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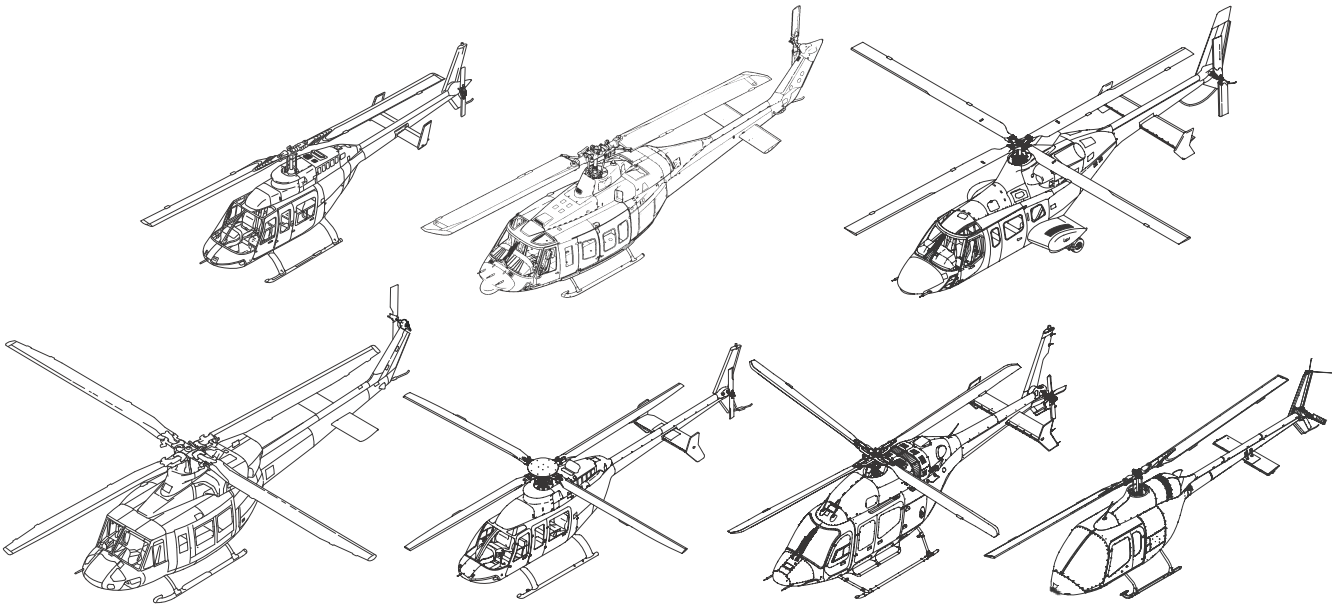

STANDARD PRACTICES MANUAL

FOR ALL BELL HELICOPTER COMMERCIAL PRODUCTS

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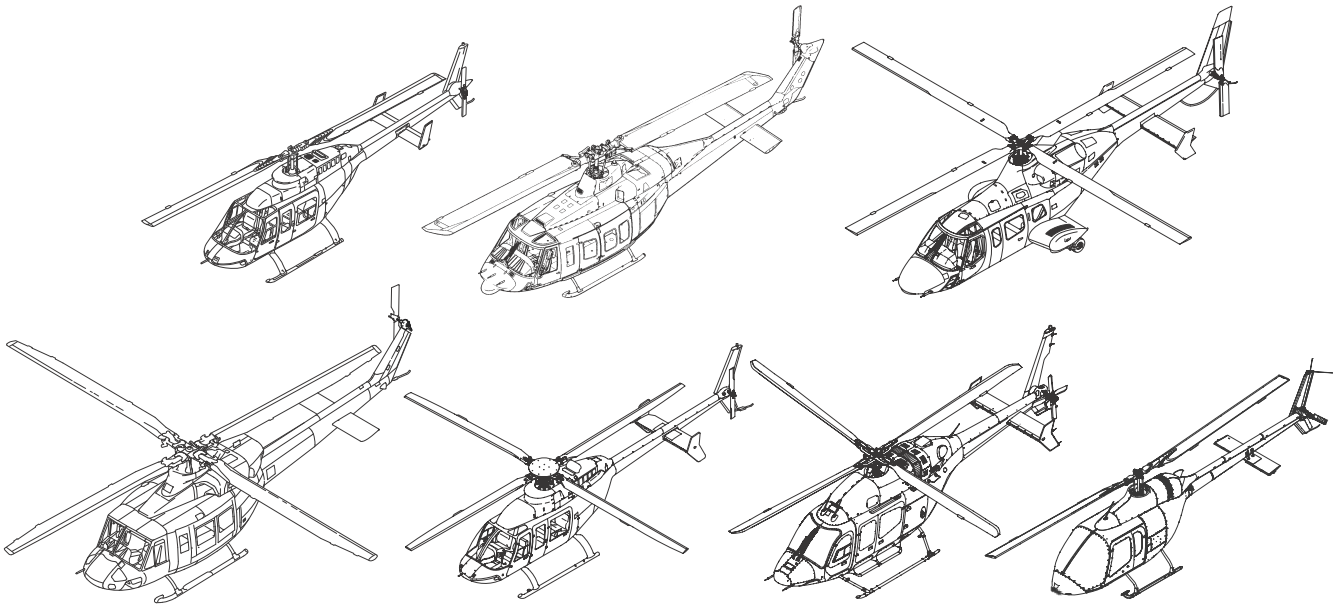

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Reissue ..... 0 ..... 10 OCT 96	Revision ..... 3 ..... 19 JAN 11	Revision ..... 8 ..... 30 AUG 21
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January 2007

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NOTE:

△1 The contents of Chapter 12 have been deleted. Please refer to the Bell Helicopter Electrical Standard Practices Manual (BHT-ELEC-SPM) for information on Nickel-Cadmium Aircraft Batteries.

CHAPTER 1 — INTRODUCTION

CONTENTS — MAINTENANCE PROCEDURES

INTRODUCTION

1-1. INTRODUCTION

This manual contains maintenance information and procedures that are common to all Bell Helicopter models. Typical information includes standard torque charts and application procedures, corrosion control, painting, cleaning, nondestructive inspection, bonding, miscellaneous practices, bearing, sleeve and bushing inspection and replacement, storage, use of solvents, and consumable materials.

WARNING

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1-2. CONSUMABLE MATERIALS

NOTE

Handling, storage and safety precautions for consumable materials shall be in accordance with the consumable material manufacturers instructions unless otherwise specified in this manual.

A list of consumable materials is contained in Chapter 13. This comprehensive listing provides a description, specification and suggested source. Within this manual, consumable items are referred to within the maintenance tasks by "C" number. When a task states to use solvent (C-304), refer to Chapter 13 and find item C- 304 for type of solvent to use.

CAUTION

METRIC EQUIVALENTS TO U.S. STANDARD WEIGHTS AND MEASURES ARE PROVIDED THROUGHOUT THIS MANUAL. WHILE PERFORMING MEASUREMENTS TO DETERMINE THE SERVICEABILITY OF A COMPONENT OR TO ESTABLISH A SPECIFIED DIMENSION, ONLY THE U.S. STANDARD VALUES SHALL BE USED.

CHAPTER 2 — TORQUE

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TORQUE

2-1. TORQUE VALUES

CAUTION

ALL TORQUE VALUES APPLY TO DRY THREADS. DO NOT USE THREAD LUBRICANT OR ANTI-SEIZE COMPOUND UNLESS SPECIFICALLY CALLED FOR IN THE APPLICABLE MAINTENANCE PUBLICATION. DRY FILM LUBRICANT MATERIALS APPLIED TO THE NUTS BY THE NUT MANUFACTURER SHALL NOT BE REMOVED.

1. Definition.

a. Standard Torque — A general torque requirement that is applied when a specified torque is not identified in the applicable maintenance publication. Standard torque values are listed in Table 2-1 through Table 2-7. Unless otherwise specified, standard torque requires the addition of tare torque.

NOTE

When torques are specified in the applicable maintenance publication, they take preference over the standard torque values in Table 2-1 through Table 2-7.

b. Specified Torque — A specific torque identified in the applicable maintenance publication for a particular fastener. Unless otherwise specified, specified torque requires the addition of tare torque.

c. Non-specified Torque — A non-specified torque does not have a torque value included in the maintenance publications. Torque values listed in Table 2-1 through Table 2-7 may be used as a reference for tightening the various fastener/nut combinations. Torque measurement and calibration installation tools are not required. Normal shop practice shall be used. Normal shop practice shall ensure the bearing surface(s) of the fastener contacts the material being joined and the fastener is seated with a sufficient application of torque to prevent the fastener from becoming unseated.

d. Tare Torque. Torque — Required to overcome resistance of self-locking nuts against mating bolt, screw, or stud threads. Tare torque must be measured using the same fastener combination that the torque will be applied to. Tare torque is unique to that fastener combination. It is not acceptable to measure tare torque for one fastener combination and apply this tare torque value to all similar fasteners. The preferred method for measuring tare torque is to use a dial (indicator) type torque wrench, but may be measured by approaching the value with a click style torque wrench. The value must be measured after all threads are engaged and then compared to the minimum tare torque value (paragraph 2-2). If measured tare torque value is less than the minimum listed, the lock nut must be replaced.

e. Assembly Torque — The total torque value applied to a fastener (preferably the nut in a nut/bolt combination). Assembly torque is the standard torque or specified torque, plus the tare torque. It is unique to that fastener combination. An adjacent fastener combination with the same hardware may require a different assembly torque value. Variations in wear, stress, and finish will impact tare values of fasteners of the same size and type.

NOTE

Recommended installation torque for threaded studs is given in Table 2-8.

Recommended installation torque for flared fitting nuts is given in Table 2-9.

Recommended installation torque for flareless fitting nuts is given in Table 2-10.

Recommended installation torque for dynamic beam seal nuts is given in Table 2-11.

Recommended pin and nut torque values are given in Table 2-12.

f. Installation Torque — Unless otherwise stated in the applicable maintenance publication, installation torque is the actual torque measured when installing the threaded fastener.

g. Shear Load — A dynamic force causing two parts in contact to move in a direction parallel to their point of contact.

h. Tension Load — A static force applied 90° to the plane of rotation of contiguous parts.

2-2. STANDARD TORQUE — USE OF

CAUTION

DO NOT EXCEED THE MAXIMUM ALLOWABLE TORQUE VALUE, OVERSTRESSING OF THE BOLT OR NUT MAY RESULT. IF THERE IS CONCERN THAT FASTENERS HAVE BEEN OVER-TORQUED, THE FASTENERS ARE TO BE REMOVED AND REPLACED. IN ADDITION, THE ASSEMBLY OR COMPONENT BEING ASSEMBLED IS TO BE INSPECTED FOR DAMAGE THAT MAY HAVE BEEN CAUSED FROM THE OVER-TORQUE.

1. The standard torque charts (Table 2-1 through Table 2-7) list the standard torque for various combinations of bolts and nuts. The torque values listed do not include the tare torque (friction drag) of the self-locking feature.

CAUTION

RECOMMENDED STANDARD TORQUE RANGES ARE GIVEN IN TABLE 2-1 THROUGH TABLE 2-7. TARE TORQUE SHALL BE ADDED TO STANDARD TORQUE VALUE LISTED, UNLESS OTHERWISE STATED.

2. Standard torque value charts usage.

a. To locate the correct standard torque for a bolt and nut, the following must be known:

(1) Type of bolt used (AN, MS, NAS, etc.).

(2) Type of nut used (AN, etc.).

(3) Thread size of bolt (10-32, 1/4-28, 5/16-24, 3/8-24, etc.).

b. When all three of the previous values are known, refer to Table 2-1 through Table 2-7, as applicable.

(1) With reference to Table 2-1 through Table 2-7, locate the specific table that carries the primary bolt part number (designation) and the part number of the nut. Locate thread size and read across to obtain the standard torque values.

CAUTION

TARE TORQUE MUST BE MEASURED ON THE SAME FASTENER COMBINATION THAT THE TORQUE WILL BE APPLIED TO USING A DIAL INDICATOR TYPE TORQUE WRENCH. MEASURE TARE TORQUE OF SELF LOCKING NUT TO BE INSTALLED AFTER ALL THREADS ARE ENGAGED. COMPARE VALUE TO MINIMUM TARE TORQUE VALUE LISTED BELOW. IF MEASURED TARE TORQUE IS LESS THAN MINIMUM LISTED, REPLACE SELF-LOCKING FASTENER.

c. Measure tare torque of self-locking nut to be installed using dial indicator type torque wrench. The minimum allowable tare torque value of self-locking bolts and nuts is as follows:

MINIMUM TARE TORQUE VALUE

THREAD SIZE	MINIMUM TARE TORQUE INCH-POUNDS (NM)
10-32	2.0 (0.23)
1/4-28	3.5 (0.40)
5/16-24	6.5 (0.73)
3/8-24	9.5 (1.07)
7/16-20	14.0 (1.58)
1/2-20	18.0 (2.03)

MINIMUM TARE TORQUE VALUE (Cont)

THREAD SIZE	MINIMUM TARE TORQUE INCH-POUNDS (NM)
9/16-18	24.0 (2.71)
5/8-18	32.0 (3.62)
3/4-16	50.0 (5.65)
7/8-14	70.0 (7.91)
1-12	90.0 (10.17)
1-1/18-12	117.0 (13.22)
1-1/4-14	143.0 (16.16)
1-3/8-12	170.0 (19.21)
1-1/2-12	197.0 (22.26)

d. Calculate assembly torque by adding standard torque to the measured tare torque.

NOTE

When the specified torque is provided in the applicable maintenance publication, the assembly torque is calculated by adding the specified torque to the measured tare torque.

Example:

- Type of bolt: MS9088
- Type of nut: MS14145
- Thread size of bolt: 0.2500-28
- Recommended shear load standard torque range: 30 to 40 inch-pounds (3.39 to 4.52 Nm)
- Measured tare torque of nut: 3.6 inch-pounds (0.41 Nm)
- Assembly torque equals 35 inch-pounds (3.95 Nm) + 3.6 inch-pounds (0.41 Nm) = 38.6 inch-pounds (4.36 Nm)

2-3. SELF-LOCKING NUTS

For self-locking hardware (nuts, nut plates, inserts, etc.), the total assembly torque is the measured tare torque plus the standard torque or specified torque. In all cases, sufficient torque shall be applied to engage the locking element and seat the fastener.

2-4. RECOMMENDED GRIP LENGTH CONTROL REQUIREMENTS FOR THREADED FASTENERS

CAUTION

UNLESS OTHERWISE STATED IN THE APPLICABLE MAINTENANCE PUBLICATION, THE INFORMATION IN PARAGRAPH 2-4, PARAGRAPH 2-5, AND PARAGRAPH 2-6 SHALL NOT APPLY TO THE ASSEMBLY OR INSTALLATION OF DRIVE SYSTEM COMPONENTS. THE DRIVE SYSTEM INCLUDES ALL SHAFTS, COUPLINGS, GEARBOXES, AND BEARING HANGERS USED IN THE TRANSMISSION OF ENGINE POWER TO THE MAIN AND TAIL ROTORS OR TO ANY REMOTE MOUNTED ACCESSORY. DRIVE SYSTEM COMPONENTS ARE IDENTIFIED WITH A PART NUMBER THAT HAS THE SECOND SET OF THREE DIGITS (UNIVERSAL CODE) OF -040-, -044-, -140-, -340-, -342-, -344-, -540-, -620-, -640-, -644-, OR -645-.

1. Because of variations due to tolerance buildup in structure and fasteners, the adjustment of bolt and screw grip length is necessary where grip oriented standard bolts and screws are used. This adjustment shall be accomplished by changing the grip length of the bolt or screw and/or by the use of standard (flat) washers in accordance with the requirements of paragraph 2-5 and paragraph 2-6. When the attachment hardware is changed from the original installation, a clearance check must be done to ensure an improper clearance or foul condition does not exist.

2-5. BOLTS AND SCREWS GRIP LENGTH

NOTE

Grip length changes for reasons other than specified as follows are not permitted. The following is not applicable to studs or fully threaded fasteners used in threaded holes.

1. For standard bolts and screws, grip lengths specified in the applicable maintenance or parts publication may be changed one grip length only (longer or shorter) for the following reasons only:

a. To preclude threads from being in the bearing area: The shanks of structural fasteners shall be such that no threads are in the bearing area where the sheet or fitting next to the nut is 0.093 inch (2.36 mm) or less in thickness. Where the sheet or fitting next to the nut is greater than 0.093 inch (2.36 mm), a maximum of one and one half threads, including thread run out, is permitted in the bearing area, provided that these threads do not exceed 25% of the thickness of the section having threads in the bearing area.

b. To prevent nuts from bottoming out on the bolt or screw shank: Nut threads, which engage the first incomplete thread next to the bolt shank of a grip oriented fastener, are considered to be bottomed out and are not acceptable.

NOTE

The following does not apply where thread protrusions cannot be seen. Examples include bolts or screws used with inserts, plate nuts, or barrel nuts. However, full nut thread engagement is required.

c. To prevent inadequate thread engagement: Unless otherwise stated in the maintenance publication, all threads of the nut shall be engaged and, as a minimum, the full round or chamfer plus one thread pitch on the bolt or screw shall protrude beyond the nut. Flat ended bolts or screws shall protrude a minimum of two thread pitches beyond the nut.

d. To prevent bolts or screws from bottoming out in blind threaded holes.

2. The provisions of the above do not apply to studs, fully threaded bolts, nor do they apply to bolts or screws used in conjunction with inserts, nut plates, or barrel nuts where thread protrusion cannot be seen.

2-6. PLAIN WASHER SUBSTITUTION REQUIREMENTS

CAUTION

DO NOT SUBSTITUTE WASHERS OF DIFFERENT PART NUMBERS. THE ADDITION OR SUBSTITUTION OF PLAIN, FLAT WASHERS TO JOINTS WHERE PARTICULAR WASHERS, I.E., CHAMFERED, CONCAVE, COUNTERBORED, DISSIMILAR METAL, KEYED, OR LOCK ARE SPECIFIED, IS NOT PERMITTED.

1. Additional plain, flat washers (thick or thin) of the same part number as those specified in the applicable maintenance or parts publication may be used when required for proper nut or cotter pin installation or to allow assembly torque to be attained. Not more than a total of three washers will be used, two under the nut for grip adjustment and one under the bolt or screw head for surface protection, unless otherwise specified by the applicable maintenance publications.

2. If the applicable maintenance publication does not specify the location of the washers, they shall be placed under the bolt or screw head or under the nut, whichever is being rotated during tightening, except where one washer, under the bolt or screw head is required for material protection.

2-7. SELECTION AND USE OF TORQUE WRENCH

WARNING

DO NOT EXCEED THE MAXIMUM ALLOWABLE TORQUE VALUE. OVERSTRESSING OF THE BOLT OR NUT MAY RESULT. IF THERE IS CONCERN THAT THE FASTENERS HAVE BEEN OVER-TORQUED, THE FASTENERS ARE TO BE REMOVED AND REPLACED. IN ADDITION, THE

ASSEMBLY OR COMPONENT BEING ASSEMBLED IS TO BE INSPECTED FOR DAMAGE THAT MAY HAVE BEEN CAUSED FROM THE OVER-TORQUE.

1. Selecting torque wrench:

a. The accuracy of most torque wrenches tends to decrease at the extremes of the torque range. The torque value being measured should be between the 30 and 80% points of the torque wrench range. For example, a 0-100 inch-pound torque wrench should be used to apply a torque of 30 to 80 inch-pounds (3.89 to 9.04 Nm).

b. The graduation increments of the torque wrench should not be greater than 10% of the torque value being measured.

c. The torque wrench should be calibrated in the same torque units as the specified torque for the fastener.

d. The selected torque wrench should be within the calibration period specified by the torque wrench manufacturer or applicable local regulations.

2. Force application on torque wrench grip — A smooth steady force must be applied to obtain an accurate torque value. Rapid or jerky force can result in error in the torque applied.

NOTE

Make sure to add bolt shank friction during step 3.

3. Tightening fastener on the head end — When a fastener is tightened from the head end, some of the torque applied is absorbed in turning the bolt in the hole. The amount of torque absorbed will vary. For this reason, bolt shank friction shall also be measured and added to the torque value.

a. If the fastener can be inserted through the hole and started into the nut by the fingers, use the specified torque range or standard torque range.

b. If the fastener is inserted through a hole that increases the tightening resistance, torque to the high limit of the torque range.

c. If the fastener is inserted into a threaded hole and if the hole thread length is more than the fastener diameter, use the provided torque range. If the hole thread length is less than the fastener diameter, use the lower limit of the torque range.

NOTE

Do not use the torque wrench to loosen fasteners.

4. Tightening new fastener — Tighten the fastener to the standard or specified torque value, as defined in paragraph 2-1. Loosen the fastener by backing off 1/2 turn. Retighten to desired assembly torque value. This aids in cleaning and smoothing the threads and results in more accurate torque.

5. Cotter pin or lockwire hole alignment — When tightening nuts that are secured by cotter pins or lockwire, stop the torque load just above the minimum assembly torque value. If required, additional tightening to the next hole alignment may be accomplished, provided the maximum assembly torque value is not exceeded.

6. Re-torque — When a re-torque is specified in the applicable maintenance publication or it is uncertain if a joint has been properly torqued, back off the faster 1 or 2 turns, then tighten to the required torque, as follows:

NOTE

Do not use the torque wrench to loosen fasteners.

a. Remove all torque from the fastener (loosening) until no preload is on the fastener.

b. Measure the tare torque (paragraph 2-2).

c. Determine the specified torque or standard torque, as applicable, and add the measured tare torque to determine the assembly torque.

d. Torque the fastener to this assembly torque value.

e. If the fastener is one in a multi-fastener pattern requiring a torque sequence, then all the fasteners will require re-torque.

7. Fastener thread condition — Threads should be clean and free from nicks, burrs, paint, grease, and oil to obtain the correct torque. However, there are some

applications specified in the maintenance publications where lubrication or anti-seize compound is used on the threads (OSN GEN-02-34).

NOTE

Do not loosen fasteners during a torque check.

