragraph 4-95.

6-221. Repair — Oil Cooler Assembly. a. Repairs to oil cooler are limited to straightening of air fins, using duck-bill pliers which have been ground to fit between cooling tubes.

b. Replace (without repair) oil cooler for damage, metal particle contamination or malfunction. In event of transmission internal failure, disassemble and clean oil thermal valve, replace oil cooler and flush out all connecting lines and fittings (paragraph 6-203).

c. Replace (without repair) unserviceable lines, fittings, gaskets, or support.

d. The oil cooler will be replaced (without repair) if any of the following conditions exist.

(1) Tubes blown or bulged.

(2) Leaks in tube walls or seams, tubes to headers, tanks to headers, or castings.

(3) Cracked or broken flanges, shrouds, ducts or castings.

(4) Major dents and similar damage in tube edges or in tanks which do not leak but could impair oil cooler performance.

(6) Damaged air fins which cannot be straightened,

(6) Damaged threads in drain port or on inlet and outlet pad studs.

(7) Replace the preformed packing at the elbow connected to the bottom of the oil cooler.

(8) Install lockwire (C155) on bolts and connections as required.

Installation — Oil Cooler Assembly.

CAUTION

The oil cooler and long vertical connecting line shall be filled to extent possible during installation, Shut down and check oil level after a short period of operation to avoid the possibility of the sump oil supply being taken Into an unfilled external system.

a. Install oil cooler unit in accordance with paragraph 4-100.

b. After a short period of operation, shut down engine and check oil level.

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X,Y,Z

¤ U.S. GOVERNMENT PRINTING OFFICE: 1992 554-123/40046

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R.L. DILWORTH
Brigadier General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-31, AVUM and AVIM Maintenance requirements for UH-1H, UH-1V Helicopter, Utility and EH-1H Helicopter, Electronic Countermeasure and EH-1X Helicopter, Electronic Countermeasure & Intercept.

These are the instructions for sending an electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" <whomever@wherever.army.mil>
To: 2028@redstone.army.mil

Subject: DA Form 2028

1. ***From:*** Joe Smith
2. *Unit:* home
3. ***Address:*** 4300 Park
4. ***City:*** Hometown
5. ***St:*** MO
6. ***Zip:*** 77777
7. ***Date Sent:*** 19−OCT−93
8. ***Pub no:*** 55−2840−229−23
9. ***Pub Title:*** TM
10. ***Publication Date:*** 04−JUL−85
11. *Change Number:* 7
12. *Submitter Rank:* MSG
13. ***Submitter FName:*** Joe
14. *Submitter MName:* T
15. ***Submitter LName:*** Smith
16. ***Submitter Phone:*** 123−123−1234
17. ***Problem:*** **1**
18. *Page:* 2
19. *Paragraph:* 3
20. *Line:* 4
21. *NSN:* 5
22. *Reference:* 6
23. *Figure:* 7
24. *Table:* 8
25. *Item:* 9
26. *Total:* 123
27. ***Text:***

This is the text for the problem below line 27.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25–30; the proponent agency is ODISC4.	Use Part II (*reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/ Supply Manuals (SC/SM)	DATE 8/30/02
TO: (*Forward to proponent of publication or form)(Include ZIP Code)* Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM–MMC–MA–NP R eds t one A r s enal, AL. 35898	FROM: (*Activity and location)(Include ZIP Code)* MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565	

PART 1 – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9–1005–433–24	16 Sep 2002	Organizational, Direct Support, And General Support Maintenance Manual for Machine Gun, .50 Caliber M3P and M3P Machine Gun Electrical Test Set Used On Avenger Air Defense Weapon System

ITEM NO.	PAGE NO.	PARA–GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON
1	WP0005 PG 3		2			Test or Corrective Action column should identify a different WP number.

EXAMPLE

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/ AUTOVON, PLUS EXTENSION	SIGNATURE
MSG, Jane Q. Doe, SFC	788–1234	

TO: (*Forward direct to addressee listed in publication)*	**FROM:** (*Activity and location) (Include ZIP Code)*	**DATE**
Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM–MMC–MA–NP R eds t one A r s enal, AL. 35898	MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565	8/30/02

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS (*Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

EXAMPLE

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
MSG, Jane Q. Doe, SFC	788–1234	

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25–30; the proponent agency is ODISC4.	Use Part II (*reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/ Supply Manuals (SC/SM)	DATE
TO: (*Forward to proponent of publication or form)(Include ZIP Code)* Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, AL. 35898	FROM: (*Activity and location)(Include ZIP Code)*	

PART 1 – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PU BLIC ATIO N /FO R M N U MBER	DATE	T I T LE
TM 55-1520-210-23-1	30 SEPT 1987	Aviation and Intermediate Maintenance Instructions ARMY Model UH-1/V/EH-1H/X Helicopter

ITEM NO.	PAGE NO.	PARA–GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/ AUTOVON, PLUS EXTENSION	SIGNATURE

TO: (*Forward direct to addressee listed in publication)* Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, AL 35898	**FROM:** (*Activity and location) (Include ZIP Code)*	**DATE**

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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 040151-000