8. Torque check — When a torque check is called out in the applicable maintenance publication, it should be done by torquing in the tightening direction. Do not loosen the fastener(s). The value applied should be one of the following:

a. If the assembly torque is known from when the fastener was originally installed (i.e., recorded in a logbook), then this is the assembly torque for torque check purposes.

b. If the original assembly torque was not recorded, then the assembly torque for torque check purposes would be the minimum specified torque or minimum standard torque, as applicable, plus the minimum acceptable tare torque (paragraph 2-2).

c. If during the application of the assembly torque as detailed step b, no motion is detected between the fasteners, then the joint is considered acceptable.

d. Joints that are having a torque check done as a part of a special inspection, as required after a specified number of flight hours, only need to be tightened. Looseness may occur until the components seat themselves and the fasteners simply need to be tightened. This is not cause for disassembly. However, the fastener(s) will have to be torque checked again at the same scheduled interval set for the first torque check until the assembly is completely seated. If a specific torque sequence is to be followed, as initially torqued, then this same sequence should be followed during the torque check. Some fasteners in the sequence may accept additional torque while others may not, this is acceptable.

e. Joints that have not retained torque will require disassembly and inspection. If the fastener(s) move, the assembly shall be rechecked for damage, corrosion, improper assembly, etc. If no problem is found, the fastener(s) may be re-torqued to the assembly torque value. In this case, the fastener(s) would have to be torque checked again at the same scheduled interval set for the first torque check.

NOTE

Do not use the torque wrench to back off fasteners.

9. Torque verification — Checking fasteners accurately to determine if they have been tightened to the required assembly torque is not possible. When there is doubt as to whether a fastener has been tightened to the correct torque value, the fastener should be backed off from 1/2 to 1 full turn and retightened to the correct torque value.

10. Tightening chilled or heated fastener — Do not tighten a chilled or heated fastener until it has returned to room temperature. A heated fastener may loosen when it cools. A chilled fastener may become overstressed when it warms.

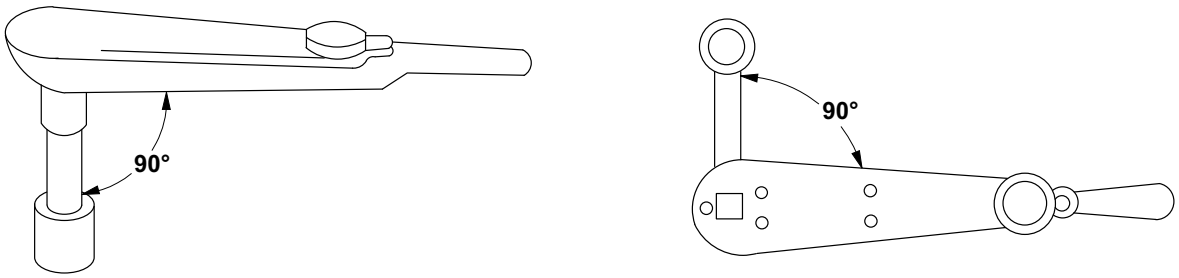
11. Tightening fastener on part with a slow permanent set — Hold desired torque until the part is seated.

NOTE

Do not use the torque wrench to backoff fasteners.

12. Tightening fasteners in a series — If fasteners are to be torqued in a series, select a median torque value within the required assembly torque range. If some fasteners are tightened to the minimum value and others to the maximum, force is not distributed evenly. Unequal distribution of force may cause fastener failure. Do not apply final assembly torque during the first drawdown. After the median torque value is applied, loosen fasteners one at a time and apply final torque. Tightening in a diametrically opposite (staggered) sequence is desirable in most cases.

13. Tightening fasteners with concentric attachment — The use of a concentric attachment, which operates concentrically with the torque wrench drive square, presents no particular problem. The torque value applied is the torque value indicated (Figure 2-1).



NOTE

Applied and indicated torque values are the same.

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Figure 2-1. Torque Wrench Concentric Type Attachments

14. Tightening fastener with nonconcentric attachment — The use of a nonconcentric attachment, which does not operate concentrically with the drive square, presents a mathematical problem. This type of attachment affects the lever length. The torque value applied is not the torque value indicated. It is necessary to calculate the effect of the lever length to determine the correct indicated torque value (Figure 2-2).

15. Force application when using nonconcentric attachment.

a. The point of force applied on a flexible beam-type torque wrench pivoted grip will not affect the calculated torque applied to the fastener.

b. The point of force applied on rigid frame and audible indicating torque wrench grips will affect the calculated torque applied to the fastener. Refer to Figure 2-3 for proper and improper application of force and their effect.

2-8. MISCELLANEOUS TORQUING INFORMATION

1. The recommended torque range for worm gear clamps on oil, fuel, or coolant hose is 20 to 30 inch-pounds (2.26 to 3.39 Nm).

2. The recommended torque range for 0.1900-32 thread size bolts or screws mounting loop clamps is 12 to 15 inch-pounds (1.36 to 1.69 Nm).

3. The final installation torque for all non-metallic fitting nuts can be achieved by tightening the nut past the point of sharp torque rise, plus the following:

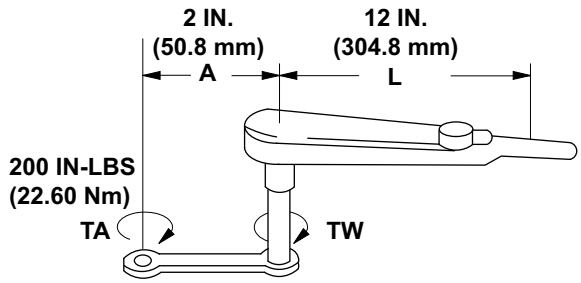
- For pipe threads: 1/4 turn (90°)
- For screw threads: 1/6 turn (60°) (one hex flat)

FORMULA TO OBTAIN CORRECT INDICATED TORQUE VALUE WHEN USING NONCONCENTRIC ATTACHMENT

$$TW = \frac{(TA) \times (L)}{(L) \pm (A)}$$

TW = INDICATED TORQUE VALUE ON TORQUE WRENCH
TA = ACTUAL TORQUE VALUE APPLIED TO FASTENER
L = LEVEL LENGTH
A = ATTACHMENT LENGTH

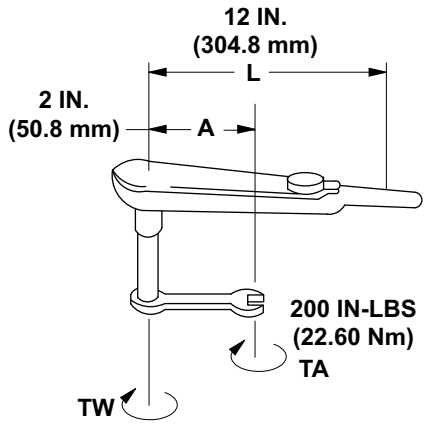
FORMULA



$$TW = \frac{200 \times 12}{12 + 2} = \frac{2400}{14} = 171.4 \text{ IN-LBS } (19.37 \text{ Nm})$$

RESULTS: FASTENER TORQUED 200 IN-LBS (22.60 Nm) WHEN WRENCH INDICATES 171.4 IN-LBS (19.37 Nm)

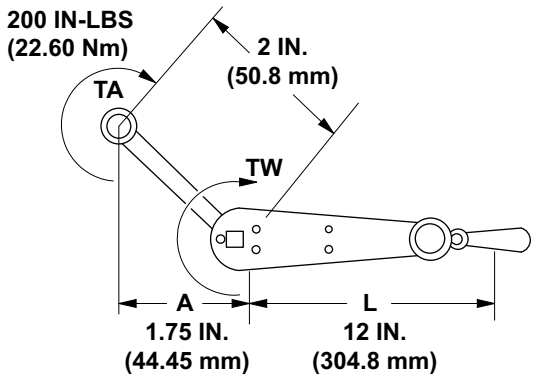
EXAMPLE 1



$$TW = \frac{200 \times 12}{12 - 2} = \frac{2400}{10} = 240 \text{ IN-LBS } (27.12 \text{ Nm})$$

RESULTS: FASTENER TORQUED 200 IN-LBS (22.60 Nm) WHEN WRENCH INDICATES 240 IN-LBS (27.12 Nm)

EXAMPLE 2



$$TW = \frac{200 \times 12}{12 + 1.75} = \frac{2400}{13.75} = 174.5 \text{ IN-LBS } (19.72 \text{ Nm})$$

RESULTS: FASTENER TORQUED 200 IN-LBS (22.60 Nm) WHEN WRENCH INDICATES 174.5 IN-LBS (19.72 Nm)

EXAMPLE 3

ALL_SPM_02_0002

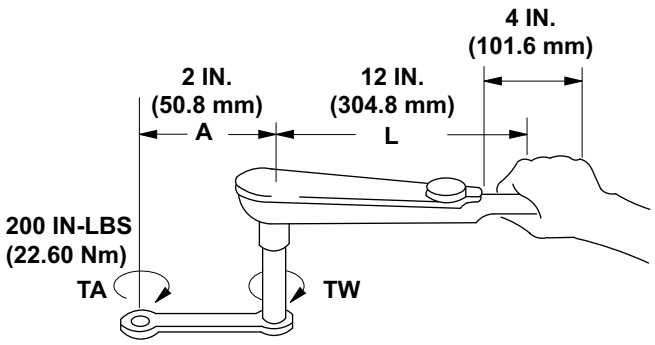
Figure 2-2. Torque Wrench Nonconcentric Type Attachments

FORMULA TO OBTAIN CORRECT INDICATED TORQUE VALUE WHEN USING NONCONCENTRIC ATTACHMENT

$$TW = \frac{(TA) \times (L)}{(L) \pm (A)}$$

TW = INDICATED TORQUE VALUE ON TORQUE WRENCH
TA = ACTUAL TORQUE VALUE APPLIED TO FASTENER
L = LEVEL LENGTH
A = ATTACHMENT LENGTH

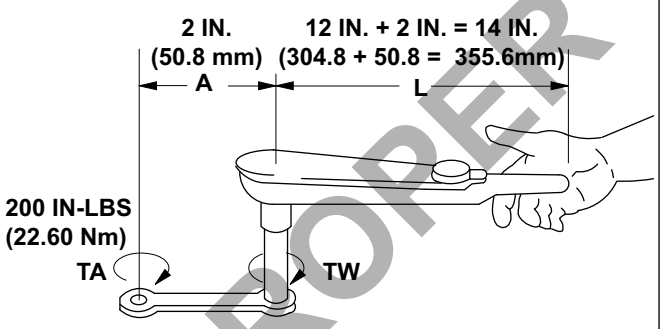
FORMULA



$$TW = \frac{200 \times 12}{12 + 2} = \frac{2400}{14} = 171.4 \text{ IN-LBS } (19.37 \text{ Nm})$$

RESULTS: FASTENER TORQUED 200 IN-LBS (22.60 Nm) WHEN WRENCH INDICATES 171.4 IN-LBS (19.37 Nm)

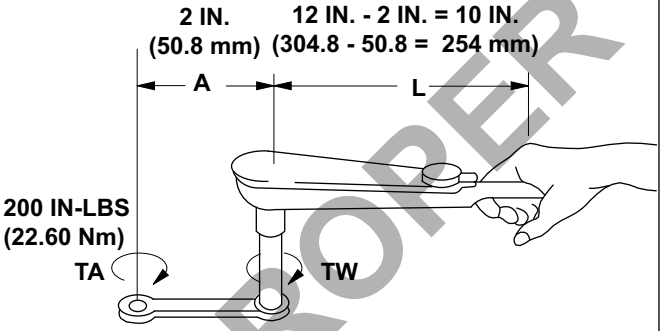
PROPER APPLICATION OF FORCE EXAMPLE 1



$$TW = \frac{200 \times (12 + 2)}{(12 + 2) + 2} = \frac{2800}{16} = 175 \text{ IN-LBS } (19.77 \text{ Nm})$$

RESULTS: FASTENER TORQUED 200 IN-LBS (22.60 Nm) WHEN WRENCH INDICATES 175 IN-LBS (19.77 Nm)

IMPROPER CALCULATION AND APPLICATION OF FORCE EXAMPLE 2



$$TW = \frac{200 \times (12 - 2)}{(12 - 2) + 2} = \frac{2000}{12} = 166.6 \text{ IN-LBS } (18.82 \text{ Nm})$$

RESULTS: FASTENER TORQUED 200 IN-LBS (22.60 Nm) WHEN WRENCH INDICATES 166.6 IN-LBS (18.82 Nm)

IMPROPER CALCULATION AND APPLICATION OF FORCE EXAMPLE 3

ALL_SPM_02_0003

Figure 2-3. Affect of Applied Force to Rigid Frame and Audible Indicating Torque Wrenches Using Nonconcentric Attachments

Table 2-1. Standard Torque for Nuts MS17825 and MS17826 on 125 KSI Minimum Ultimate Tensile Fasteners

THREAD SIZE	TORQUE RANGE			
	SHEAR		TENSION	
	INCH-POUNDS (NM)	FOOT-POUNDS (NM	INCH-POUNDS (NM)	FOOT-POUNDS (NM
0.1900-32 (10-32)	7-12 (0.8-1.4)		12-15 (1.4-1.7)	
0.2500-28	25-35 (2.8-4.0)		30-40 (3.4-4.5)	
0.3125-24	50-70 (5.6-7.9)		60-85 (6.8-9.6)	
0.3750-24	70-90 (7.9-10.2)		95-110 (10.7-12.4)	
0.4375-20	110-150 (12.4-16.9)		270-300 (30.5-33.9)	
0.5000-20	150-200 (16.9-22.6)			24-34 (32.5-46.1)
0.5625-18	200-300 (22.6-33.9)			40-50 (54.2-67.8)
0.6250-18	300-420 (33.9-47.5)			55-65 (74.6-88.1)
0.7500-16		45-62 (61.0-84.1)		108-125 (146.4-169.5)
0.8750-14		79-96 (107.1-130.2)		125-150 (169.5-203.4)
1.0000-12		125-150 (169.5-203.4)		183-275 (248.1-372.9)
1.1250-12		208-292 (282.0-395.9)		250-350 (339.0-474.5)
1.2500-12		292-375 (395.9-508.4)		450-500 (610.1-677.9)
NUTS	MS17826		MS17825	
125 KSI BOLTS AND SCREWS	AN3 through 20 AN21 through 37 AN42 through 49 AN173 through 186	AN502 AN503 AN525 MS9088 through 94	MS20073 through 81 MS21091 MS24694 MS27039	NAS428 NAS1297

NOTES:

1. It is recommended that paragraph 2-1 through paragraph 2-8 be read and understood prior to tightening any threaded fasteners.
2. The standard torque values shown apply to any combination of bolt and nut shown unless otherwise specified. They are recommended for dry, coated or plated, unlubricated threads and are in addition to the actual locking torque (tare torque) value of each self-locking nut.
3. **To determine the Total Assembly Torque, add the Standard Torque from table to the Actual Measured Locking Torque (Tare Torque) of the nut.**
   Total Assembly Torque = Standard Torque (from table) + Measured Locking Torque (Tare Torque) of nut.

Table 2-2. Standard Torque for Specified Nuts on 125 KSI Minimum Ultimate Tensile Fasteners

THREAD SIZE	TORQUE RANGE			
	SHEAR		TENSION	
	INCH-POUNDS (NM)	FOOT-POUNDS (NM)	INCH-POUNDS (NM)	FOOT-POUNDS (NM)
0.1640-32 (8-32)	7-9 (0.8-1.0)		12-15 (1.4-1.7)	
0.1900-32 (10-32)	12-15 (1.4-1.7)		20-25 (2.3-2.8)	
0.2500-28	30-40 (3.4-4.5)		50-70 (5.6-7.9)	
0.3125-24	60-85 (6.8-9.6)		100-140 (11.3-15.8)	
0.3750-24	95-110 (10.7-12.4)		160-190 (18.1-21.5)	
0.4375-20	270-300 (30.5-33.9)			37-42 (50.2-56.9)
0.5000-20		24-34 (32.5-46.1)		40-58 (54.2-78.6)
0.5625-18		40-50 (54.2-67.8)		66-83 (89.5-112.5)
0.6250-18		55-65 (74.6-88.1)		91-108 (123.4-146.4)
0.7500-16		108-125 (146.4-169.5)		191-208 (259.0-282.0)
0.8750-14		125-150 (169.5-203.4)		208-250 (282.0-339.0)
1.0000-12		183-275 (248.1-372.9)		308-458 (417.6-621.0)
1.1250-12		250-350 (339.0-474.5)		416-583 (564.0-790.4)
1.2500-12		450-500 (610.1-677.9)		750-916 (1016.9-1241.9)
NUTS	AN316 AN320 MS14145 MS21025 MS21083 NAS1022	NAS1068 NAS1789 80-026 90-002 90-003 90-033	AN256 AN310 AN315 MS14144 MS20500 MS21043 MS21044 MS21047 through 49 MS21051 through 56 MS21058 through 62 MS21069 through 76 MS21080 MS21083 MS21086 MS21225 NAS509	NAS679 NAS1021 NAS1023 NAS1031 NAS1033 NAS1067 NAS1473 NAS1474 NAS1766 NAS1791 NAS1792 NAS1793 NAS1870 90-099 90-100 90-105
125 KSI BOLTS AND SCREWS	AN3 through 20 AN21 through 37 AN42 through 49 AN173 through 186	AN502 AN503 AN525 MS9088 through 94	MS20033 through 46 MS20073 through 81 MS21091 MS24694	MS27039 NAS428 NAS1003 through 20 NAS1297

Table 2-2. Standard Torque for Specified Nuts on 125 KSI Minimum Ultimate Tensile Fasteners (Cont)

NOTES:

1. It is recommended that paragraph 2-1 through paragraph 2-8 be read and understood prior to tightening any threaded fasteners.
2. The standard torque values shown apply to any combination of bolt and nut shown unless otherwise specified. They are recommended for dry, coated or plated, unlubricated threads and are in addition to the actual locking torque (Tare Torque) value of each self-locking nut.
3. **To determine the Total Assembly Torque, add the Standard Torque from table to the Actual Measured Locking Torque (Tare Torque) of the nut.**
   Total Assembly Torque = Standard Torque (from table) + Measured Locking Torque (Tare Torque) of nut.
4. Fasteners listed in higher tensile categories (Table 2-2 through Table 2-5) may be used in conjunction with fasteners listed in lower tensile categories (Table 2-2 through Table 2-5). The lower category recommended Standard Torque is to be used to calculate the Total Assembly Torque (Note 3), regardless of the bolt tensile or nut strength relationship.

Table 2-3. Standard Torque for Specified Nuts on 160 KSI Minimum Ultimate Tensile Fasteners

THREAD SIZE	TORQUE RANGE			
	SHEAR		TENSION	
	INCH-POUNDS (NM)	FOOT-POUNDS (NM)	INCH-POUNDS (NM)	FOOT-POUNDS (NM)
0.0860-56 (2-56)	2-3 (0.2-0.3)			
0.1120-40 (4-40)	4-5 (0.5-0.6)			
0.1380-32 (6-32)	6-8 (0.7-0.9)			
0.1640-32 (8-32)	12-16 (1.4-1.8)			
0.1900-32 (10-32)	20-25 (2.3-2.8)		30-40 (3.4-4.5)	
0.2500-28	50-70 (5.6-7.9)		75-95 (8.5-10.7)	
0.3125-24	100-140 (11.3-15.8)		120-160 (13.6-18.1)	
0.3750-24	160-190 (18.1-21.5)			25-28 (33.9-38.0)
0.4375-20		37-42 (50.2-56.9)		39-43 (52.9-58.3)
0.5000-20		40-58 (54.2-78.6)		53-71 (71.9-96.3)
0.5625-18		66-83 (89.5-112.5)		83-100 (112.5-135.6)
0.6250-18		91-108 (123.4-146.4)		116-133 (157.3-180.3)
0.7500-16		191-208 (259.0-282.0)		200-216 (271.2-292.9)
0.8750-14		208-250 (282.0-339.0)		333-375 (451.5-508.4)
1.0000-12		308-458 (417.6-621.0)		433-583 (587.1-790.4)
1.1250-12		416-583 (564.0-790.4)		691-858 (936.9-1163.3)
1.2500-12		750-916 (1016.9-1241.9)		1441-1608 (1953.7-2180.2)

Table 2-3. Standard Torque for Specified Nuts on 160 KSI Minimum Ultimate Tensile Fasteners (Cont)

NUTS	90-099	MS21086	50-048	NAS1771
	90-100	MS21225	90-099	NAS1772
	AN256	NAS509	MS21042	NAS1773
	AN310	NAS679	NAS577	NAS1778
	AN315	NAS1021	NAS1291	NAS1805
	MS14144	NAS1031	NAS1770	
	MS20500	NAS1033		
	MS21043	NAS1067		
	MS21044	NAS1473		
	MS21047 through 49	NAS1474		
	MS21051 through 56	NAS1766		
	MS21058 through 62	NAS1791		
	MS21069 through 76	NAS1792		
	MS21080	NAS1793		
	MS21083	NAS1870		
160 KSI BOLTS, SCREWS AND STUDS	20-057	120-266	NAS1101	NAS1580
	20-058	120-267	NAS1102	NAS1801
	20-092	120-268	NAS1103 through 20	NAS1802
	20-099	120-269	NAS1121 through 28	NAS6203 through 20
	20-100	120-270	NAS1131 through 38	NAS6303 through 20
	20-113	120-271	NAS1141 through 48	NAS6403 through 20
	20-114	120-276	NAS1151 through 58	NAS6603 through 20
	20-116	120-278	NAS1161 through 68	NAS6703 through 20
	20-122	M87114/1	NAS1171 through 78	NAS6803 through 20
	50-047	M87114/2	NAS1181 through 88	NAS7103 through 16
	120-142 △6	M87114/3	NAS1189	NAS7203 through 16
	120-184	MS16997 through 98	NAS1190	NAS7303 through 16
	120-186	MS20004 through 24	NAS1191	NAS7500 through 16
	120-212	MS27576	NAS1202 through 10	NAS8100 through 06
	120-220	NAS144 through 158	NAS1218	NAS8200 through 06
	120-225	NAS333 through 340	NAS1223 through 35	NAS8702 through 16
	120-259	NAS464	NAS1266 through 70	NAS8802 through 16
	120-261	NAS517	NAS1303 through 20	NAS9101 through 06
	120-262	NAS583 through 590	NAS1351 △5	NAS9201 through 06
	120-264	NAS623	NAS1352 △5	
	120-265	NAS673 through 678	NAS1402 through 06	

NOTES:

1. It is recommended that paragraph 2-1 through paragraph 2-8 be read and understood prior to tightening any threaded fasteners.
2. The standard torque values shown apply to any combination of bolt and nut shown unless otherwise specified. They are recommended for dry, coated or plated, unlubricated threads and are in addition to the actual locking torque (tare torque) value of each self-locking nut.
3. **To determine the Total Assembly Torque, add the Standard Torque from table to the Actual Measured Locking Torque (Tare Torque) of the nut.**
   Total Assembly Torque = Standard Torque (from table) + Measured Locking Torque (Tare Torque) of nut.
4. Fasteners listed in higher tensile categories (Table 2-2 through Table 2-5) may be used in conjunction with fasteners listed in lower tensile categories (Table 2-2 through Table 2-5). The lower category recommended standard torque is to be used to calculate the Total Assembly Torque (Note 3), regardless of the bolt tensile or nut strength relationship.

Table 2-3. Standard Torque for Specified Nuts on 160 KSI Minimum Ultimate Tensile Fasteners (Cont)

NOTES (CONT):

5 A-286 CRES and alloy steel only.

6 120-142 shall use the shear values, regardless of nut type.

Table 2-4. Standard Torque for Specified Nuts on 180 KSI Minimum Ultimate Tensile Fasteners

THREAD SIZE	TORQUE RANGE			
	SHEAR		TENSION	
	INCH-POUNDS (NM)	FOOT-POUNDS (NM)	INCH-POUNDS (NM)	FOOT-POUNDS (NM)
0.1900-32 (10-32)	22-28 (2.5-3.2)		34-45 (3.8-5.1)	
0.2500-28	56-79 (6.3-8.9)		84-107 (9.5-12.1)	
0.3125-24	112-158 (12.7-17.9)		135-180 (15.3-20.3)	
0.3750-24	180-214 (20.3-24.2)			28-32 (38.0-43.4)
0.4375-20		42-47 (56.9-63.7)		44-48 (59.7-65.1)
0.5000-20		45-54 (61.0-73.2)		60-80 (81.3-108.5)
0.5625-18		74-93 (100.3-126.1)		93-112 (126.1-151.9)
0.6250-18		102-122 (138.3-165.4)		130-150 (176.3-203.4)
0.7500-16		215-234 (291.5-317.3)		225-243 (305.1-329.5)
0.8750-14		234-281 (317.3-381.0)		375-422 (508.4-572.2)
1.0000-12		346-515 (469.1-698.2)		487-656 (660.3-889.4)
1.1250-12		468-656 (634.5-889.4)		777-965 (1053.5-1308.4)
1.2500-12		844-1030 (1144.3-1396.5)		1621-1809 (2197.8-2452.7)
NUTS	MS21042 NAS577	NAS1291	MS14156 MS21133 EB – ( ) (ESNA)	LH 3830 (ESNA) 48FLW (SPS) NAS1805
180 KSI BOLTS AND STUDS	20-065 20-069 20-087 20-096 20-102	20-104 20-105 20-109 20-118 120-064 △5	120-244 MS14157 MS21134 MS21250 NAS624 through 644	NAS1972 through 80 NAS2803 through 10

NOTES:

1. It is recommended that paragraph 2-1 through paragraph 2-8 be read and understood prior to tightening any threaded fasteners.
2. The standard torque values shown apply to any combination of bolt and nut shown unless otherwise specified. They are recommended for dry, coated or plated, unlubricated threads and are in addition to the actual locking torque (tare torque) value of each self-locking nut.
3. **To determine the Total Assembly Torque, add the Standard Torque from table to the Actual Measured Locking Torque (Tare Torque) of the nut.**
   Total Assembly Torque = Standard Torque (from table) + Measured Locking Torque (Tare Torque) of nut.
4. Fasteners listed in higher tensile categories (Table 2-2 through Table 2-5) may be used in conjunction with fasteners listed in lower tensile categories (Table 2-2 through Table 2-5). The lower category recommended standard torque is to be used to calculate the total assembly torque (Note 3), regardless of the bolt tensile or nut strength relationship.

△5 120-064 shall use the shear values, regardless of nut type.

Table 2-5. Standard Torque for Specified Nuts on 220 KSI Minimum Ultimate Tensile Fasteners

THREAD SIZE	TORQUE RANGE			
	SHEAR		TENSION	
	INCH-POUNDS (NM)	FOOT-POUNDS (NM)	INCH-POUNDS (NM)	FOOT-POUNDS (NM)
0.1900-32 (10-32)	28-34 (3.2-3.8)		41-55 (4.6-6.2)	
0.2500-28	69-96 (7.8-10.8)		103-131 (11.6-14.8)	
0.3125-24	138-192 (15.6-21.7)		165-220 (18.6-24.9)	
0.3750-24	220-261 (24.9-29.5)			34-38 (46.1-51.5)
0.4375-20		51-58 (69.1-78.6)		54-59 (73.2-80.0)
0.5000-20		55-80 (74.6-108.5)		73-98 (99.0-132.9)
0.5625-18		91-114 (123.4-154.6)		114-138 (154.6-187.1)
0.6250-18		125-148 (169.5-200.7)		160-183 (216.9-248.1)
0.7500-16		263-286 (356.6-387.8)		275-297 (372.9-402.7)
0.8750-14		286-344 (387.8-466.4)		458-516 (621.0-699.6)
1.0000-12		424-630 (574.9-854.2)		595-802 (806.7-1087.4)
1.1250-12		572-802 (775.5-1087.4)		950-1180 (1288.0-1599.9)
1.2500-12		1031-1260 (1397.9-1708.3)		1981-2211 (2685.9-2997.7)
NUTS	LH6520 (ESNA) 90-101	NAS1805	MS14164 MS21084 NAS1758 FN22 M (SPS)	LH3393 (ESNA) LH6422T (ESNA) LHEB220 (ESNA) MS14182
220 KSI BOLTS	20-071 20-088 20-089	20-097 20-098 20-101	20-106 20-112 MS14163	MS21297 MS14181

NOTES:

1. It is recommended that paragraph 2-1 through paragraph 2-8 be read and understood prior to tightening any threaded fasteners.
2. The standard torque values shown apply to any combination of bolt and nut shown unless otherwise specified. They are recommended for dry, coated or plated, unlubricated threads and are in addition to the actual locking torque (tare torque) value of each self-locking nut.
3. **To determine the Total Assembly Torque, add the Standard Torque from table to the Actual Measured Locking Torque (Tare Torque) of the nut.**
   Total Assembly Torque = Standard Torque (from table) + Measured Locking Torque (Tare Torque) of nut.
4. Fasteners listed in higher tensile categories (Table 2-2 through Table 2-5) may be used in conjunction with fasteners listed in lower tensile categories (Table 2-2 through Table 2-5). The lower category recommended standard torque is to be used to calculate the total assembly torque (Note 3), regardless of the bolt tensile or nut strength relationship.

Table 2-6. Standard Torque for Steel and CRES Nuts on <125 KSI Minimum Ultimate Tensile Fasteners

THREAD SIZE	TORQUE RANGE
	INCH-POUNDS (NM)
0.1900-32 (10-32)	4-6 (0.5-0.7)
0.2500-28	10-15 (1.1-1.7)
0.3125-24	21-31 (2.4-3.5)
0.3750-24	34-40 (3.8-4.5)
0.4375-20	97-108 (11.0-12.2)
0.5000-20	103-147 (11.6-16.6)

NOTES:

1. It is recommended that paragraph 2-1 through paragraph 2-8 be read and understood prior to tightening any threaded fasteners.
2. The standard torque values shown apply to any combination of bolt and nut shown unless otherwise specified. They are recommended for dry, coated or plated, unlubricated threads and are in addition to the actual locking torque (tare torque) value of each self-locking nut.
3. **To determine the Total Assembly Torque, add the Standard Torque from table to the Actual Measured Locking Torque (Tare Torque) of the nut.**
   Total Assembly Torque = Standard Torque (from table) + Measured Locking Torque (Tare Torque) of nut.

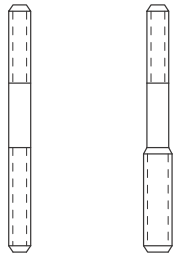
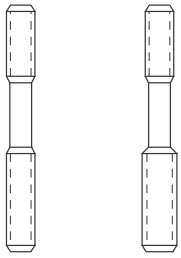
Table 2-7. Standard Torque for Non-Structural Small Diameter Fasteners

THREAD SIZE	TORQUE RANGE	
	MINIMUM	MAXIMUM
	INCH-POUNDS (NM)	INCH-POUNDS (NM)
0860-56 (#2)	0.5 (0.1)	1 (0.1)
.1120-40 (#4)	1 (0.1)	2 (0.2)
.1380-32 (#6)	2 (0.2)	6 (0.7)
.1640-32 (#8)	4 (0.5)	8 (0.9)

NOTES:

1. It is recommended that paragraph 2-1 through paragraph 2-8 be read and understood prior to tightening any threaded fasteners.
2. The standard torque values listed are recommended fastener torques for non-structural applications such as attachment of clips, trim, and flange mount connectors. They are applicable for aluminum, brass, CRES, and steel fasteners in wet or dry installations. These torques will not induce significant preload in the fastener. Torques are the minimum needed to keep the fastener from becoming loose in the joint. These values should be added to the actual measured locking torque of the nut.
3. **To determine the Total Assembly Torque, add the Standard Torque from table to the Actual Measured Locking Torque (Tare Torque) of the nut.**
   Total Assembly Torque = Standard Torque (from table) + Measured Locking Torque (Tare Torque) of nut.

Table 2-8. Recommended Installation Torque for Threaded Studs

THREAD SIZE		TORQUE RANGE	
			
NUT END	**STUD END**	**TYPE A**	**TYPE B**
0.1900-32 (10-32)	0.1900-24 (10-24)		30-40 in-lb (3.4-4.5 Nm)
0.1900-32 (10-32)	0.2500-20	30-40 in-lb (3.4-4.5 Nm)	30-40 in-lb (3.4-4.5 Nm)
0.2500-28	0.2500-20	50-95 in-lb (5.6-10.7 Nm)	50-70 in-lb (5.6-7.9 Nm)
0.2500-28	0.3125-18	50-110 in-lb (5.6-12.4 Nm)	50-80 in-lb (5.6-9.0 Nm)
0.3125-24	0.3125-18	100-225 in-lb (11.3-25.4 Nm)	100-130 in-lb (11.3-14.7 Nm)
0.3125-24	0.3750-16	100-240 in-lb (11.3-27.1 Nm)	100-160 in-lb (11.3-18.1 Nm)
0.3750-24	0.3750-16	175-375 in-lb (19.8-42.4 Nm)	175-250 in-lb (19.8-28.2 Nm)
0.3750-24	0.4375-14	175-475 in-lb (19.8-53.7 Nm)	175-325 in-lb (19.8-36.7 Nm)
0.4375-20	0.4375-14	20-54 ft-lb (27.1-73.2 Nm)	250-400 in-lb (28.2-45.2 Nm)
0.4375-20	0.5000-13	20-60 ft-lb (27.1-81.3 Nm)	250-525 in-lb (28.2-59.3 Nm)
0.5000-20	0.5000-13	33-83 ft-lb (44.7-112.5 Nm)	33-58 ft-lb (44.7-78.6 Nm)
0.5000-20	0.5625-12	33-95 ft-lb (44.7-128.8 Nm)	33-70 ft-lb (44.7-94.9 Nm)
0.5625-18	0.5625-12	50-120 ft-lb (67.8-162.7 Nm)	41-87 ft-lb (55.6-118.0 Nm)
0.5625-18	0.6250-11	50-137 ft-lb (67.8-185.7 Nm)	50-95 ft-lb (67.8-128.8)
0.6250-18	0.6250-11	75-166 ft-lb (101.7-225.1 Nm)	58-116 ft-lb (78.6-157.3 Nm)
0.6250-18	0.6875-11	75-200 ft-lb (101.7-271.2 Nm)	75-141 ft-lb (101.7-191.2 Nm)

NOTES:

1. It is recommended that paragraph 2-1 through paragraph 2-8 be read and understood prior to tightening any threaded fasteners.
2. **Installation torque shown in the table is the actual torque measured when installing the threaded stud into the parent material (i.e., gearbox case, etc.).**
3. Threaded stud —
   Type A: The grip portion of the stud is approximately the same diameter as the pitch diameter of the nut end thread.
   Type B: The grip portion of the stud is less than the minor diameter of the nut end thread.
4. For nut standard torque, refer to Table 2-2, as applicable.

Table 2-9. Recommended Installation Torque for Flared Fitting Nuts

TUBE SIZE	FLARED FITTING NUTS (AN818) ⚠1		HOSE END FITTINGS AND HOSE ASSEMBLY (MS28740 AND MS28759)	RIGID TUBE CONNECTOR		
	ALUMINUM TUBING FLARE (MS33583 OR MS33584)	STEEL TUBING FLARE (MS33584)		DASH NO.	STEEL TUBING NAS 594 AND 596	ALUMINUM TUBING NAS 591 AND 593
3/16	30-45 in-lb (3.4-5.1 Nm)	90-100 in-lb (10.2-11.3 Nm)	70-100 in-lb (7.9-11.3 Nm)			
1/4	40-65 in-lb (4.5-7.3 Nm)	135-150 in-lb (15.3-16.9 Nm)	70-120 in-lb (7.9-13.6 Nm)	4	60-96 in-lb (6.8-10.8 Nm)	48-96 in-lb (5.4-10.8 Nm)
5/16	60-80 in-lb (6.8-9.0 Nm)	180-200 in-lb (20.3-22.6 Nm)	85-180 in-lb (9.6-20.3 Nm)	5	66-108 in-lb (7.5-12.2 Nm)	60-108 in-lb (6.8-12.2 Nm)
3/8	75-125 in-lb (8.5-14.1 Nm)	270-300 in-lb (30.5-33.9 Nm)	100-250 in-lb (11.3-28.2 Nm)	6	72-120 in-lb (8.1-13.6 Nm)	72-120 in-lb (8.1-13.6 Nm)
1/2	150-250 in-lb (16.9-28.2 Nm)	450-500 in-lb (50.8-56.5 Nm)	210-420 in-lb (23.7-47.5 Nm)	8	144-232 in-lb (16.3-26.2 Nm)	120-216 in-lb (13.6-24.4 Nm)
5/8	200-350 in-lb (22.6-39.5 Nm)	54-58 ft-lb (73.2-78.6 Nm)	300-480 in-lb (33.9-54.2 Nm)	10	204-360 in-lb (23.0-40.7 Nm)	144-360 in-lb (16.3-40.7 Nm)
3/4	300-500 in-lb (33.9-56.5 Nm)	75-83 ft-lb (101.7-112.5 Nm)	41-70 ft-lb (55.6-94.9 Nm)	12	300-540 in-lb (33.9-61.0 Nm)	216-540 in-lb (24.4-61.0 Nm)
1	41-58 ft-lb (55.6-78.6 Nm)	100-116 ft-lb (135.6-157.3 Nm)	58-95 ft-lb (78.6-128.8 Nm)	16	42-58 ft-lb (56.9-78.6 Nm)	480-696 in-lb (54.2-78.6 Nm)
1-1/4	50-75 ft-lb (67.8-101.7 Nm)			20	50 -75 ft-lb (67.8-101.7 Nm)	50-75 ft-lb (67.8-101.7 Nm)
1-1/2	50-75 ft-lb (67.8-101.7 Nm)			24	50-75 ft-lb (67.8-101.7 Nm)	50-75 ft-lb (67.8-101.7 Nm)
1-3/4				38	60-90 ft-lb (81.3-122.0 Nm)	62-90 ft-lb (84.1-122.0 Nm)
2				32	75-110 ft-lb (101.7-149.1 Nm)	75-100 ft-lb (101.7-135.6 Nm)
2-1/2				40	150-175 ft-lb (203.4-237.3 Nm)	110-150 ft-lb (149.1-203.4 Nm)
3				48	150-175 ft-lb (203.4-237.3 Nm)	
4				64	200-225 ft-lb (271.2-305.1 Nm)	

NOTES:

⚠1 For flared nuts installed with conical seal washers (AS4824 or 110-144), apply the recommended installation torque, wait 10 to 15 seconds, then again apply the same torque value to the nut. Refer to the applicable Illustrated Parts Breakdown (IPB) manual to make sure the washer installation is authorized on the fitting (Information Letter GEN-07-108).

2. Refer to Table 2-10 for flareless fitting nuts.

Table 2-10. Recommended Installation Torque for Flareless Fitting Nuts

INSTALLATION WRENCH TORQUE, FLARELESS FITTINGS, AS 21922 BITE TYPE SLEEVE				
TUBE OD	TUBE WALL THICKNESS	ALUMINUM FITTING, ALUMINUM TUBE	STEEL FITTING, ANNEALED CRES TUBE	STEEL OR TITANIUM FITTING, CRES 1/8 HARD TUBE
		△1 INCH-POUNDS (NM)	△1 INCH-POUNDS (NM)	△1 INCH-POUNDS (NM)
.125	.012			55 (6.2)
.188	.016			100 (11.3)
.188	.020		100 (11.3)	
.188	.028	80 (9.0)		
.250	.020		140 (15.8)	140 (15.8)
.250	.028	110 (12.4)	140 (15.8)	
.312	.020		190 (21.5)	190 (21.5)
.312	.028	140 (15.8)	190 (21.5)	
.375	.028	170 (19.2)		270 (30.5)
.375	.035		270 (30.5)	
.500	.028	280 (31.6)		
.500	.035	360 (40.7)		500 (56.5)
.500	.042		500 (56.5)	
.625	.028	360 (40.7)		
.625	.035	415 (46.9)		
.625	.042			700 (79.1)
.625	.058		700 (79.1)	
.750	.028	450 (50.8)		
.750	.049	450 (50.8)		
.750	.058			900 (101.7)
.750	.065		900 (101.7)	
1.000	.035	750 (84.7)		
1.000	.049	800 (90.4)		
1.000	.065	1200 (135.6)		1200 (135.6)
1.000	.083		1200 (135.6)	

NOTE:

Refer to next page for notes.

Table 2-10. Recommended Installation Torque for Flareless Fitting Nuts (Cont)

INSTALLATION WRENCH TORQUE, FLARELESS FITTINGS, NAS 1760 FITTING ENDS,		
TUBE OD	ALUMINUM FITTING	STEEL AND TITANIUM FITTING
	⚠1 INCH-POUNDS (NM)	⚠1 INCH-POUNDS (NM)
.125	---	55 (6.2)
.188	80 (9.0)	100 (11.3)
.250	110 (12.4)	140 (15.8)
.312	140 (15.8)	190 (21.5)
.375	170 (19.2)	270 (30.5)
.500	280 (31.6)	500 (56.5)
.625	360 (40.7)	700 (79.1)
.750	450 (50.8)	900 (101.7)
1.000	750 (84.7)	1200 (135.6)
1.250	900 (101.7)	1600 (180.8)
1.500	900 (101.7)	2000 (226.0)
2.000	---	2000 (226.0)

NOTES:

⚠1 Torque values shown may be altered ±5%.

2. Flareless fitting nuts:

a. Nut turn method: When standard open end wrenches are used for assembly, the final installation torque for flareless tubing connections can be achieved by tightening the nut 1/6 to 1/3 turns (1 to 2 hex flats) past the point of sharp torque rise.

b. Torque method: When a torque wrench is used for assembly, the tightening torque for AS21922 bite type and NAS1760 style sleeves shall be in accordance with table.

c. Leaking joints: After installation, if leakage is encountered at the fitting joint, loosen the coupling nut and remove the tube end from the fitting. Do not attempt to prevent the leakage by overtorquing. Instead, inspect the seal areas of the sleeve and mating fitting for scratches, nicks, dents, foreign material, etc. Reassemble the joint with new parts, if necessary.

Table 2-11. Recommended Installation Torque for Dynamic Beam Seal Nuts

RECOMMENDED INSTALLATION TORQUE FOR DYNAMIC BEAM SEAL NUTS (OPERATING PRESSURES TO 3000 PSI TITANIUM, MATERIAL)		
FITTING SIZE	TORQUE RANGE COUPLING NUTS	TORQUE MAXIMUM JAM NUTS
	FOOT-POUNDS (NM)	FOOT-POUNDS (NM)
-03	5-9 (6.8-12.2)	7 (9.5)
-04	10-14 (13.6-19.0)	12 (16.3)
-05	10-16 (13.6-21.7)	13 (17.6)
-06	15-25 (20.3-33.9)	20 (27.1)
-08	30-40 (40.7-54.2)	35 (47.5)
-10	41-55 (55.6-74.6)	48 (65.1)
-12	50-70 (67.8-94.9)	60 (81.3)
-16	70-94 (94.9-127.4)	82 (111.2)
-20	90-120 (122.0-162.7)	105 (142.4)
-24	110-150 (149.1-203.4)	130 (176.3)

RECOMMENDED INSTALLATION TORQUE FOR DYNAMIC BEAM SEAL NUTS (OPERATING PRESSURES TO 5000 PSI TITANIUM, MATERIAL)		
FITTING SIZE	TORQUE RANGE COUPLING NUTS	TORQUE MAXIMUM JAM NUTS
	FOOT-POUNDS (NM)	FOOT-POUNDS (NM)
-04	10-14 (13.6-19.0)	12 (16.3)
-06	15-25 (20.3-33.9)	20 (27.1)
-08	30-40 (40.7-54.2)	35 (47.5)
-10	60-70 (81.3-94.9)	48 (65.1)
-12	70-80 (94.9-108.5)	60 (81.3)
-16	135-155 (183.0-210.2)	82 (111.2)

Table 2-12. Recommended Pin and Nut Torque Values

SHEAR PIN: 100-076, 100-085, 100-090 NUT: MS21042, H541L, NAS1291		
THREAD SIZE	**RECOMMENDED TORQUE**	
	INCH-POUNDS	**NM**
8-32	15-25	1.7-2.8
10-32	25-35	2.8-4.0
0.2500-28	60-80	6.8-9.0
.3125-24	130-160	14.7-18.1
.3750-24	200-240	22.6-27.1
.4375-20	270-330	30.5-37.3
.5000-20	370-430	41.8-48.6
NOTE: 1. These values apply to any combination of pin and nut shown.		

TENSION PIN: 100-047, 100-048, 100-049, 100-059 NUT: MS21042, H541L, NAS1291		
THREAD SIZE	**RECOMMENDED TORQUE**	
	INCH-POUNDS	**NM**
8-32	30-40	3.4-4.5
10-32	40-50	4.5-5.6
0.2500-28	115-130	13.0-14.7
0.3125-24	200-250	22.6-28.2
0.3750-24	360-420	40.7-47.5
	FOOT-POUNDS	**NM**
0.4375-20	44-56	59.7-75.9
0.5000-20	61-83	82.7-112.5
NOTE: 1. These values apply to any combination of pin and nut shown.		

CHAPTER 3 — CORROSION CONTROL AND PROTECTIVE COVERINGS/COATINGS

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TABLES

CORROSION CONTROL AND PROTECTIVE COVERINGS/COATINGS

3-1. GENERAL

There are many various forms of corrosion which attack metal and metallic materials causing early part failure. Several types of corrosion most common in aircraft are listed below. Routine and preventive maintenance and inspections are designed to help prevent corrosion caused component failure.

1. Surface Corrosion. The direct surface attack form of corrosion is generally the least serious of the various forms of corrosion. It is the result of direct reaction of metal surfaces with oxygen in air and occurs more readily when metal surfaces are exposed to salt spray or salt-bearing air. Sulphur and chlorine compounds which may be present in smoke stack gases and engine exhaust gases also cause direct surface attack. Etching may be noticed on the surface when corrosion deposits are removed. If the metal is aluminum alloy with a coating of pure aluminum (ALCLAD), the affect on strength of ductility of metal is negligible; however, corrosion of a similar degree on non-clad metals may be considered serious. (Refer to applicable Component Repair and Overhaul Manual). The pits may become sites for crack development in parts which are critical in fatigue.

2. Galvanic Corrosion. This is caused by dissimilar metal contact in the presence of a liquid such as salt spray or condensate, forming a true chemical cell. This causes electrons to flow and the most easily oxidized surface becomes the anode and corrodes. The emitting surface becomes the cathode of the cell.

3. Pitting Attack. This is a special kind of galvanic reaction and is usually localized. It occurs at a point of weakness and is caused by a lack of homogeneity in the alloy surface. Pitting originates from mechanical contact, faulty heat treatment, or localized contamination that breaks down surface protection. These areas become anodic characteristics of the pit area. A deep penetrating attack develops rather than general surface attack.

4. Intergranular Corrosion. This is a selective type of corrosion and attacks along the grain boundaries of metal alloys. Aluminum alloys which contain appreciable amounts of copper and zinc and some stainless steels are vulnerable to intergranular corrosion. Piano hinges are an example of aluminum extrusions which are vulnerable. Lack of uniformity in the alloy structure caused by heat treating procedures or localized overheating such as from fire damage, may result in intergranular corrosion. This corrosion may exist without visible evidence on exterior surfaces and serious structural weakening may occur without detection.

5. Exfoliation. This is a type of corrosion which most often occurs in aluminum parts made from plate, bar, tube and extrusions which have long, thin grains. Exfoliation corrosion is recognizable by the long, thin leafs of material which delaminate from the surface of a part. This type of corrosion often appears as a blister on the surface of a part. This is due to corrosion products between the grains forcing the grains apart, causing a bulge on the surface. Exfoliation corrosion is a form of intergranular corrosion.

6. Stress Corrosion. Stress affects metals that are too highly stressed under corrosive conditions. Shrink fit parts and parts subjected to cold working conditions are susceptible to stress corrosion cracking. Stressed metal tends to become anodic when in contact with stress-free metal. Galvanic corrosion occurs along the lines of stress and rapid failure of the part results.

7. Fatigue Corrosion. This is closely related to stress corrosion and appears in metals under cyclic stress in a corrosive surrounding. A jet engine turbine blade is an example of a part subject to fatigue corrosion. The corrosion causes sharp deep pits which, in turn, become the origin of cracks that may ultimately result in failure of the part. It is difficult to detect this type of attack in advance except as cracking develops.

8. Fretting Corrosion. This type corrosion develops when two heavily loaded surfaces contact each other and are subject to slight vibratory motion. The rubbing contact removes small particles of virgin metal from each surface. These particles will usually oxidize to form abrasive materials. The attack is compounded by the continued motion which prevents formation of any protective oxide film, creating a prime area for further corrosion to occur. Fretting is evident at an early stage by surface discoloration and the presence of corrosion particles in any lubricant present. Continued fretting will ruin bearing surfaces, destroy critical dimensions, and may be serious enough to eventually cause cracking and fatigue failure. Fretting may be controlled by preventing

slippage of the two surfaces or by lubricating the surfaces.

9. Hygroscopic Material Corrosion. This is caused by such materials as sponge rubber, felt, cork, etc., absorbing water and holding it in contact with the part. As a result, surface or galvanic corrosion may develop.

3-2. CORROSION PREVENTION

3-3. CORROSION PREVENTIVE TREATMENT

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-105	Corrosion Preventive
C-304	Solvent

After parts are cleaned, control and precautionary measures shall be exercised at all times to prevent corrosion. Fingerprint residue, reactive with moisture in the air, will cause accelerated corrosion in the affected areas. In order to avoid these difficulties, the following procedures shall be applied to ferrous metal parts after cleaning and inspection.

1. Wash all ferrous parts in a clean rinse of solvent (C-304) then drain the parts.

2. Gently agitate parts in fingerprint remover corrosion preventive (C-105) and allow to drain.

NOTE

Normally, parts treated with the above compounds may be left covered in indoor storage for approximately six days without being affected.

3. Immediately prior to reassembly, clean parts with solvent (C-304) and coat with approved oil. Do not handle or assemble unoiled parts.

3-4. CORROSION PREVENTIVE OIL

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-125	Preservative Oil

Use preservative oil (C-125) as a general light corrosion preventive for bonded, exposed, and painted metals.

3-5. CORROSION PROTECTION — CONTROL BOLTS, ROTATING, AND NON-ROTATING

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound
C-104	Corrosion Preventive Compound

Prior to assembly, coat all rotating and non-rotating control bolt shanks with corrosion preventive compound (C-104) unless otherwise specified. After assembly, coat boltheads and exposed threads with corrosion preventive compound (C-101).

3-6. CORROSION CORRECTIVE TREATMENT

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-304	Solvent
C-500	Crocus Cloth

Corrosion corrective treatment can be applied to all metal parts of the assemblies in varying degrees (unless otherwise specified in the text). The following method shall be applied to remove corrosion using the

applicable information as a criteria to determine serviceability of the part.

1. Wash part in solvent (C-304) to remove loose foreign matter.

2. Dry the part.

3. Use crocus cloth (C-500) or hand buffing wheel with jewelers rouge to remove corrosion from affected area by polishing. Do not use any abrasive coarser than specified.

4. Clean parts to remove all traces of corrosion and polishing agents.

NOTE

No polishing is acceptable on bearing surfaces.

3-7. CORROSION REMOVAL — STEEL PARTS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-344	Cleaner

1. Thoroughly mix one volume of cleaner (C-344) and three volumes of water.

2. Prepared surfaces which are to receive cleaner shall be free of oil, grease, shop soil, and paint. Recleaning shall be accomplished, as required, by any acceptable method.

3. Apply cleaner to metal surface by brushing or swabbing. The cleaner shall remain in contact with metal surface for one to three minutes and shall be followed by a thorough rinse.

NOTE

Step 3 may be repeated, as required, to remove light rust. Apply cleaner to corroded area only, then rinse.

4. Surfaces shall be dried using an oven 150°F (65°C) maximum, clean dry rags, or using compressed air which has been filtered to render it oil and moisture free.

5. Treat for corrosion prevention (paragraph 3-2).

3-8. CORROSION REMOVAL — ALUMINUM PARTS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-204	Primer
C-423	Abrasive Cloth or Paper

1. Remove corrosion using 400 grit abrasive cloth or paper (C-423).

NOTE

Depth of repair shall be twice the depth of corrosion not to exceed repair limits. Refer to applicable maintenance or CR&O manual for limits.

2. Apply two coats of epoxy polyamide primer (C-204) to repaired area.

3-9. CORROSION REMOVAL — MAGNESIUM PARTS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-116	Chromic Acid
C-117	Hydroflouric Acid
C-304	Solvent
C-305	Aliphatic Naphtha
C-309	Methyl-Ethyl-Ketone (MEK)
C-348	Alkaline Steel Cleaner

NOTE

A chromic acid bath is used to remove corrosion from magnesium parts.

1. Wipe parts clean before immersing in acid bath using solvent (C-304), MEK (C-309), or aliphatic naphtha (C-305).

CAUTION

CORROSION REMOVAL PROCESS SHALL BE MONITORED TO ENSURE MACHINED DIMENSIONS ARE MAINTAINED, CORROSION LIMITS SPECIFIED FOR THE INDIVIDUAL PART ARE NOT EXCEEDED, AND CADMIUM PLATING IS NOT REMOVED FROM STUDS.

2. Mix a solution of 20 to 24 ounces of chromic acid (C-116) with one gallon of water.

NOTE

The mixture can be used at room temperature to 200°F (93°C). Preferred temperature range being from 160°F to 180°F (71°C to 82°C).

3. Immerse corroded part in mixture until corrosion has been removed.

4. Thoroughly rinse part in fresh water until all corrosion removing products are removed.

5. Remove remaining contaminants from parts using alkaline cleaner (C-348). Follow manufacturer's instructions for use of cleaner on magnesium parts.

6. Rinse parts in fresh water until all cleaner is removed.

7. Acid pickle parts as follows:

a. Prepare a 15 to 20 percent (by weight) hydrofluoric acid solution (C-117).

b. Allow solution to reach room temperature.

c. Immerse AZ31B alloy parts for 30 seconds to one minute. Immerse all other alloys for four to five minutes.

d. Thoroughly rinse parts in fresh water to remove all traces of fluoride.

8. Immediately after corrosion removal, apply chemical film treatment (paragraph 3-15).

3-10. CORROSION REMOVAL — ELASTOMERIC COMPONENTS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-305	Aliphatic Naphtha
C-355	Detergent

NOTE

Many elastomeric components on helicopter will be severely damaged, if they are allowed to remain in contact with oil. Oil contaminants should be removed on regular basis, using mild detergent (C-355) and warm water.

1. Scrub elastomeric components used in main rotor, swashplate pylon support, and airframe. Use mild detergent (C-355) and water. Rinse with water and dry with clean cloths.

2. Rinse both metal and rubber elastomeric component surfaces with aliphatic naphtha (C-305). Wipe dry with clean cloths.

3-11. CORROSION PROTECTION — FAYING SURFACES

Refer to tables 3-1 and 3-2 for definitions of similar and dissimilar metals and organic protective requirements.

Table 3-1. Definitions of Similar and Dissimilar Metals

GROUP I	GROUP II	GROUP III	GROUP IV
Magnesium and its alloys	Cadmium and its alloys	Iron	Copper
Aluminum alloys of 5052, 5056, 5356, 6061, and 6063	Zinc and its alloys	Lead	Chromium
	Aluminum and its alloys (including the aluminum alloys in Group I)	Tin	Nickel
			Titanium
			Cobalt
			Stainless Steel

NOTES:

1. Metals classified in the same group are considered similar.
2. Metals classified in different groups are considered dissimilar.
3. For the purpose of this table, the metal referred to is the metal on the surfaces of the part.

Table 3-2. Organize Protective Requirements for Metals

METAL	INTERIOR	EXTERIOR
Magnesium	0.4 mil (mininum), epoxy polyamide primer (C-204)	0.1 mil (minimum) epoxy polyamide primer (C-204), then applicable finish
Aluminum	0.4 mil (mininum), epoxy polyamide primer (C-204)	One coat of epoxy polyamide primer (C-204), then applicable finish
Copper alloys 400 series steel and low alloy steels △1		
200 and 300 series stainless steels	No protective finish required	
Titanium		

NOTE:

△1 When 400 series steels are used in high heat application, omit the organic finish.

3-12. SIMILAR METALS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-204	Primer
C-308	Sealant
C-430	Tape

Faying surfaces of similar metals shall be protected by applying epoxy polyamide primer to interior or exterior surfaces as required by table 3-1.

1. Exterior surfaces. In addition to the 0.4 mil minimum thickness of epoxy polyamide primer (C-204) applied to each surface, magnesium faying surfaces on the interior or exterior surfaces of the helicopter shall be protected using sealing compound sealant (C-308). The sealant shall be applied between surfaces and squeezed out at the boundaries. The squeeze-out shall be approximately 1/4 inch in width and shall be smoothed to fair in.

2. Interior surfaces. In addition to the 0.4 mil minimum thickness of epoxy polyamide primer (C-204) applied to each surface, magnesium faying surfaces shall be protected by placing either of the following materials between the surfaces:

a. Adhesive barrier tape (C-430). When adhesive barrier tape is used, it shall cover the entire faying surface area of one of the parts. Also, it shall extend at least 1/4 inch beyond the joint edges.

b. Sealing compound sealant (C-308). When sealing compound sealant (C-308) is used, it shall be applied between the surfaces and squeezed out at all boundaries. The squeeze-out shall form a fillet approximately 1/4 inch in width.

3. Butt joints. In addition to the 0.4 mil minimum thickness of epoxy polyamide primer (C-204) applied to each surface, the separating butt joints consisting of magnesium sheet and a sheet of any other material, including magnesium, shall be filled with sealing compound sealant (C-308).

3-13. DISSIMILAR METALS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-204	Primer

Faying surfaces of dissimilar metals (except magnesium) shall be protected by applying a 0.4 mil minimum thickness of epoxy polyamide primer (C-204) to each surface.

3-14. CORROSION PROTECTION — EXCEPTIONS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound
C-104	Corrosion Preventive Compound
C-204	Primer

1. On parts that are to be welded or adhesive bonded.

2. Slip fits. Use unreduced epoxy polyamide primer (C-204) except when anaerobic sealants are specified.

3. Press fits. Use unreduced epoxy polyamide primer (C-204) except when anaerobic sealant or adhesives are used. Press fitted parts, permanently housed in oil, shall be assembled with the oil to be used in the housing.

4. Thermal fits. Assemble thermal fits without organic coatings.

5. Staked bearings. Using one of the following methods, as applicable.

a. Use unreduced wet epoxy polyamide primer (C-204) on faying surfaces. Do not allow primer to get on seal or shield of bearing.

b. If bearings operate in oil or other fluid, use fluid they operate in on faying surface.

c. If bearings are installed with a sealant, do not use epoxy polyamide primer.

6. Adjusting threads. Coat threads with corrosion preventive compound (C-101) before and after each adjustment.

7. Control bolts, rotating and nonrotating. Coat all rotating and nonrotating control bolt shanks with corrosion preventive compound (C-104) unless otherwise specified.

3-15. CHEMICAL FILM (CHROMIC ACID) TREATMENT — MAGNESIUM

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-103	Chromic Acid
C-113	Calcium Fluoride
C-114	Corrosion Treatment
C-115	Magnesium Fluoride
C-116	Chromic Acid
C-118	Sodium Hydroxide
C-204	Primer
C-309	Methyl-Ethyl-Ketone (MEK)
C-318	Cleaning Compound
C-407	Abrasive Pad
C-426	Tape

1. Immersion Method. The following procedure is a dip tank formula and complies with DOW 7, Type III, and MIL-M-3171 Type III corrosion treatment (C-114).

a. Mix magnesium alloy chemical film treatment as follows:

MAGNESIUM ALLOY CHEMICAL FILM TREATMENT

	MEASUREMENTS
Sodium Dichromate (C-212),	16 to 24 oz. (473.00 to 609.00 liter)
Calcium (C-113) or Magnesium (C-115) Flouride,	1/3 oz. (9.86 liter)
and	
Water to make	1 gal. (3.7854 liter)

(1) The pH factor of the solution shall be maintained between 4.1 to 5.5 while processing castings, and 4.1 to 5.0 while processing other magnesium.

(2) The pH factor shall be adjusted and maintained with chromic acid (C-116) or caustic soda sodium hydroxide (C-118) as necessary.

(3) The solution shall be kept saturated with fluorides by suspending a cloth or fiberglass bag filled with calcium fluoride (C-113) or magnesium fluoride (C-115) in the solution corrosion treatment (C-114).

(4) The temperature of the solution shall not fall below 200°F (93°C) during treatment.

b. Treat parts for 30 ±5 minutes. Alloy EK60A may be treated for only 15 minutes due to faster coating action.

c. After chemical treatment, the parts shall be thoroughly rinsed in room temperature water followed by a dip in hot water maximum 180°F (82°C), to facilitate drying. If a hot air dryer is used, a double water rinse shall precede the drying.

d. Parts requiring painting as the next operation shall be painted as soon as practicable after drying, preferably within 24 hours. Bare steel inserts shall be oiled immediately after drying to prevent corrosion.

2. A brush-on method of chemical film treatment MIL-M-3171 type VI can be applied to magnesium parts that require touchup. This treatment is generally

used in refinishing procedures and is relatively inexpensive. The treatment may be applied with a brush and is not harmful when trapped in faying surfaces, nor does it present the toxicity hazards of related treatments.

a. Preparation. Mask the area to receive treatment with masking tape (C-426) and wrapping paper to protect adjacent areas from coating.

b. Cleaning.

(1) Remove oil and grease with a clean cloth dampened with solvent MEK (C-309).

(2) Scrub area with abrasive pad (C-407) and cleaning compound (C-318) 10 to 20 percent by volume in clean water. Thoroughly rinse with clean water.

c. Drying. Allow surface to air dry or force dry using clean, filtered, compressed air and clean dry cloths.

d. Mix magnesium touchup treatment solution as follows:

MAGNESIUM TOUCHUP TREATMENT SOLUTION

	MEASUREMENTS
Chromic Acid (C-116),	1-1/3 oz (10 g)
Calcium Sulfate (C-120),	1 oz (7.5 g)
and	
Water to make	1 gal. (1 liter)

e. Treatment. Apply magnesium touchup solution, or premixed solution chromic acid (C-103) liberally to area to be treated. Keep area wet with solution about 1 to 3 minutes, to produce a brown film. Treatment should not be less than 30 seconds nor longer than 3 minutes. Rinse area thoroughly with clean water and dry.

NOTE

Do not rinse area with hot water. Time between coating and water rinsing is not critical. In fact, where running water is not feasible, rinse step can be eliminated without altering coating effectiveness.

f. Appearance. The treatment should provide an appearance that is continuous and uniform. The color should range from brassy iridescence to dark brown depending upon treatment time. Up to 1 minute of treatment produces a brassy film and from 2 to 3 minutes a dark brown coating. For best paint adhesion, dark brown coatings are preferred. Processed coatings require painting or sealing before exposure to overnight or outdoor atmospheric conditions.

g. Primer. Apply one spray coat (0.6 mil minimum thickness) of primer (C-204).

3-16. ALUMINUM ALLOY — CHEMICAL FILM TREATMENT (TOUCHUP)

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-100	Chemical Film Material
C-204	Primer
C-304	Solvent
C-309	Methyl-Ethyl-Ketone (MEK)
C-318	Cleaning Compound
C-407	Abrasive Pad
C-422	Aluminum Wool
C-426	Tape

The chemical film treatment of aluminum alloy is a chromate conversion coating that increases the corrosion resistance and provides a base for organic finishes on all aluminum alloys. The chemical film coating has no significant abrasion resistance.

NOTE

When applying solution near or next to an anodized surface, the solution must not make contact with the anodized surface. Make sure the anodized surface is protected with masking tape (C-426) and plastic sheeting.

1. Preparation. To protect adjacent areas from coating, mask the perimeter of the area to receive treatment with masking tape (C-426) and plastic sheeting.

2. Cleaning.

a. Remove oil and grease with a clean cloth dampened with drycleaning solvent (C-304) or MEK (C-309).

b. Scrub area to be treated to clean bare metal using nylon web abrasive pad (C-407) or fine aluminum wool (C-422).

c. Scrub area with nylon web abrasive pad and cleaning compound (C-318) 10 to 20% by volume in clean water.

d. Thoroughly rinse with clean water.

e. Repeat step c and step d until water break-free surface cleanliness is achieved.

3. Drying. Allow surface to air dry or force dry using clean filtered compressed air and clean dry cloths.

4. Mix aluminum conversion coating solution chemical film material (C-100) as follows:

ALUMINUM CONVERSION COATING SOLUTION RATIO

	RATIO BY VOLUME
Chemical Film Material (C-100)	6 parts
Nitric Acid (C-432)	1 part
and	
Distilled or Demineralized Water	256 parts

NOTE

When applying solution near or next to an anodized surface, the solution must not make contact with the anodized surface. Make sure the anodized surface is protected with masking tape (C-426) and plastic sheeting.

5. Treatment. Apply solution chemical film material (C-100) liberally to area to be treated. Keep area wet with solution 1 to 3 minutes. Rinse area thoroughly with clean water and dry.

6. Appearance. The treatment should provide an appearance that is continuous and uniform. Color should range from golden iridescent to brown. Streaks and mottled areas caused by the surface condition of the metal will be allowed, provided there is chemical film coverage in these areas.

7. Primer. Apply one spray coat (0.6 ml minimum thickness) of epoxy polyamide primer (C-204) to interior and exterior surfaces.

3-17. CADMIUM PLATING

Selective brush cadmium plating shall be in accordance with MIL-STD-865.

CAUTION

BELL HELICOPTER TEXTRON DOES NOT AUTHORIZE CADMIUM PLATING OF STRUCTURAL PARTS IN THE FIELD USING ELECTRO DEPOSITED OR VACUUM DEPOSITED PROCEDURES.

NOTE

Selective brush cadmium plating is intended to be used for the repair and/or touch up of metal surfaces where existing cadmium plating has been damaged or partially removed.

Bell Helicopter Textron approves the use of LHE brush cadmium plating methods, procedures, and equipment established by:

LDC
Liquid Development Company
3748 East 91st Street
Cleveland, Ohio
U.S.A. 44105
Phone: (216) 641-9366
Toll Free: 1-800-321-9194
Fax: (216) 641-6416
http://www.ldcbrushplate.com

OR

SIFCO Metachemical
Div. of SIFCO Industries Inc.
Cleveland, Ohio 44131.
Phone: (216) 881-8600

3-18. CHROMATE CONVERSION COATING

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-112	Chromate Conversion Coating

NOTE

Chromate conversion coating is used over cadmium plated surfaces.

1. Mix chromate conversion coating (C-112) as follows:

CHROMATE CONVERSION COATING

	MEASUREMENTS
Cadmium Chromate Conversion Coating (C-112)	6-1/2 (191.80 ml)
Nitric Acid (C-432)	2-3/4 oz
and	
Water	1 gal

2. Apply chromate conversion coating (C-112) liberally to the area to be treated. Rinse area thoroughly with clean water or by swabbing with clean cloths wetted with water. Dry with clean dry cloths or dry compressed air.

3. The treatment shall provide an appearance that is smooth, fine grained, adherent, free from blisters, pits, nodules, and burned areas. The color should be bronze iridescent to light brown.

3-19. DELETED

3-20. SOLID FILM LUBRICANT

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-005	Solid Film Lubricant
C-021	Solid Film Lubricant
C-305	Aliphatic Naphtha
C-309	MEK
C-316	Acetone
C-407	Abrasive Pad
C-426	Masking Tape
C-486	Cheesecloth
C-516	Low-lint Cleaning Cloth

1. If the solid film lubricant is partially or completely removed from the part, do the steps that follow:

a. If applicable, remove any solid film lubricant that remains with an abrasive pad (C-407) moistened with acetone (C-316) or MEK (C-309).

b. Clean the area to be coated with a clean cheesecloth (C-486) and aliphatic naphtha (C-305). Dry the part with a clean low-lint cleaning cloth (C-516) before aliphatic naphtha (C-305) evaporates.

c. Cover areas that do not require solid film lubricant with masking tape (C-426).

NOTE

Refer to Table 3-3 for the applicability of solid film lubricants.

e. Spray solid film lubricant (C-005) or solid film lubricant (C-021), as applicable, on the area to be coated to a thickness of 0.0002 to 0.0008 inch (0.005 to 0.020 mm), unless otherwise specified.

NOTE

Let the solid film lubricant dry for 15 minutes before you touch it.

f. Air dry the part for a minimum of 30 minutes.

g. Remove masking tape (C-426) from the part.

NOTE

Refer to Table 3-3 for the different cure temperature and time applicable to solid film lubricants.

h. As applicable, heat cure the solid film lubricant (C-005) or solid film lubricant (C-021).

2. If the solid film lubricant on the part requires a touch-up, do the steps that follow:

NOTE

Only touch-up repairs not exceeding 5% of the coat area are permitted.

a. Clean the area to be repaired with aliphatic naphtha (C-305).

b. Lightly abrade the area with an abrasive pad (C-407).

c. Clean the area again with a clean cheesecloth (C-486) and aliphatic naphtha (C-305). Dry with a clean low-lint cleaning cloth (C-516).

d. Cover areas that do not require solid film lubricant with masking tape (C-426).

e. Spray solid film lubricant (C-021) on the area to be repaired to a thickness of 0.0002 to 0.0008 inch (0.005 to 0.020 mm), unless otherwise specified.

NOTE

Let the solid film lubricant dry for 15 minutes before you touch it.

f. Air dry the part for 12 hours before use.

g. Remove the masking tape (C-426) from the part.

Table 3-3. Solid Film Lubricants — Heat Cure Applicability and Characteristics

SOLID FILM LUBRICANT	MATERIAL	CURE TEMPERATURE	CURE TIME (1)
C-005	Steel (2)	370 to 430°F (187 to 221°C)	60 minutes
	Corrosion Resistant Steel (CRES) (3)		
	Titanium		
	Titanium alloys		
	Plated surfaces (4)		
C-021	Aluminum alloy	135 to 165°F (57 to 75°C)	60 minutes
	Magnesium alloy		
	CRES 440		
	Steel (5)		

NOTES:

(1) Cure time begins when the part reaches the specified temperature.

(2) Except carburized parts or parts containing induction hardened areas.

(3) Except CRES 440.

(4) Unless limited by the base material.

(5) Carburized parts or parts containing induction hardened areas.

3-21. BLACK OXIDE

CAUTION

BLACK OXIDE TREATMENT OF PARTS IS NOT REQUIRED OR AUTHORIZED.

3-22. DELETED

3-23. COPPER PLATING

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-413	Stripper
C-415	Corrosion Preventive
C-417	Inhibitor
C-431	Hydrochloric (Muriatic) Acid
C-506	Potassium Cyanide
C-507	Sodium Cyanide

NOTE

Copper plating is used to coat indicated areas. This procedure is to be used to remove copper plating and reapply copper plate to the same area.

1. Remove all oils and grease from component.

2. Strip existing copper plating using Metex copper F stripper (C-413) per manufacturers instructions.

3. Rinse part thoroughly with water.

4. Clean part using corrosion preventive (C-415) following manufacturers instructions.

5. Rinse part thoroughly with water.

6. Mask areas that are not to be plated.

CAUTION

ACID PICKLE (HYDROCHLORIC (MURIATIC) ACID (C-431) SOLUTION) WILL REMOVE ANY BLACK OXIDE COATING THAT IS PRESENT. USE SOLUTION ONLY AT ROOM TEMPERATURE AND KEEP FULLY INHIBITED USING RODINE AID PICKLE INHIBITOR (C-417).

IMMERSE CASE HARDENED PARTS A MAXIMUM OF 10 SECONDS.

7. Immerse part in acid pickle solution (40 to 60% Hydrochloric (muriatic) acid (C-431) by volume in water).

8. Rinse part thoroughly in water.

9. Cyanide dip parts to passivate, if required, to hold parts prior to plating. Cyanide dip solution consists of 2 to 6 ounces of potassium cyanide (C-506) or sodium cyanide (C-507) per gallon of water.

10. If part is not going directly to plating bath, wash part thoroughly in clean water.

11. Copper plate part in solution given in Table 3-4. Plating thickness shall be in accordance with dimensions specified in applicable maintenance chapter. Adjust voltage for current densities of 30 to 45 amps per square foot. Rotate part as necessary to eliminate unplated areas under clamps and to ensure a uniform thickness of plating is achieved.

12. Rinse part thoroughly in clean water.

13. Dry part and remove masking tape.

14. Perform embrittlement relief in accordance with instruction contained in appropriate maintenance text.

15. Apply corrosion preventive to part, if required (paragraph 3-2).

Table 3-4. Copper Plating Bath

INGREDIENT AND/OR CONDITIONS	CONTROL RANGE
Ph	12.5 — 13.5
Free Cyanide	1.4 — 2.5 oz/gal
Copper Metal	4.0 — 6.0 oz/gal
Rocheltex	4.0% — 8.0% by vol
Carbonates	9.0 oz/gal maximum
Temperature	140°F to 160°F
Wetting Agent	0.33% by vl maximum
This bath composition may be obtained by dissolving the following materials in water:	
Copper Cyanide	- 8.6 oz/gal
Potassium Cyanide	- 14.1 oz/gal
Potassium Hydroxide	- 1.0 oz/gal
Rocheltex	6.0% by vol
Copper Brightener	- 2.0% by vol
Wetting Agent	- 0.33% by vol
Copper metal concentration may be maintained by using Potassium Copper Cyanide:	
Double Salts or Copper Cyanide.	

3-24. PLASTIC MEDIA BLASTING

Plastic Media Blasting (PMB) is a mechanical method to remove organic finish, fairing compounds and adhesives from helicopter parts and assemblies. The process is done with the use of compressed air to propel a stream of plastic particles at a part to abrade the paint.

PMB can cause damage to helicopter parts if it is done by untrained personnel. PMB can cause warping of skins, roughing of surface finish, removal of corrosion protective inorganic surface treatments, penetration through of thin tapered metal fittings, and close fatigue cracks.

CAUTION

PMB MEDIA AND DUST CAN BLOCK OIL AND AIR PASSAGEWAYS, OR CONTAMINATE BEARINGS, WHICH CAN LEAD TO PREMATURE FAILURE.

1. There are two ways to do PMB:

a. Method 1: Closed cabinet blasting of detail parts and assemblies.

b. Method 2: Open booth blasting of the helicopter exterior or individual panels (metal or composite) that form the exterior of the helicopter.

2. Even if PMB is done by a trained operator, damage to some materials can occur. It is not recommended to use PMB with all types of components or materials.

CAUTION

USE EXTREME CARE WHEN USING PMB ON A GEARBOX CASE. THE GEARBOX CASE CONTAINS CORED AND/OR DRILLED OIL PASSAGES WHICH CAN BE BLOCKED WITH PMB MEDIA.

3. The example that follows gives a list of materials on which PMB method 1 is not recommended:

a. Composite Surface: The resins and adhesive used in composite parts are easily removed as the organic coating by PMB. Excessive resin removal can damage the structural composition of the parts. Resin removal cannot be controlled.

b. Unsupported Skins: Unsupported (not stiffened or non-core bonded) aluminum skins, less than 0.032 inch (0.813 mm) thick can be distorted by PMB. The pummeling effect and the friction heat build-up of PMB cannot be prevented.

c. Clad Aluminum and Cadmium Plated Surfaces: Ductile clad aluminum and cadmium plated surfaces are easily moved and removed by PMB. The clad on aluminum is not repeatable and cadmium plating is restricted to touch-up.

4. The method that follows gives material on which a PMB method 2 is not recommended:

a. Cadmium Plated Surfaces: The cadmium plated surface is easily moved or removed by the PMB.

b. Replacement of the cadmium plating is restricted to touch-up.

3-25. PLASTIC MEDIA BLASTING EQUIPMENT — DESCRIPTION

1. The siphon feed abrasive blasting equipment is not to be used for PMB. Only direct pressure feed abrasive blasting equipment is to be used for PMB. The blasting equipment must have indication and regulation devices to measure and control the blasting pressure.

2. The PMB equipment must have a separation system which is made up of a cyclone separator, a vibrator screen system, and dust bag to remove paint chips, dust, sand, metallic particles etc., produced by the blasting operation.

3. Manufacturers of cabinet and open booth for PMB include, but are not limited to, Paul & Griffin, Clemo, Zeroblast, and Turco.

4. Open booth (Method 2) operator must have the equipment that follows:

a. Breathing Air: A compressor is used to provide breathing air for the operators along with the safety equipment that follows:

b. Breathing Air Filter: A breathing air filter to remove particles, moisture, and vapor. Clemco Industries, Model CPF-80 or equivalent.

c. Carbon Monoxide Monitor: A carbon monoxide monitor, Dynamation Inc., Model ABL-50 or equivalent.

d. Voice Communications: Two radio headsets to permit communication between the blaster and the blast helper.

e. Hearing Protection: All PMB personnel must wear hearing protection.

f. Blast Suit: An "Apollo" helmet with a protection cover suit and gloves.

5. Open booth equipment:

a. Safety Warning Light: A safety light is installed outside the personnel entrance doors and flashes during PMB operation.

b. Booth Door: The booth door opens outward.

c. Ground Cords: The ground cords are used to ground the helicopter or parts that are to be blasted.

d. Emergency Lighting: An integrated emergency lighting system is used in the event of a power failure.

e. Illuminated Exit Sign(s): An illuminated exit sign is used to show the exit(s) location.

f. Ventilation: A minimum cross-draft ventilation rate of 75 cubic feet per minute per square foot (2,12 cubic meters per minute per 926 square centimeters) of open face area.

3-26. PLASTIC MEDIA BLASTING OPERATOR TRAINING

Only PMB operators with a thorough knowledge of helicopter components and the potential for direct and indirect damage are to be considered as PMB operators. The operator must have a working understanding of the PMB operation parameters and have the aptitude for PMB operation. The PMB operator has to be able to remove organic finishes layer by layer.

3-27. MEDIA PARTICLES METHOD 1

1. The media particles that are used in method 1 have to meet the specification MIL-P-85891, Type II. The particles are made of thermoset Urea Formaldehyde that have to be free of moisture.

2. Particle Sizes: 16/20, 20/30, 30/40, and 40/60 may be used. However, a particle size of 20/30 is recommended.

a. Color: Yellow or unspecified color.

b. Hardness: Barcol hardness 54 to 62 (approximately MOH hardness 3.5).

c. Manufacturers: Blast Off Inc., U.S. Technology Corp., Tri-Mech Co.

d. P/N When Ordering Yellow Color Particles: M85891-21-1620, M85891-21-2030, M85891-21-3040, M85891-21-4060.

e. P/N When Ordering Unspecified Color Particles: M85891-26-1620, M85891-26-2030, M85891-26-3040, M85891-26-4060.

3-28. MEDIA PARTICLES METHOD 2

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-318	Cleaning Compound

1. The media particles that are used in method 2 have the specification of MIL-P-85891, Type V. The particles are made from thermoplastic "Acrylic Plastic". The particles must be free of moisture and are not to exceed 200 parts per million of high density particle contamination.

2. Particle Sizes: Only particle size of 20/30 is recommended.

a. Color: White to light grey or unspecified color.

b. Hardness: Barcol hardness 46 to 54 (approximately MOH hardness 3.5).

c. Manufacturers: Blast Off Inc., U.S. Technology Corp., Tri-Mech Co.

d. P/N When Ordering White Color Particles: M85891-55-2030.

e. P/N When Ordering Unspecified Color Particles: M85891-56-2030.

3-29. PMB Procedure — Requirement

1. Observe all of the operation limits given by the equipment manufacturers for cabinet blasting and open booth blasting modes.

2. PMB Method 1 (close cabinet) parameters — Description.

a. Blasting Pressure: Never exceed 40 PSI (276 kPa) of blasting pressure. The normal operating blasting pressure is 20 to 30 PSI (138 and 207 kPa) for most applications. The pressure is to be measured at the nozzle and not from the regulating gauge. To check the nozzle pressure, use a hypodermic needle gauge positioned at a 45 degree angle to the main flow and away from the main flow.

b. Impingement angle: The impingement angle is measured from the horizontal and is between 45 and 60 degrees.

c. Nozzle Distance: The distance between the tip of the nozzle and the part to be blasted should never be closer than 4 inches (10.2 cm).

d. Dwell Time: Never let the nozzle stay in a localized area for more than one second. It is recommended to make several passes over the area to be stripped rather than to let the nozzle stay in a localized area.

e. Flow Rate: The flow rate is between 140 and 170 Pounds per hour (63.6 and 77.2 kilograms per hour).

3-30. PMB Method 1 Procedures

1. Clean the component surface with (C-318).

2. Remove the organic finish from the necessary areas with a regular rate of stroke.

3. Do not blast directly into the bond lines because the adhesive will be removed.

4. The best method to remove organic finishes is to use a combination of low blast pressure, a low impingement angle, and the longest nozzle distance.

5. Do not increase the rate of production with an increase of the blast pressure and an increase of the impingement angle.

6. If the production rate must be increased, it is safer to increase the blast pressure and increase the zozzle distance.

3-31. PMB METHOD 2 (OPEN BOOTH) PROCEDURES

For the method 2 procedures refer to table 3-5.

Table 3-5. PMB Method 2 Parameters — Description

MATERIAL THICKNESS (INCH)	SUPPORTED/ UNSUPPORTED NOTE (1)	AIR PRESSURE (PSI) NOTE (2)	MEDIA FLOW RATE (LBS/HR) NOTE (3)	STANDOFF DISTANCE (INCHES)	IMPINGEMENT ANGLE (DEGREES)	CLAD/ NONCLAD	DWELL TIME (SECONDS)
			METAL				
0.16 - 0.31	Supported/ Unsupported	30 ±2 30 ±2	450 - 480 450 - 480	18 - 24 18 - 24	15 - 30 <16	either	<1
0.32 - 0.63	Supported/ Unsupported Note (1)	30 ±2 30 ±2	450 - 480 450 - 480	18 - 24 18 - 24	15 - 30 15 - 30	either	<1
0.64 - and more	Supported/ Unsupported	30 ±2 30 ±2	450 - 480 450 - 480	18 - 24 18 - 24	60 - 80 45 - 60	either	<1
			COMPOSITES				
All	either	18 - 20	450 - 480	24 - 30	16	N/A	<1

NOTES:

1. Unsupported - no backing structure to the surface being treated.
2. Air pressure reading taken at a 45 degree angle from the linear flow of the media.
3. All parameters based on a nozzle diameter of 0.050 inch.

3-32. PREPARATION OF THE HELICOPTER FOR PMB

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-318	Cleaning Compound

1. Clean the helicopter exterior or individual panel with cleaning compound (C-318) and a high pressure cleaning machine.

2. Remove, open or protect all the cowlings, doors, avionic equipment, fuel or oil lines, and the fuel cells.

3. Install tape on the doors, the cowlings, and template closures where required.

CAUTION

TO AVOID SEVERE BURNS, WEAR PROTECTIVE GLOVES WHEN YOU USE A HOT GLUE (MOLTEN PLASTIC) GUN.

4. Seal all seam covers and access panel gaps of 3/16 inch (187 mm) or less with a bead of hot glue.

CAUTION

MAKE SURE YOU COVER ALL TRANSPARENT PLASTIC SURFACES BEFORE YOU BEGIN PMB.

5. Install form fitting cover on all glass and transparent plastic surfaces. Mask the transparent edges with tape.

6. Mask or plug all open ports of the helicopter.

7. Mask all areas like driveshafts, bearings, and actuator linkages that will not be stripped.

6. To measure the flow rate, blast the media into a container for one minute and weigh the media. Refer

8. Mask all cadmium plated or conversion coated hardware that will not be replaced after the PMB operation.

3-33. PMB MAPPING PROCEDURE

1. The mapping technique gives the PMB operator information that lets him know what pressure, nozzle distance, and impingement angle to use when removing paint from different skin thicknesses on the helicopter. This technique reduces the possible damage to the different skins during the PMB operation.

a. Make a chart that shows the different skin thicknesses and material compositions of the exterior of the helicopter.

b. Give a specific color for each skin thickness category. Refer to table 3-5.

c. Give a specific color for the composite material.

NOTE

You can use chalk instead of paint to outline the areas. Write on the skin the type of material and the thickness.

2. Spray the outline of each skin thickness and material with the corresponding color on the chart.

3-34. ORGANIC COAT REMOVAL PROCEDURE

1. Put clean and masked part in PMB booth.

2. Ensure the PMB equipment and helicopter are grounded.

3. Ensure the PMB operator wears the proper safety equipment.

4. Measure the media flow pressure at the nozzle with a hypodermic needle gauge and make sure the reading is in the parameters of table 3-5.

5. Measure the flow rate if new media is added or media type has been changed.

to table 3-5 for the media flow rate parameters.

7. Remove the organic coat from the part and use the parameters in table 3-5 in the sequence that follows:

a. Supported aluminum honeycomb.

b. Unsupported skin panels - strip by thickness categories of table 3-5. Strip the panels in thin to thick order.

c. Composite panels.

3-35. PMB CLEAN-UP OPERATION

1. Remove all plastic media and media that remains (with heavy duty wet/dry vacuum cleaner) on the helicopter/individual panel.

2. Remove all the masking material from the masked parts.

3. Examine all the masked areas for media that remains in gaps. Remove the media with an heavy duty wet/dry vacuum cleaner.

CHAPTER 4 — PAINTING

CONTENTS – MAINTENANCE PROCEDURES

TABLES

PAINTING

4-1. PAINT

4-2. PAINT REMOVERS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-109	Protective Oil
C-205	Thinner
C-206	Thinner
C-309	Methyl-Ethyl-Ketone
C-318	Cleaning Compound
C-348	Cleaner
C-435	Paint Remover
C-436	Paint Remover

1. Types and usages:

CAUTION

REMOVERS SHALL BE USED ONLY IN AREAS OF ADEQUATE VENTILATION. SUITABLE GOGGLES OR FACE MASKS, CHEMICAL RESISTANT GLOVES, BOOTS AND CLOTHING SHALL BE WORN TO AVOID CONTACT OF CHEMICAL REMOVERS WITH EYES, SKIN AND CLOTHING. CHEMICAL REMOVERS SHALL FURTHER BE HANDLED IN ACCORDANCE WITH APPLICABLE OSHA REGULATIONS, STATE AND LOCAL SAFETY CODES, AND COMPANY ESTABLISHED SAFETY STANDARDS AND POLICIES.

DO NOT USE PAINT REMOVERS OR STRIPPERS ON HONEYCOMB PANELS, COMPOSITE PARTS (INCLUDES FIBERGLASS) OR ADHESIVE BONDED STRUCTURES.

a. General remover, solvent type thinner (C-205), thinner (C-206) and MEK (C-309) may be used to remove all organic finishes, except epoxy and polyurethane base finishes, from all metal of all strength levels.

b. General Remover, chlorinated hydrocarbon paint remover (C-435) may be used to remove all organic finishes except epoxy and polyurethane base finishes, from all metals of all strengths. Water rinseable.

c. General paint remover, alkaline type paint remover (C-436) may be used to remove all organic finishes from all strength levels. Use for removing epoxy polyamide finishes. Will remove super Koropon and polyurethane finishes at a much slower rate. Water rinseable.

2. Precautions.

a. Protect all vulnerable parts and areas, such as acrylic plastic, synthetic and natural rubber, all fabric covered surfaces, exposed bearings, joints, seams, as necessary, by masking with protective materials.

NOTE

Protective materials provide protection for chemical stripping by wipe, brush and spray, or mechanical stripping by plastic media blasting or abrasive sanding. These maskants do not provide suitable protection for chemical stripping by immersion.

b. Magnesium parts and assemblies shall not be immersed in acid type epoxy and polyurethane remover.

c. Magnesium parts immersed in alkaline type general remover shall be restricted to a 12 hour immersion time.

d. Magnesium parts immersed in chlorinated hydrocarbon type remover or solvent type remover shall be restricted to a 24 hour immersion time.

e. Parts that have acrylic lacquer or polyurethane topcoat and epoxy prime need only to have topcoat removed for magnetic particle inspection. Parts that have aluminized acrylic lacquer topcoat must have topcoat and primer removed prior to magnetic particle inspection.

f. All paint and primer shall be removed from parts prior to fluorescent penetrant inspection.

3. Application.

NOTE

When general removers are used on titanium, finish removal shall be followed by alkaline cleaning with materials conforming to cleaner (C-348) or cleaning compound (C-318).

a. Solvent type removers, MEK (C-309), thinner (C-205), thinner (C-206), and paint remover (C-435) may be applied by wiping or squirting on.

b. Spray or brush application:

(1) Liberally spray, using a non-atomizing applicator or use a stiff brittle brush on top surface and work down.

(2) Keep surface moist with stripper. Allow first application to work for 15 to 45 minutes, until finish is loosened (as indicated by wrinkling).

(3) Remove excess stripper with squeegees, rags, or soft scrappers. Fiber brush, if necessary, to assist in finish removal from difficult areas. This cycle may be repeated until paint is removed.

(4) Thoroughly rinse stripped surfaces with high pressure (preferably hot). Allow surfaces to dry.

c. Immersion.

NOTE

Tanks used for immersion stripping shall be equipped with a lid and/or adequate ventilation to prevent stripper fumes from being introduced in to the workplace. Heated immersion tanks shall be equipped with automatic temperature controls capable of maintaining specified operating temperatures to within ± 10°F when stripping with hot tank removers.

(1) Immerse the entire part in paint removal dip tank. Allow to remain immersed for 15 to 45 minutes. Do not exceed 24 hours.

(2) Remove loosened finish and excess stripper with high pressure air and/or water blast. Fiber brush, if necessary, to assist in finish removal from difficult areas. Repeat immersion in stripper and rinsing as necessary to complete stripping. Allow surfaces to dry.

d. Apply a temporary coating of protective oil (C-109) to parts not scheduled for immediate refinishing.

4-3. PAINT STRIPPING — PARTS WITH TEFLON BEARINGS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-407	Abrasive Pad
C-435	Paint Remover
C-436	Paint Remover

CAUTION

ALL PAINT FINISH REMOVERS ARE INJURIOUS TO TEFLON BEARINGS AND ADHESIVES SECURING TEFLON TO BEARING RACES. CARE MUST BE EXERCISED WHEN USING CLEANING SOLVENTS OR PAINT REMOVERS TO AVOID WASHING WASTE PRODUCTS INTO TEFLON BEARINGS.

1. Degrease or solvent clean parts (Chapter 5) to remove dirt, grease, oil, and other contamination that can lesson action of stripper.

2. Cut masking tape circles to diameter of bearing outside diameter. Apply three or four circles over each side of bearing, press down well to seal.

CAUTION

DO NOT USE ACID BASE PAINT REMOVERS ON PARTS. USE PAINT REMOVER (C-435) OR PAINT REMOVER (C-436).

3. Apply paint remover with a brush, allow to set from 15 to 45 minutes to soften paint.

4. Using a stiff fiber brush and flowing water, rinse paint from part. For stubborn finishes, use abrasive pad (C-407) and paint remover to aid in lifting paint.

5. Rinse part clean with flowing water and dry thoroughly.

6. Refinish part as soon as practical or protect by coating with a light weight water displacing corrosion preventive oil.

4-4. PAINT APPLICATION

4-5. DEFINITIONS

1. A clean surface is a surface that is not contaminated with oil, grease, fingerprints, etc.

2. Contaminated area. A contaminated area is a surface that is contaminated with oil, grease, fingerprints, etc. and/or chemical conversional film or treatment has been damaged.

3. Chemical film. Chemical film is a chemical conversion coating applied to aluminum surfaces to give increased corrosion protection, and to improve paint adhesion.

4. Chemical treatment. Chemical treatment includes etching, pickling, anodizing, metal plating and other such metal treatments intended to provide corrosion resistance, improve paint adhesion and/or alter surface condition of metal for reasons.

5. Corrosion preventive compound. Corrosion preventive compounds are solvent-dispersed compounds which deposit a film. These compounds are used on parts where a paint film might prove detrimental to operation on parts requiring frequent disassembly, and on parts where a paint film would be removed by abrasion or flexing.

6. Sealants. Sealants refer to rubber base or synthetic rubber type materials. Sealants are used to provide water and fuel tightness and as a barrier between magnesium and/or dissimilar metals.

7. Extreme conditions. Extreme conditions include, but are not limited to exhaust trails, gun-blast surfaces, rocket-blast areas, leading edges, areas that may trap or be exposed to fumes from exhaust, guns or rockets, or surfaces subjected to temperatures above 250°F (121°C), as result of thermal radiation, aerodynamic heating, or other sources of heat.

8. External surfaces. External surfaces are outside surface of hollow part whether sealed or not. These surfaces may form an interior, cabin interior or exterior surface.

9. Internal surfaces. Internal surfaces are inside surfaces of hollow parts whether sealed or not.

10. Faying surfaces. Faying surfaces are face-to-face areas of adjoining (contacting) parts.

11. Frequent disassembly. Disassembly which occurs or is anticipated to occur within maximum of 6 months.

4-6. PAINTING — EXTERIOR SURFACES

CAUTION

PROTECT ALL PLASTIC SURFACES AND VULNERABLE PARTS AND AREAS PRIOR TO STARTING PAINTING PROCEDURES.

Refer to table 4-1 for finish requirements.

Table 4-1. Painting Requirements for Exterior Surfaces

ITEM	CHEMICAL TREATMENT REQUIREMENTS	PAINTING REQUIREMENTS
ALUMINUM SURFACES	Alodine 1200 MIL-C-5541 (1)	One coat of epoxy polyamide primer (C-204) and two coats of topcoat (C-218).
MAGNESIUM SURFACES	Dow No. 7 or No. 19 MIL-M-3171C	One coat of epoxy polyamide primer (C-204) and two topcoats to be in accordance with marking drawings (#9128508) and/or applicable manual.
PLASTIC		For application of polyurethane enamel as a finish coat, refer to paragraphs 4-33 and 4-39.
1. Non-reinforced		
a. Acrylic		a. None
b. Polycarbonate		b. Sand defective area with No. 400 grit paper. Feather edges and remove sanding residue. Apply one cross coat of Organocerams adhesive (C-301) and allow 15 minutes between coats. Color to match adjacent or surrounding area.
c. Acrylic PVC Alloy (Kydex) (Landing Gear Fairings)		c. Finish to match surrounding or adjacent surfaces.
2. Reinforced (Laminates, etc.)		
a. Acrylic		a. Finish to match surrounding or adjacent surfaces.
b. Epoxy, Phenolic or polyester (Fiberglass) (Facings)		b. Finish to match adjacent or surrounding areas.
BLADES, MAIN AND TAIL ROTOR		Refer to applicable Maintenance Manual and Component Repair and Overhaul Manuals.

Table 4-1. Painting Requirements for Exterior Surfaces (Cont)

ITEM	CHEMICAL TREATMENT REQUIREMENTS	PAINTING REQUIREMENTS
ROTATING CONTROLS	⚠1 ⚠2	Where applicable, all exterior surfaces of the mast (except splines) and rotating controls located above the transmission (except main rotor blades) and exterior surfaces of the tail rotor rotating controls, located on or outboard of the 90 degree gearbox (except tail rotor blades), shall receive one spray coat of epoxy polyamide primer (C-204) and two spray coats of original color polyurethane.

NOTES:

⚠1 Model 206 series masts are painted and require a phosphate coating of the cadmium plating prior to priming. Refer to BHT-206-CR&O-1.

⚠2 Model 204, 205, 212, 214B, 214ST, 222, 230 and 412 series mast do not require painting.

⚠3 Type of paint required for topcoats shall be determined by applicable manual.

4-7. EPOXY POLYAMIDE PRIMER APPLICATION

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-204	Primer
C-246	Primer

The primer (C-204) and coating (C-246) are intended for use as a prime coating for acrylic, epoxy, and urethane topcoats and as final finish for interior and internal surfaces not requiring topcoats. These primers may be applied to mechanically prepared and/or chemically treated metal, plastic, and composite surfaces or as tie coat over properly prepared, cured, primed or topcoated surfaces.

CAUTION

COATING (C-246) SHOULD NOT BE USED ON IRON OR BARE CARBON STEEL, NOR FOR WET INSTALLATIONS OF FASTENERS OR FAYING SURFACES. REFER TO TABLE 4-2 FOR WET INSTALLATIONS OF FASTENERS.

4-8. Equipment Requirements

1. Spray equipment. Spray guns and accessories used for application of epoxy polyamide primer must be capable of spraying paint film which will conform to the requirements of paragraph 4-9.

2. Hot spray equipment. Hot spray equipment should be of the circulating type. The circulation should be from the gun to the heater, not to include the reservoir. The equipment should have temperature controls such that the prime temperature does not exceed 160°F (71.11°C) in the system and not exceed 135°F (57.22°C) at the spray gun.

Table 4-2. Installation Guidelines

PARTS TO BE JOINED	SPECIFIC SITUATION	LOCATION IN AIRCRAFT	SPECIAL CIRCUM-STANCES	INSTALLATION REQUIREMENTS	NOTES
Similar Metals	All (Except Magnesium)	Interior		NONE	1
		Exterior		NONE	1
Dissimilar Metals	All (Except below or Magnesium)	Interior		Wet install with unreduced primer (C-204).	2 4 5 6
		Exterior		Wet install with adhesive (C-308).	2 7
	Aluminum or Cadmium Plating	Interior		Wet install with unreduced primer (C-204).	2 4 5 6 7 8 9
		Exterior		Wet install with sealant (C-392).	2 3 6
Metal to Com-posite	Aluminum to Carbon Composite	All Locations		Wet install and cap seal fastener end with sealant (C-392).	3
	Cadmium Plated Steel to Carbon Composite	Interior	Permanent Assembly	Wet install with unreduced primer (C-204).	2 4 5 6
		Exterior		Wet install and cap seal fastener end with sealant (C-392).	3
		Interior	Frequent Dis-assembly	Wet install with corrosion preventive (C-106).	
		Exterior		Wet install and cap seal fastener end with sealant (C-392).	3
	Metal (other than Aluminum or Cadmium Plated) to Carbon Composite	Interior		Wet install with unreduced primer (C-204).	4 5
		Exterior		Wet install and cap seal fastener end with sealant (C-392).	
	Metal to Fiberglass (or Plastic)	Interior	Permanent Assembly	NONE	
		Interior	Frequent Disassembly	Wet install with corrosion preventive com-pound (C-104), grade 2.	
		Exterior	All (except below)	Wet install with adhesive (C-308).	8
			Aluminum or Cadmium-Plated	Wet install with sealant (C-392).	3

Table 4-2. Installation Guidelines (Cont)

PARTS TO BE JOINED	SPECIFIC SITUATION	LOCATION IN AIRCRAFT	SPECIAL CIRCUM-STANCES	INSTALLATION REQUIREMENTS	NOTES
Carbon Composite to Carbon Composite	Cadmium Plated or Aluminum Fasteners	Interior or Exterior		PROHIBITED	
	Titanium Fasteners	Interior		NONE	△6
		Exterior		Wet install withsealant (C-392)	△6

NOTES:

△1 Similar metals includes the fastener (aluminum to aluminum with aluminum fastener) if the fastener is dissimilar to the similar metal to be joined, the joint is considered to be dissimilar.

△2 Fasteners or fastener finish should be less active with respect to the most active metal to be joined (where magnesium is considered the most active and carbon (graphite) the least active).

△3 sealant (C-392) should be used preferentially for aluminum or cadmium plated joints.

△4 Where production considerations preclude wet installation, the hole or fastener may be coated with primer and allowed to dry prior to fastener installation.

△5 Do not use MIL-P-85582 waterbase coating (C-246) for wet installation of fasteners.

△6 Use adhesive (C-308) if a pressure tight fuel tight, or water tight joint is required.

△7 Magnesium is a special case - see the applicable finish Specification for finishing instructions.

△8 sealant (C-392) may be used as an alternate.

△9 Use unreduced zinc chromate primer (C-101) if disassembly is required.

3. Compressed air. Compressed air should be filtered to render it moisture and oil free prior to use.

4-9. Process and Product Requirements

1. Appearance. After drying, applied film shall be free from grit, seeds, craters, blisters or other such irregularities.

2. Thickness. The dry film thickness of epoxy polyamide primer should be 0.0006 to 0.0009 inch (0.01524 to 0.02286 mm).

3. Fastener holes that are coated by brush or swab method and internal surfaces and tubing or tubular type parts that are coated by wet install or fill and drain method shall not be subject to thickness requirements, except these areas shall not exhibit any bare (unprimed) areas.

4-10. Procedure Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-204	Primer
C-235	Thinner
C-246	Primer
C-309	Methyl-Ethyl-Ketone (MEK)
C-426	Tape
C-435	Paint Remover
C-462	Tape

1. Surface preparation. Prepare clean aluminum, titanium, stainless steel and cadmium coated surfaces for priming by wiping with tack rag. Prepare other surfaces as specified in table 4-3.

2. Masking. Areas (except plastic surfaces) requiring masking should be masked using tape (C-426) and suitable solvent resistant masking paper. Mask area not to be painted, as required.

NOTE

Plastic surfaces (polycarbonate, acrylic, etc.) requiring masking should be masked using tape (C-462).

3. Primer preparation.

NOTE

Primer preparation for epoxy primers shall be accomplished in accordance manufacturer instructions. If manufactures instructions are not available proceed as follows:

a. Two component epoxy polyamide primer (C-204) should be prepared for spraying as follows:

NOTE

Catalyzed primer should be discarded if not used within 8 hours after mixing. If hot spray equipment is used, heated primer will have usable life of less than 2 hours.

(1) Shake or stir the pigmented resin component (Component I) until uniform.

(2) Add one volume of the activator (Component II) to one volume of the pigmented resin (Component I) and mix thoroughly. Use only components from the same kit.

(3) For spray application, thin as necessary to achieve viscosity of 16 to 18 seconds Zahn #2 by adding thinner (C-235).

(4) For brush, swab, wet install and fill and drain, the mixed primer shall not be thinned.

(5) Strain the mixed material through a paint strainer. Shake or stir the primer prior to use.

NOTE

Primer preparation for epoxy primers shall be accomplished in accordance manufacturer instructions. If manufactures instructions are not available proceed as follows:

b. Two component epoxy polyamide coating (C-246) should be prepared for spraying as follows:

NOTE

Catalyzed coating (C-246) should be discarded if not used within 4 hours after mixing.

(1) Shake or stir the pigmented resin component (Component A) until uniform.

(2) Add one volume of the activator (Component B) to three volumes of the pigmented resin component (Component A) and mix thoroughly. Use only components from the same kit.

(3) Do not thin material unless directed by the manufacturer's instructions on the label. Unthinned material will have viscosity of approximately 40 seconds using a Ford #4 viscosity cup.

(4) Strain mixed material through paint strainer. Shake or stir primer prior to use.

4. Application procedure.

a. Spraying. Adjust spray equipment and control rate of stroke to apply a film of primer which when dry will meet requirements of paragraph 4-9.

b. Brush or swab. Fastener holes or other small areas which require primer shall be coated using suitable brush or swab of appropriate size to assure complete coverage.

c. Fill and drain. Apply primer to internal surfaces of tubing and tubular type parts using one or both of following techniques:

(1) Seal or plug one end, then flow primer into part. Fill and/or slosh as needed to coat all internal surfaces. Remove seal or plug and allow excess primer to drain.

(2) Flow primer into parts while rotating them so as to coat all internal surfaces. Allow excess primer to drain.

NOTE

Swagged tubes with threaded ends shall have the primer removed from all threads within 3 minutes after primer application. Primer removal shall be accomplished by laying tube horizontally and inserting, with twisting motion, a nylon brush wetted with MEK (C-309). Repeat insertion as necessary to achieve complete primer removal from threaded areas. Allow tubes to remain in horizontal position for minimum of 1 hour to prevent any primer migration back to threaded areas.

d. Wet install. Where possible coat both surfaces with primer using a suitable means. Install within 30 minutes. After installation, remove excess primer with solvent soaked rag. Allow 72 hours ambient temperature for complete cure.

e. Dry time before first overcoating. Primer must be overcoated in not less than 30 minutes and not more than 3 hours (this time limit includes applying primer at elevated temperatures). If required, primed surfaces should be wiped with tack rag to remove lint and dust prior to overcoating.

5. Refinishing. Epoxy primed surfaces requiring refinishing should be processed as follows:

CAUTION

BONDED ASSEMBLIES, PLASTICS AND OTHER PARTS OR AREAS WHICH MIGHT BE DAMAGED BY EPOXY STRIPPER WILL REQUIRE MECHANICAL REMOVAL OF THE PRIMER. CHEMICALLY TREATED SURFACES, DAMAGED BY PRIMER REMOVAL, SHOULD BE REPAIRED IN ACCORDANCE WITH APPLICABLE INSTRUCTIONS PRIOR TO REPRIMING.

a. Strip parts and assemblies using an alkaline type general paint remover (C-435). This remover may be used on all organic finishes and metals of all strength levels.

b. Refinish parts in accordance with paragraphs 4-3, 4-4, and 4-5 above.

4-11. EPOXY SUPER KOROPON PRIMER — APPLICATION

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-100	Chemical Film Material
C-112	Cadmium Chromate Conversion Coating
C-202	Primer
C-305	Aliphatic Naphtha
C-306	Toluene
C-309	Methyl-Ethyl-Ketone (MEK)
C-318	Cleaning Compound
C-319	Chlorothene
C-344	Alcoholic Phosphoric
C-407	Abrasive Pad
C-423	Abrasive Cloth or Paper

Epoxy primer (C-202) is intended for use over mechanically or chemically treated metal surfaces.

1. Prepare for priming by wiping with a tack rag. Prepare surfaces as specified in table 4-3.

2. Mask area not to be painted, as required.

3. Prepare epoxy primer (C-202) as follows:

NOTE

Primer preparation for epoxy primers shall be accomplished in accordance manufacturer instructions. If manufacturers instructions are not available proceed as follows:

a. Shake or stir pigmented resin component until uniform.

b. Add one volume of activator thinner component to one volume of pigmented resin component and mix thoroughly. Use only components from same kit.

c. Strain mixture through paint strainer.

NOTE

Catalyzed primer shall be discarded if not used within 8 hours after mixing.

4. Apply epoxy primer (C-202) by spraying, brush or swab, or for internal use, plug one end, flow epoxy primer into hollow part, slosh as needed to coat surface, drain excess epoxy primer.

5. Epoxy primer (C-202) shall be overcoated in not less than 30 minutes and not more than 4 hours. If necessary, primed surfaces should be wiped with tack rag prior to overcoating to remove lint and dust. Clean primed surfaces which have cured for longer than 4 hours but less than 24 hours, wipe with tack rag and give a mist coat of epoxy primer prior to overcoating. Primed surfaces which have cured for 24 hours or longer shall be prepared per table 4-3. Painted surfaces (cured), shall be given a mist coat of epoxy primer prior to overcoating. Primer on exterior surfaces, may be overcoated 10 minutes after solvent flash-off if epoxy primer is being applied to an unpainted surface.

4-12. URETHANE COMPATIBLE PRIMER — APPLICATION

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-234	Primer

The primer (C-234) is intended for use as a prime for urethane topcoats or as primer coating for the internal surfaces of rotor blade spars.

4-13. Equipment Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-234	Primer

1. Spray guns used for application of primer (C-234) shall be capable of spraying a paint film which will conform to paragraph 4-14.

2. Compressed air shall be trapped and filtered to render it moisture and oil free, prior to use.

3. There shall be up to 65 pounds air pressure available for paint spray atomization at nozzle.

4. Air gauges and regulators should be installed on atomization lines.

5. All hoses and fittings shall be of 3/8 inch diameter with adaptable fittings.

6. Atomization air lines should bypass pressure pot air regulator.

4-14. Process and Product Requirements

1. Appearance. Applied cured film shall be free of runs, sags, streaks, blisters, lifting, or blushing.

2. Adhesion. There shall be no loss of adhesion of urethane coating system when tested.

Table 4-3. Surface Preparation

STEP	OPERATION	MATERIAL											
		ALUMINUM ALLOYS	STAINLESS STEEL	CADMIUM PLATE	TITANIUM	MAGNESIUM ALLOYS	TUNGSTEN AND TUNGSTEN ALLOYS	NICKEL	LEAD	CARBON AND LOW ALLOY STEEL	COMPOSITE SURFACES	PLASTICS	TOP-COATED OR PRIME SURFACES (CURED)
1	DEGREASE												
	Metals - (except Titanium) Vapor Degrease or solvent clean aliphatic naphtha (C-305), toluene (C-306) or MEK (C-309) as applicable.	X	X	X		X	X	X	X	X	X		X
	Titanium - Solvent clean with aliphatic naphtha (C-305), toluene (C-306), or MEK (C-309).				X								
	Composite Surfaces - Solvent clean with toluene (C-306) or alcohol (C-385).										X		
	Plastics - Solvent clean with materials specified in appropriate manual.											X	
2	SAND - Lightly abrade surfaces with 180 grit or finer abrasive coated cloth or paper (C-423) or abrasive pad (C-407).				X						X	X	X
	Note:Exercise extreme care to prevent damage to the outer-most fibers of composite surfaces.										X		
3	SANDBLAST - Dry Abrasive Blasting												
	Carbon and low alloy steel - Uniformly blast with 80 grit aluminum oxide (C-474) at 50 to 80 psi to produce a matte surface finish.									X			
	Lead - Uniformly blast with 80 grit aluminum oxide (C-474) at pressures less than 60 psi to produce a matte surface finish.								X				
	Composite Surfaces - Uniformly blast with 100 grit or finer aluminum oxide (C-474) at pressures less than 40 psi when using hand operated blasting equipment or less than 60 psi when using automatic blasting equipment. ⚠3										X		
	Note:For dry abrasive blasting of composites, the nozzle distance(s), impingement angle(s), and traverse rate shall be adjusted to prevent damage to the outermost fibers.										X		
4	VAPOR BLAST - Wet Abrasive Blasting												
	Nickel - Uniformly blast with 3/0 flint quartz (C-496) at 30 to 80 psi to produce a matte surface finish.						X						
	Tungsten - Uniformly blast with 3/0 flint quartz (C-496) at pressures less than 60 psi to produce a matte surface finish.					X							
	Plastics - Uniformly blast 3/0 flint quartz (C-496) at pressures less than 40 psi to produce a matte surface finish. ⚠3											X	
5	RESIDUE REMOVAL - Remove dry abrasive blasting or sanding residue with a blast of compressed air. ⚠1				X				X	X	X	X	X
6	SOLVENT WIPE - Solvent clean using materials specified in 1.				X						X	X	X
7	SOAP CLEAN - Scrub with abrasive pad (C-407) and an cleaning compound (C-318) solution (4 to 6 fl. oz./gallon in water).	X	X	X	X								
8	RINSE - Thoroughly rinse with clean water.	X	X	X	X								

Table 4-3. Surface Preparation (Cont)

STEP	OPERATION	MATERIAL											
		ALUMINUM ALLOYS	STAINLESS STEEL	CADMIUM PLATE	TITANIUM	MAGNESIUM ALLOYS	TUNGSTEN AND TUNGSTEN ALLOYS	NICKEL	LEAD	CARBON AND LOW ALLOY STEEL	COMPOSITE SURFACES	PLASTICS	TOP-COATED OR PRIME SURFACES (CURED)
9	INSPECT - Inspect washed surfaces to assure a water break free surface. △2	X	X	X	X								
10	DICHROMATE TREATMENT - Apply dichromate treatment.					X							
11	DICHROMATE ETCH						X						
12	CHEMICAL FILM TREATMENT - Apply chemical film (C-100) treatment in accordance with the Brush procedure.	X			X								
13	CHROMATE TREAT - Apply Brush chromate treatment with C-108.			X									
14	ALCOHOLIC PHOSPHORIC TREATMENT - Apply alcoholic phosphoric treatment with C-344.		X										
15	WASH PRIMER - Apply wash primer.												
	Stainless Steel - Application is optional. Wash primer may be applied in addition to or in lieu of alcoholic phosphoric treatment.		X										
	Cadmium Plate - Application is mandatory only as cadmium plate has not received a supplemental chemical treatment such as a chromate conversion or a phosphate coating.			X									
16	RINSE - Thoroughly rinse with clean water.	X	X	X	X	X	X	X					
17	DRY	X	X	X	X	X	XX	X			X	X	X

NOTES:

△1 Carbon and low alloy steels, and lead shall be epoxy primed immediately following removal of the blasting residue.

△2 Apply a film of water to the surface to be inspected. If a flashout occurs within 25 seconds after the flow of water is stopped, the surface shall have failed the test and shall be recleaned and retested. If a flashout does not occur, the surface shall have passed the test.

△3 This operation may be performed in lieu of the operation presented in 2.

3. Thickness. Dry film thickness of one spray coat of primer (C-234) shall be 0.0004 to 0.0010 inch (0.01016 to 0.0254 mm).

4-15. Procedure Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-227	Primer Surfacer
C-234	Primer
C-306	Toluene
C-423	Abrasive Cloth or Paper
C-426	Tape
C-474	Dry Blasting Abrasive

1. Surface preparation.

a. Composite surfaces shall be wiped with clean cloths wetted with toluene (C-306).

b. Composite surfaces shall be abrasive blasted with dry blasting abrasive aluminum oxide (C-474) or sanded with abrasive coated cloth or paper (C-423) to remove glazed surface. Dry blasting abrasive size shall be no coarser than 100 grit and abrasive coated cloth or paper (C-423) shall be no coarser than 180 grit. Blasting pressure shall not exceed 40 psi when using hand operated blasting equipment or 60 psi when using automatic blasting equipment.

CAUTION

FOR ALL DRY BLASTING OPERATIONS, NOZZLE DISTANCE(S), IMPINGEMENT ANGLE(S), AND TRAVERSE RATE SHALL BE ADJUSTED TO PREVENT DAMAGE TO THE OUTERMOST FIBERS.

FOR SANDING OPERATIONS, EXERCISE EXTREME CAUTION TO PREVENT DAMAGE TO OUTERMOST FIBERS.

c. Remove sanding residue with clean cloths wetted with toluene (C-306).

d. Metal surfaces shall be prepared in accordance with table 4-3.

e. Pin holes in composite surfaces shall be filled by one of the following methods as specified in applicable manual.

(1) Method 1 - Sanding surfacer. Apply epoxy sanding surfacer primer surfacer (C-227) to all composite surfaces assuring covering and/or filling of pin holes.

(2) Method 2 - Pin hole filler. All composite surfaces shall receive pin hole filler as follows:

(a) Shake pin hole filler container thoroughly.

(b) Apply, using clean cloths or rags, by rubbing filler into surface with a circular motion. Circular rubbing action produces a static charge which draws the filler into pin holes. Remove excess filler while rubbing filler into surface.

(c) Allow 40 to 60 minutes dry time of filler on surface of blade. Excess filler will dry to a soft powder which shall be removed with clean cloths, rags, or abrasive pads.

NOTE

Filler residue which is not readily removable may be painted over with primer.

(3) After a minimum of 4 hours dry of pin hole filler apply one coat of primer (C-234).

2. Primer preparation.

a. Mix primer (C-234) in accordance with manufacturers recommendation. Thin mixed primer (if required) according to manufacturers recommendation.

NOTE

Allow primer material to reach room temperature (65° to 95°F (18.3° to 35°C)) prior to mixing and applying.

b. After mixing, a viscosity check shall be conducted and shall be 35 ±5 seconds in a Zahn #1 cup or 17 ±5 seconds in a Zahn #2 cup.

3. Application procedures.

a. Areas requiring masking shall be masked using tape (C-426) and/or suitable masking devices as required.

b. Adjust spray equipment and control rate of stroke to apply one wet coat of primer (C-234).

c. Overcoating primer should be between 1 hour and 8 hours. From 8 hours to 24 hours air dry, a mist coat of primer shall be applied prior to overcoating. After 24 hours, primer shall be sanded and a primer coat applied.

4-16. Process Control Requirements

1. Cured coat shall conform to requirements in paragraph 4-14.

2. Prime and topcoated surfaces shall be capable of passing adhesion test (paragraph 4-24) after 72 hours minimum at ambient temperatures or after 1 hour air cure followed by 2 hour minimum cure at 140°F to 160°F (60°C to 71.1°C).

4-17. POLYURETHANE COATINGS APPLICATION

Table 4-4. Cure Times for Sprayed Polyurethane Coating

SEE NOTES (1) (2) (3)		HOURS @ 70°F
Dust Free	(2)	1/2
Dry to Tape	(2)	6
Dry Hard	(2)	8
Water Resistant		24
Oil Resistant		24
Aircraft Ready for Outdoors		48-72

(1) Drying time may be accelerated by holding in a warm atmosphere (90° to 150°F).

(2) Flat colors usually dry 25 - 50 percent faster than gloss colors.

(3) Below 50°F drying times may be more than doubled.

4-18. Polyurethane Coatings

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-213	Coating
C-218	Topcoat
C-245	Coating

The coating (C-245) and coating (C-213) is intended for use over epoxy primer or urethane compatible primer.

NOTE

For topcoat (C-218) application procedures refer to paragraph 4-25.

4-19. Equipment Requirements

Spray equipment shall be capable of applying a film which will conform to the requirements of paragraph 4-20. Cup gun, pressure pot, airless or airless electrostatic may be used.

4-20. Process and Product Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-245	Coating

1. Appearance.

a. Details, parts, assemblies, and exterior of helicopter. Cured film shall be free of runs, sags, streaks, blisters, lifting, and blushing.

b. Rotor blades, main and tail. Cured film shall be free of runs, sags, streaks, lifting, and blushing. Slight burnishing or marring of polyurethane topcoat during handling and shipping is permissible provided no physical damage such as nicks, digs, scratches, imprints, etc., occurs.

2. Adhesion. There shall be no loss of adhesion of polyurethane coating system when tested (paragraph 4-24).

3. Thickness. Dry film thickness of one spray coat of coating (C-245) shall be 0.00085 to 0.00115 inch (0.02159 to 0.02921 mm).

4-21. Procedure Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-213	Coating
C-245	Coating
C-305	Aliphatic Naphtha

1. Area control. Polyurethane coating shall be sprayed in an area where temperature is between 50°F and 100°F (10°C and 37.8°C) and relative humidity is between 50 and 90 percent. In addition, spraying and drying areas shall be as free as possible from airborne contamination.

2. Surface preparation. Normally, polyurethane coating shall be applied over surfaces that have been epoxy primed. Surfaces that have been primed shall receive polyurethane topcoat in 1 to 8 hours after priming. Other surfaces shall be prepared in accordance with following step.

3. Acrylic PUC (Kydex) and reinforced glass sheet. These materials shall be prepared as follows:

a. Degrease with aliphatic naphtha (C-305).

b. Wet and/or dry sand with a suitable grit sandpaper which will not leave scratches which will show after final coat of polyurethane.

NOTE

Sand until glaze has been removed.

c. Remove sanding residue using a clean, dry, lint-free cloth.

d. Wipe surfaces with a tack rag.

e. Apply coating (C-245) or coating (C-213).

f. Use of epoxy primer on above surface is permissible but not required.

4-22. Polyurethane Coating Preparation

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-213	Coating
C-245	Coating

1. The coating (C-213) consists of two components. A resin base component, Component I and aliphatic isocyanate, Component II. These are furnished as a kit. Mix in accordance with manufacturer instructions.

NOTE

Allow coating materials to reach room temperature (65°F to 95°F (16.6°C to 35°C) prior to mixing and applying.

a. Viscosity. After mixing, viscosity check shall be conducted. Viscosity at 70°F – 75°F (21.1°C – 23.9°C) shall be 17-23 seconds using a Zahn No. 2 viscometer.

b. Thinning. If thinning is required to meet viscosity requirements, use appropriate thinner.

2. The coating (C-245) consists of two components. Component A is pigmented and contains polyester resins and solvent. Component B contains clear aliphatic isocyanate catalyst. These components are packaged separately and are furnished in a kit form. Mixing ratio shall be as specified by manufacturer.

a. Viscosity. After thinning to maximum VOC content, viscosity shall not exceed 30 seconds through a Ford #4 cup. If viscosity exceeds this limit, the material is considered to be rejectable.

b. Thinning. If thinning is required, thin according to manufacturer's instruction. However, material shall

not be thinned to point that it is no longer VOC compliant.

4-23. Application Procedures

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-213	Coating
C-234	Primer
C-245	Coating
C-423	Abrasive Cloth or Paper
C-426	Tape

1. Masking. Areas requiring masking shall be masked using tape (C-426) and/or suitable masking devices as required.

2. Spraying. Adjust spray equipment and control rate of stroke and apply a minimum of two wet top coats of coating (C-245) or coating (C-213).

3. Dry time between coats. The dry time between coats of polyurethane coating shall be 30 minutes to 8 hours at room temperature.

4. Striping colors. Striping colors may be applied to top coating without sanding, provided 24 hours cure on coating has been not exceeded. Over 24 hours, striping area shall be sanded to provide adhesion of striping colors to base coating.

NOTE

Polyurethane coating (C-245) on rotor blades shall be thoroughly sanded with 180 grit or finer abrasive coated cloth or paper (C-423) and primed with primer (C-234) prior to stripping.

5. Drying time characteristics. Table 4-4 lists drying time requirements of sprayed coating (C-245) or coating (C-213).

6. Touch-up procedures shall be in accordance with paragraph 4-39.

4-24. Process Control Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-518	Tape

1. Appearance. Cured polyurethane shall conform to paragraph 4-20.

2. Adhesion. Polyurethane coated surfaces shall be capable of passing adhesion test specified in following step after a minimum of 24 hours cure of paint system.

3. Dry tape test. Apply to areas selected a one inch wide strip of tape (C-518). Press tape onto surface with firm finger pressure. Grasp one end of tape and while holding it at approximately 90 degrees from coated surface, remove tape with an abrupt motion. Loss of adhesion shall result in further adhesion tests. If these additional tests indicate generally poor adhesion, area shall be stripped to prime or base material, re-chemically treated as required, and refinished. If additional tests indicate isolated areas of non-adhesion, areas shall be refinished in accordance with touch-up procedures (paragraph 4-39).

4. Total coating thickness. Total coating thickness of polyurethane system shall be 0.0023 to 0.0032 inch (0.0584 to 0.0813 mm).

NOTE

This total coating thickness does not apply to rotor blades.

4-25. Polyurethane Coating (C-218) Application

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-218	Topcoat

Aliphatic polyurethane, chemical agent resistant topcoat (C-218) is a topcoat intended for use over

epoxy polyamide primers to provide aircraft surfaces that may be easily and effectively decontaminated after exposure to liquid chemical agents. Futhermore, depending on color applied, coating provides either a non-specular surface (non-camouflage) or a camouflage surface to aircraft.

4-26. Equipment Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-218	Topcoat

Spray equipment. External mix spray equipment, either siphon or pressure feed, shall be used. Spray equipment shall be capable of applying topcoat (C-218) to requirements of paragraph 4-27.

4-27. Process and Product Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-218	Topcoat

1. Appearance. After drying, applied coating shall show no signs of running, sagging, streaking or blushing.

2. Adhesion. There shall be no loss of adhesion of topcoat (C-218) when tested.

3. Thickness. Dry film thickness of one spray coat shall be 0.0009 to 0.0011 inch (0.02286 to 0.02794 mm).

NOTE

For adequate camouflage properties, it is necessary to apply camouflage topcoat (C-218) to a minimum dry film thickness of 0.0018 (0.0457 mm).

4-28. Procedure Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-204	Primer
C-218	Topcoat
C-235	Thinner
C-423	Abrasive Cloth or Paper
C-426	Tape

1. Surface preparation. Coating (C-218) shall be applied to surfaces primed with primer (C-204).

2. Coating preparation. Coating (C-218) is a two-component material supplied in kit form. Mix in accordance with manufacturer instruction. Thoroughly agitate and check viscosity using Zahn #2 viscometer. Reduce as necessary with thinner (C-235) type I. Strain mixed coating and allow to sweat for 30 minutes prior to application. Pot life of mixed material is 8 hours.

3. Application.

a. Masking. Areas requiring masking shall be masked using tape (C-426) and/or suitable masking devices as required.

b. Spraying. Immediately prior to spraying, wipe all surfaces to be painted with a tack rag. Adjust fluid delivery to 17-20 ounces per minute (for pressure application) and atomization air pressure to 55-60 psi at gun. Mixed coating in spray equipment or containers shall be redispersed prior to spraying. Using a controlled rate of stroke, apply a wet film of topcoat (C-218) which when dry will meet requirements of paragraph 4-27.

c. Dry time between coats. Drying time between coats shall be a minimum of 30 minutes and a maximum of 24 hours at ambient temperatures.

d. Markings. A minimum of 6 to 8 hours air dry shall be allowed prior to masking and marking. Heat curing at 120°F ± 10°F for 2 hours may be used in lieu of air dry, provided a minimum of 1 hour air dry is accomplished prior to heat curing.

e. Final curing. Completed paint system shall be allowed to air dry for a minimum of 48 hours prior to exposure to elements.

4. Touch-up procedures. Damaged surfaces and small areas of non-adhesion shall be repaired in accordance with paragraph 4-39 except use 360 grit or finer abrasive coated cloth or paper (C-423).

4-29. Process Control Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-218	Topcoat
C-518	Tape

1. Appearance. Cured topcoat (C-218) shall conform to paragraph 4-27.

2. Adhesion. Polyurethane coated surfaces shall be capable of passing adhesion test specified in following paragraph after a minimum of 24 hours cure of paint system.

3. Dry tape test. Apply to areas selected a one inch wide strip of tape (C-518). Press tape onto surface with firm finger pressure. Grasp one end of tape and while holding it at approximately 90 degrees from coated surface, remove tape with an abrupt motion. Loss of adhesion shall result in further adhesion tests. If these additional tests indicate generally poor adhesion, area shall be stripped to prime or base material, re-chemically treated as required, and refinished. If additional tests indicate isolated areas of non-adhesion, areas shall be refinished in accordance with touch-up procedures (paragraph 4-39).

4-30. EPOXY ENAMEL — APPLICATION

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-100	Chemical Film Material
C-202	Primer
C-207	Enamel
C-318	Cleaning Compound
C-344	Alcoholic Phosphoric Cleaner
C-407	Abrasive Pad
C-423	Abrasive Cloth or Paper
C-426	Tape

Epoxy enamel (C-207) may be applied directly to mechanically or chemically treated metal surfaces, reinforced plastic laminates, and epoxy primed surfaces. (Refer to table 4-3 for surface preparation.) Epoxy enamel (C-207) is intended for use where a paint coating with good abrasion and chemical resistance is desired.

4-31. Process and Product Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-207	Enamel

1. Appearance. After drying, applied film shall be free from grit, seeds, craters, blisters or other such surface irregularities.

2. Thickness. Dry film thickness of enamel (C-207) shall be 0.0005 to 0.0007 inch (0.0127 to 0.01778 mm) per coat.

NOTE

Epoxy enamel coatings applied to internal surfaces by fill and drain, or flowing, do not have a thickness requirement. Only requirement is that epoxy enamel shall cover all surfaces.

3. Adhesion. When tested there shall be no loss of adhesion. The enamel (C-207) shall have air dried a minimum of 48 hours prior to testing.

4-32. Procedure Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-204	Primer
C-207	Enamel
C-235	Thinner
C-423	Abrasive Cloth or Paper
C-426	Tape

1. Surface preparation. The enamel (C-207) shall be applied to surfaces primed with primer (C-204).

2. Masking. Areas requiring masking, should be masked using tape (C-426) suitable for masking.

3. Prepare epoxy enamel as follows:

a. Shake or stir pigmented resin until uniform.

b. Add one (1) volume of activator to one (1) volume of pigmented resin component and mix thoroughly. Reduce as necessary, with thinner (C-235) (type II) to a spray viscosity of 20-24 second Zahn # 2.

c. Strain through a paint strainer.

NOTE

Catalyzed enamel shall be discarded if not used within four hours after mixing.

4. Apply epoxy enamel (C-207) by spray, or brush. For internal use, seal or plug end of tube, flow epoxy enamel (C-207) into hollow part, slosh as needed to coat surface, drain excess enamel.

5. Time between coats shall not be less than 30 minutes nor more than eight hours. If 8 hours is exceeded, initial coat(s) of epoxy enamel shall be thoroughly sanded with 180 grit abrasive coated cloth or paper (C-423), prior to overcoating. Following exceptions are:

a. Second coat may be applied 10 minutes after solvent flash off if first coat was applied to an unpainted surface.

b. Under fast drying conditions (high temperature), second coat shall be applied within two hours after application of first.

6. Cure. Sprayed parts are normally dry to handle within one hour. Full cure is obtained after a minimum of 48 hours air dry.

7. Touch up small areas by sanding through enamel using 320 grit or finer abrasive coated cloth or paper (C-423). Smooth damaged area and fair in surrounding surfaces to a feather edge. Reapply primer (C-204), if necessary and epoxy enamel (C-207).

4-33. POLYURETHANE ENAMEL — APPLICATION

4-34. Equipment Requirements

1. Spray equipment. Spray equipment should be capable of spraying a film which will conform to requirements of paragraph 4-36.

4-35. General Information

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-233	Enamel

NOTE

Polyurethane enamel is not intended for use on polycarbonate (Kydex) surfaces.

Intended use. The enamel (C-233) covered by these instructions is intended for use on exterior surfaces over epoxy polyamide primed substrates and acrylic, PVC (Royalite), and reinforced acrylic glass sheet.

4-36. Process and Product Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-233	Enamel

1. Appearance. After curing, sprayed polyurethane enamel film shall be smooth, uniform and free from seeds, blisters, pinholes, cracks and other such film irregularities.

2. Adhesion. There shall be no loss of adhesion when tested (paragraph 4-38).

3. Thickness. Dry film thickness of one spray coat of enamel (C-233) shall be 0.0005 to 0.0008 inch (0.0127 to 0.0203 mm).

4-37. Procedure Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-233	Enamel
C-426	Tape

1. Area control. Enamel should be sprayed in an area where temperature is between 50°F and 100°F (10°C and 37.78°C) and relative humidity is between 30 and 90 percent. In addition, spraying and drying areas should be as free as possible from airborne contamination. When dew point and temperature come within five degrees of each other, application of polyurethane enamel should be stopped.

2. Surface condition. Normally, enamel (C-233) should be applied over surfaces that have been epoxy polyamide primed. Surfaces that have been epoxy primed should receive enamel within 4 to 6 hours after priming. Other surfaces that will receive enamel without prime should be prepared in accordance with following steps:

a. Acrylic, PVC (Royalite) and reinforced acrylic glass, materials shall be prepared as follows:

(1) Degrease with aliphatic naphtha.

(2) Wet and/or dry sand with a suitable grit sandpaper that will not leave scratches which will show after final coat of enamel.

NOTE

Sand until glaze has been removed.

(3) Remove sanding residue using clean, dry, lint-free cloths.

(4) Wipe surfaces with a tack rag.

(5) Apply enamel (C-233).

3. Polyurethane enamel preparation. Polyurethane enamel must be prepared for spraying in accordance with manufacturers instructions. After thoroughly mixing components, allow mixture to stand for at least 30 minutes prior to straining through a paint strainer. After straining, enamel is ready to be sprayed. Enamel shall be used within 6 hours after mixing.

4. Application procedures.

a. Masking. Areas requiring masking, should be masked using tape (C-426) suitable for masking when using polyurethane paint.

b. Spraying. Immediately prior to spraying, primed surface should be wiped with a tack rag. Adjust spray equipment and control rate of stroke to apply a wet film of enamel which (when dry) will have appearance (paragraph 4-36) and meet adhesion test as stated in paragraph 4-38. Enamel in spray equipment or containers which has settled should be dispersed prior to spraying.

c. Dry time between coats. Drying time between coats shall be a minimum of 30 minutes and a maximum of 24 hours at ambient temperature.

d. Final cure. The completed paint system shall be allowed to air dry for a minimum of 48 hours prior to exposure to the elements.

5. Touch-up procedure. Damaged surfaces and small areas of nonadhesion shall be repaired by one of the methods applicable as stated in paragraph 4-39.

4-38. Process Control Requirements

1. Appearance. After curing, the sprayed polyurethane enamel film shall be smooth uniform and free from seeds, blisters, pinholes, cracks and other such film irregularities.

2. Adhesion. Polyurethane enamel coated surfaces should have no loss of adhesion and shall be capable of passing the adhesion test (refer to step a.) after curing 96 hours at ambient temperature.

a. Adhesion test.

NOTE

Do not apply adhesion tape test over rivets, fasteners or skin edges.

(1) Apply a strip of masking tape approximately 1 by 3 inches to the curved flat surfaces in several areas over large painted surfaces.

(2) Press tape onto the surface with firm finger pressure. Grasp one end of tape, holding it at approximately 90 degrees from the painted surface. Remove tape with an abrupt motion.

(3) If the above test shows evidence of loss of paint adhesion, this usually indicates surface was dirty or improperly prepared prior to painting. These nonadhesion areas shall be refinished in accordance with instructions in paragraph 4-39.

4-39. TOUCH–UP PAINTING PROCEDURES

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-204	Primer
C-423	Abrasive Cloth or Paper

NOTE

The following instructions are primarily for the touching up of scuffed or damaged areas of the exterior painted surfaces.

1. The finish repair procedures cover three methods as follows:

a. Method 1. Areas where the finish has been removed down to the base metal or fiberglass.

b. Method 2**.** Areas where the finish has been removed down to the primer coat.

c. Method 3. Areas where the top coat has been damaged within itself, but not down to the primer coat.

2. The mixing instructions and precautions for application of polyurethane topcoat are as follows:

a. All equipment used for mixing, straining and spraying must be clean.

b. All polyurethane coating colors are mixed per manufacture instructions.

CAUTION

DO NOT PUNCTURE THE CATALYST CONTAINER. CATALYST AND BASE MATERIALS ARE VERY SENSITIVE TO MOISTURE PRIOR TO MIXING AND SPRAYING. AFTER OPENING AND MEASURING, IMMEDIATELY REPLACE LIDS AND CAPS TIGHTLY.

c. When mixing small amounts of polyurethane coating that results in leaving some base and some

catalyst in original containers, be certain to use measuring units to maintain manufacture instructions.

d. Mixed polyurethane material should have 15 to 30 minute wait prior to spraying.

e. The pot life of polyurethane material, as mixed, is 8 hours at ambient room temperature. When possible, spray the mixed material within four hours.

f. Always strain mixed polyurethane material prior to use.

NOTE

Refer to applicable Component Repair and Overhaul Manual for detailed structural repair instructions.

(1) Method 1. Areas which have been damaged to the base material shall be repaired by removing the finish in the damaged area. The damaged area shall be faired-in with the surrounding surface using 320 grit abrasive coated cloth or paper (C-423) (wet or dry sanding), and the base material, if metal, rechemically treated as required (refer to chapter 3) and the primer and topcoat reapplied. The application of the topcoat should cover a complete panel or section to provide the best possible blending with the surrounding area.

(2) Method 2. Areas which have been damaged to the extent that the primer has not been removed to the base material shall be repaired by removing only the damaged area, fair-in with the surrounding area, reapply a coat of epoxy polyamide primer (C-204) to this area, and finish with a minimum of two coats of polyurethane as outlined in method 1.

(3) Method 3. Areas which have been damaged within the topcoat only shall have this area faired-in with the surrounding surface and a minimum of two coats of polyurethane applied as outlined in method 1.

3. When finish repairs have been made on the paint, allow a minimum of 48 hours prior to subjecting repaired area to inclement weather conditions.

4-40. EPOXY/ZINC COATING — APPLICATION

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-208	Epoxy/Zinc Coating

The Epoxy/Zinc Coating (C-208) is intended for use as a protective coating for low alloy steel tubing and tubular parts. The coating shall not be used on exterior surface without overcoating. The epoxy will provide barrier protection against moisture and the zinc filler will provide galvanic protection for steel surfaces.

For optimum adhesion and corrosion protection, Epoxy/Zinc Coating (C-208) should be applied over steel surfaces which have been initially prepared by abrasive or shot blasting to remove scale and oxides then phosphatized. Particular parts and/or manufacturing procedures may necessitate the use of multiple cleaning operations.

4-41. Process and Product Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-208	Epoxy/Zinc Coating

1. Appearance. After drying, coating shall be free from pit, mud cracking, craters, blisters and other such defects which expose base metal. Runs, sag, nodules and similar type surface irregularities on internal surfaces, coated by fill and drain or by spraying, are acceptable provided they meet the requirements in paragraph 2. Metallic zinc filler shall be dispersed in coating and shall present a relatively uniform grey appearance. Dark streaks will be visible on coatings applied by fill and drain. These streaks indicate areas of heavier zinc concentration and are acceptable. Clear areas where zinc is not visible are not acceptable but may be overcoated with an additional coat of Epoxy/Zinc Coating (C-208) to obtain an acceptable appearance.

2. Thickness. Dry film thickness of sprayed coatings on flat surfaces shall be 0.0005 to 0.001 inch (0.0127 to 0.0254 mm). Internal surfaces of tubing and tubular type parts shall not be subjected to thickness requirements.

3. Coating shall be free from chipping, cracking or peeling.

4-42. Procedure Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-206	Thinner
C-208	Epoxy/Zinc Coating
C-305	Aliphatic Naphtha
C-309	Methyl-Ethyl-Ketone (MEK)
C-435	Paint Remover
C-436	Paint Remover

1. Clean surface to be painted with aliphatic naphtha (C-305) or MEK (C-309).

2. Mix components of Epoxy/Zinc Coating (C-208) as follows:

a. Measure desired volume of base material.

b. Add equal volume of accelerator/thinner and mix thoroughly.

c. Weigh mixture.

d. Calculate required amount of zinc powder to produce 35 to 45 percent (by weight) of mixed material. Each 100 grams of base/thinner mixture will require 35 to 45 grams of zinc powder.

e. Weigh required amount of zinc powder and add to base/thinner mixture, stirring constantly to achieve a uniform mixture.

f. Allow mixture to set for a minimum of 1 hour prior to use. Stir thoroughly prior to use.

NOTE

Epoxy/Zinc mixture shall be discarded if not used within twenty-four hours after mixing. Under some temperature/humidity conditions the mixture may exhibit a shorter pot life as indicated by a pronounced thickening of material. Do not attempt to thin. Discard mixed material when this occurs.

3. Apply Epoxy/Zinc Coating (C-208) as follows:

a. Mask areas not to be painted.

b. Apply Epoxy/Zinc Coating (C-208) by spraying, brushing, swabbing, or fill and drain.

NOTE

Continuously agitate mixture to insure a uniform distribution of zinc powder.

(1) Spraying. Adjust spray equipment and control rate of stroke to apply a film which, when dry, will meet requirements in paragraph 4-41. Reduce coating material to a sprayable viscosity of 20-24 seconds (#2 Zahn) with thinner (C-206).

(2) A brush or swab of suitable size may be used to apply coating in specific area.

(3) Fill and drain. Apply coating to internal surfaces using following technique:

NOTE

Epoxy/zinc coating material shall be agitated prior to and during use to assure that zinc powder is distributed uniformly throughout applied coating. A kitchen blender has been proven to be an excellent tool for this purpose.

(a) Seal or plug one end of tubing or tubular type (hollow) parts as required. Flow coating material into hollow part. Fill and/or slosh as needed to coat entire surface.

(b) Drain excess coating material from part. Allow coating to air dry for a minimum of one hour then apply a second coat by fill and drain. Drying time must be extended when slow drying conditions exist.

NOTE

Material drained from parts into clean containers may be reused for other parts provided pot life is not exceeded.

4. Equipment cleaning — Uncured epoxy/zinc coating (C-208) may be removed with MEK (C-309) or lacquer thinner. Cured coatings may be removed by using acid type remover paint remover (C-435) or paint remover (C-436).

5. Cure epoxy/zinc coating as follows:

a. Tubular type parts that are coated by fill and drain method shall remain in a vertical or near vertical position for a minimum of 1 hour to prevent puddling.

b. Heat cure coating as follows:

(1) Dry at room temperature for at least 2 hours.

(2) Cure at 150 to 160°F (66 to 71°C) for 1 hour.

c. Coating will reach final cure in 72 hours at room temperature.

6. Touch up areas that have been missed during painting using methods in step 3. If the surface has been contaminated with oils or grease, it shall be solvent cleaned prior to the application of the coating.

7. Rework — When a coating exhibits a complete lack of adhesion (large blisters, mud cracking, or peeling) it shall be removed and surface re-treated prior to recoating. Cured coatings may be removed by abrasive blasting. The use of chemical paint removers must be approved on a part number basis (referenced in the applicable maintenance/component repair manual). Coatings that exhibit minor defects and/or removal because of mechanical rework, etc., may be replaced by overcoating.

4-43. CONTROL TUBE INTERNAL SURFACE — REFINISHING

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-204	Epoxy Polyamide Primer
C-309	MEK

1. Refinish internal surfaces of the steel control tubes as follows:

a. Flush the internal surface with MEK (C-309) and allow to air dry.

b. Prepare epoxy/zinc coating according to paragraph 4-42.

c. Plug one end of the tube, flow coating material into the tube. Fill and/or slosh as needed to coat entire internal surface.

d. Remove the plug, and drain excess coating material from the tube. Position the tube in a vertical position for a minimum of 1 hour.

e. After allowing the coating to air dry for 1 hour, apply a second coat.

f. Remove the coating from the internal surface of the tube end where the end fittings will be installed with a swab wet with MEK (C-309).

g. Allow the coating to dry prior to further work. The coating will reach final cure in 72 hours at ambient temperature. Drying time may be accelerated by allowing coating to dry at ambient conditions for a least 2 hours followed by heat cure at 150 to 160°F (66 to 71°C) for a minimum of 1 hour.

2. Refinish internal surfaces of the aluminum control tubes as follows:

a. Flush the internal tube surfaces with MEK (C-309) and allow to air dry.

b. Plug one end of tube. Flow primer (C-204) into tube. Fill and/or slosh as needed to coat entire internal surface.

c. Remove plug and allow excess primer to drain.

d. Remove wet primer from internal surface of tube where end fittings will be installed using a suitable swab wetted with MEK (C-309). This must be accomplished within 3 minutes after primer application.

e. Lay tubes horizontally and allow them to remain in this position for a minimum of 1 hour.

f. After allowing primer to air dry for not less than 1 hour and not more than 8 hours, apply a second coat by repeating steps b through e.

g. Allow primer to dry prior to further work.

4-44. WALKWAY COATING — APPLICATION

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-223	Nonslip /Compound

Walkway coating nonslip compound (C-223) has superior nonslip properties and is intended for use where maximum nonslip characteristics are a desired factor.

4-45. Procedure

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-223	Nonslip Compound
C-305	Aliphatic Naphtha
C-423	Abrasive Cloth or Paper

1. Surface preparation.

a. Freshly primed or painted surfaces that are clean may have nonslip compound (C-223) applied directly to surface.

b. Primed or painted surfaces which are dry, hard, aged, and firmly bonded shall be scuff sanded using 400 grit abrasive coated cloth or paper (C-423). Remove sanding residue and clean surfaces with clean cloths dampened with aliphatic naphtha (C-305). Dry surfaces with a clean cloth before naphtha evaporates.

2. nonslip compound (C-223) shall be thoroughly stirred before placing in dispensing containers in order to assure a homogeneous mixture. When spraying is used, coating material shall be thinned as necessary to a suitable consistency for application, using solvents specified by manufacturer. For brush and roller application material need not be thinned.

4-46. Application

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-223	Nonslip Compound

1. Apply a light first coat of walkway coating nonslip compound (C-223) to required area using brush, spray, or roller.

2. Apply a second heavy cross-coat by same application method. Allow a minimum of 30 minutes drying time between coats. This produces a coating weight of 20 to 25 ounces per square yard.

3. Removal of masking tape may be accomplished when walkway coating is dry to touch. There shall be a minimum of 24 hours air dry time prior to walking on coating.

4-47. ACRYLIC LACQUER — APPLICATION

The lacquers covered by these instructions are intended for use on exterior surfaces over epoxy primers. Acrylic lacquers have excellent diester oils and possess excellent weathering characteristics.

4-48. Equipment Requirements

Spray guns and accessories. Spray equipment used for application of acrylic lacquer should be capable of spraying a paint film which conform to requirements of paragraph 4-32.

4-49. Procedure Requirements

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-245	Coating
C-246	Coating
C-235	Thinner
C-305	Aliphatic Naphtha
C-323	Filler
C-423	Abrasive Cloth or Paper
C-424	Putty
C-426	Tape

1. Surface condition. Normally, acrylic lacquers should be applied over surfaces that have been epoxy primed. Refer to paragraph 4-11.

Surfaces that have been primed with epoxy primer shall receive first coat of lacquer topcoating within 4 hours after priming. Surfaces that have been primed with polyamide epoxy primer, at room temperature, shall receive first coat of lacquer topcoating within 8 hours after priming.

2. When epoxy primer is applied at elevated temperatures, first coat shall be applied within 3 hours after priming. Other surfaces that may have received acrylic lacquer without prime should be prepared as follows:

a. Acrylic PVC alloy (Kydex), reinforced acrylic laminates, Acrylic lacquer surfaces (air dried more than 120 hours) and contaminated acrylic lacquer. Surface preparation should be as follows:

NOTE

Primer not required on Kydex parts prior to application of finish.

(1) Sand acrylic laminated plastics until glaze has been removed.

(2) Degrease with aliphatic naphtha (C-305).

(3) Sand with any grit abrasive coated cloth or paper (C-423) that will not leave scratches which will show after final coat of lacquer. Wet or dry sanding is permissible.

(4) Wipe sanded surfaces using aliphatic naphtha (C-305) and clean cloths.

(5) Wipe surfaces with a tack rag.

b. Acrylic lacquer surfaces (air dried more than 120 hours) and/or contaminated acrylic lacquer surfaces. These surfaces shall be prepared for painting in accordance with subparagraph a. above.

3. Lacquer preparation.

a. Aluminized lacquer. Aluminized lacquer (C-203) should be prepared by incorporating 8 ounces (226.8 g) of coating (C-246) into one gallon (4.546 l) of coating (C-245) with aid of thinner (C-235) conforming to manufacture's instructions.

b. Procedure. Thoroughly wet aluminum powder with thinner. Add a small amount of clear lacquer to wet powder and stir to a paste consistency. Incorporate paste into a gallon (4.546 l) of clear lacquer by use of a mechanical mixer. Thin lacquer for spraying in accordance with subparagraph c. below.

c. Thinning for spraying. Acrylic lacquers should be thinned for spraying in accordance with manufacture's instruction. Prior to thinning, lacquer must be shaken to redisperse any settling.

d. Straining. After thinning and prior to initial use, strain lacquer using a paint strainer.

e. Intermixing products. Acrylic lacquers from different manufactures shall not be mixed, nor shall different types of acrylic lacquers from same manufacture be mixed.

4. Application procedures.

a. Masking. Mask areas as required, using tape (C-426) and/or suitable masking devices.

b. Spraying. Adjust spray equipment and control rate of stroke to apply wet film of lacquer which will result in dry film thickness of 0.0004 to 0.0006 inch (0.0102 to 0.0152 mm).

c. Drying time between coats. Drying time between coats shall be 30 minutes to 72 hours at room temperature. Lacquer surfaces not overcoated within one hour should be tack rag prior to overcoating.

CAUTION

APPLICATION OF SPOT PUTTY SHALL BE LIMITED TO LOCAL AREAS OF MINOR POROSITY OR OTHER SIMILAR IMPERFECTIONS. USE SPOT PUTTY IN WELL VENTILATED AREA. FLAMMABLE FLASH POINT IS APPROXIMATELY 50F (10° C).

d. Application of filler (C-323) or putty (C-424). Prior to final lacquer topcoat, minor porosity such as pin holes and other similar imperfections may be filled with spot putty. Allow putty to dry hard. Lightly sand to fair-in with surrounding surfaces.

e. Temperature and humidity. Acrylic lacquers may be applied over a wide temperature and humidity range. However, if blushing or dry spraying of lusterless MIL-L-19537 or MIL-L-19538 lacquers occur, TT-E-776 retarder may be used to replace up to 10 percent of prescribed amount of thinner. These lacquers shall not be applied if blushing occurs after addition of maximum amount of retarder. Retarder shall not be added to Gloss or Lucite lacquers. If blushing of these lacquers occur, painting shall be stopped.

f. Cure. Acrylic lacquer system should be cured by one of following methods

(1) Cure at room temperature for 48 hours minimum.

(2) Accelerated cure may be accomplished by air drying at room temperature for one hour at approximately 150°F (65.56°C). Air dry time prior to accelerated curing of porous surfaces (fiberglass, etc.) should be adjusted as necessary to prevent surface blisters.

5. Touch-up procedure. Damaged surfaces and areas of nonadhesion shall be repaired by one of following methods as applicable:

a. Method 1. Areas which have been damaged to extent that prime has not removed to base material or small areas of nonadhesion of finish to base material shall be repaired by removing finish in damaged area to base material. Fair-in repaired area with surrounding surfaces 320 grit or finer abrasive coated cloth or paper (C-423) (wet or dry sanding is permissible). Retreat chemically (refer to Chapter 3, Chemical Film Treatment) as required and reapply organic finish in accordance with applicable instructions.

b. Method 2. Areas which have been damaged to extent that prime has not been removed to base material or small area of nonadhesion between coats of lacquer or lacquer topcoating and prime, should be repaired by removing defective coating. Damaged area shall be faired-in with surrounding surfaces as described in method 1. In cases where lacquer has been removed from prime, prime shall be reapplied in accordance with applicable instructions followed by a reapplication of lacquer topcoating in accordance with step 3, Lacquer Preparation and step 4, Application Procedures. In cases where lacquer has not been removed to prime, prime need not be applied.

4-50. Process Control Requirements

1. Appearance. After drying, acrylic lacquer shall not exhibit blushing, blisters sags, streaks, or other such surface irregularities.

2. Adhesion. Acrylic lacquer coated surfaces shall be capable of passing adhesion test after curing, in accordance with curing instructions in paragraph 4-32.

a. Adhesion test:

NOTE

Do not apply adhesion tape test over rivets, fasteners or skin edges.

(1) Apply a strip of masking tape approximately 1 by 3 inches (25 by 76 mm) to curved flat surface in several areas over large painted surfaces.

(2) Press tape onto surface with firm finger pressure. Grasp one end of tape, holding it at approximately 90 from painted surface. Remove tape with an abrupt motion.

(3) If above test shows evidence of loss of paint adhesion, this usually indicates that surface was dirty or improperly prepared prior to painting. These non-adhesion areas should be refinished in accordance with touch-up procedure (paragraph 4-32 or 4-43).

CHAPTER 5 — CLEANING

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CLEANING

5-1. CLEANING

NOTE

For detailed description of recommended cleaning agents, refer to Chapter 11.

5-2. UPHOLSTERY

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-305	Aliphatic Naphtha

CAUTION

UPHOLSTERY MUST ONLY BE CLEANED WITH AGENTS SPECIFIED ON MANUFACTURERS MATERIAL CARE TAG. IF NO CLEANING AGENT IS SPECIFIED, USE ALIPHATIC NAPHTHA (C-305), COMMERCIAL DRYCLEANING SOLVENT OR EQUIVALENT. DUE TO VARIOUS MATERIALS BEING CLEANED, TESTING SHOULD BE ACCOMPLISHED IN AN INCONSPICUOUS AREA.

ANY FLAMMABLE SOLVENT THAT MAY AFFECT MATERIAL FLAMMABILITY SHOULD BE COMPLETELY REMOVED AFTER CLEANING.

5-3. CARPET

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-305	Aliphatic Naphtha

CAUTION

CARPET CLEANING AGENTS SHOULD BE USED WITH CARE TO PREVENT DAMAGE TO UNDERLYING METAL SURFACES. CARPET MUST BE REMOVED FROM HELICOPTER FOR CLEANING. ALLOW CARPET TO DRY PRIOR TO REINSTALLATION.

Clean carpet using aliphatic naphtha (C-305) or any good grade commercial drycleaning solvent.

5-4. HEADLINER AND TRIM PANELS

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-305	Aliphatic Naphtha
C-355	Detergent
C-385	Isopropyl Alcohol

WARNING

99% ISOPROPYL ALCOHOL (C-385) IS FLAMMABLE AND TOXIC. DO NOT INGEST OR INHALE. ISOPROPYL ALCOHOL MAY REMOVE LUBRICANTS OR PRESERVATIVES AND MAY SOFTEN SOME PLASTICS. DO NOT USE ON WINDOWS OR WINDSHIELDS.

CAUTION

USE SOLVENTS SPARINGLY. CERTAIN SOLVENTS MAY SOFTEN OR DULL MATERIAL. TEST IN AN INCONSPICUOUS AREA.

1. Clean headliner and trim panel with aliphatic naphtha (C-305) or isopropyl alcohol (C-385), which should be suitable for most materials. Test inconspicuous area.

2. Finish cleanup with mild soap or detergent (C-355) and clean water.

5-5. PLASTIC AND GLASS

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent
C-305	Aliphatic Naphtha
C-330	Cleaner
C-355	Detergent
C-385	Isopropyl Alcohol

CAUTION

DO NOT USE COMPOUNDS CONTAINING ABRASIVES OR CHLORINATED HYDROCARBONS. AVOID EXCESSIVE SCRUBBING OR POLISHING OF PLASTIC PANELS. HEAT BUILDUP MAY DAMAGE PLASTIC PANELS.

REMOVE RINGS, WATCHES, AND HARD OBJECTS FROM HANDS AND WRISTS BEFORE WASHING TRANSPARENT PANELS.

1. Clean acrylic plastic windshields and windows with large quantities of clean water and a solution of detergent (C-355). Gently free all insects or dirt with soft pads or fingers. Do not use sponges or coarse cloths. Rinse the area continuously while removing insects or dirt.

2. Flush entire area thoroughly with clean water.

3. Allow surfaces to air dry.

4. Minor scratches may be reduced or removed with cleaner (C-330).

5. Apply cleaner (C-330) with a clean soft cloth or tissue in a circular motion until clean. Polish with another clean, soft, cotton cloth.

CAUTION

IF REQUIRED, IN PLACE OF DETERGENT (C-355), USE ALIPHATIC NAPHTHA (C-305) ONLY. FOR HELICOPTERS EQUIPPED WITH WIPERS, MAKE SURE NAPHTHA IS DRY BEFORE PUTTING RUBBER BLADES IN CONTACT WITH WINDSHIELD.

MOST MATERIALS USED IN THESE AREAS ARE PRONE TO SOLVENT DAMAGE. THIS INCLUDES COATED GLASS WINDSHIELDS.

WHEN CLEANING ADJACENT AREAS OR TOUCHING UP PAINT, BE EXTREMELY CAREFUL TO PROTECT TRANSPARENT AREAS FROM SOLVENT SPLASH, FUMES, AND PAINT OVERSPRAY.

6. If required, transparent areas such as windshields, windows, and sight glasses may also be cleaned with aliphatic naphtha (C-305).

CAUTION

WHEN CLEANING OR TOUCHING UP PAINT ON ADJACENT SURFACES, PROTECT PLASTIC AND FIBER REINFORCED PLASTICS FROM SOLVENT SPLASH, FUMES, OR PAINT OVERSPRAY.

DO NOT VAPOR DEGREASE OR SOAK PLASTIC OR FIBER REINFORCED PLASTICS IN ANY SOLVENT.

7. Opaque plastic parts such as heater, air ducts, door, window trim, or shields, covers and fiber reinforced plastics such as fiberglass, graphite, or polycarbonate (Kevlar) shall be degreased using only isopropyl alcohol (C-385), aliphatic naphtha (C-305), or drycleaning solvent (C-304).

5-6. USE OF HIGH-PRESSURE WASHERS

CAUTION

BELL HELICOPTER TEXTRON RECOMMENDS THAT HIGH PRESSURE WASHERS NOT BE USED FOR THE PURPOSE OF CLEANING HELICOPTERS OR COMPONENTS.

Operators using high pressure washers need to be aware of the implication when using this type of equipment. Refer to Information Letter (IL) GEN-03-95.

The use of high pressure washers has been a primary source of water contamination. Concentration of high-pressure spray will physically push water past gearbox seals and packings, breathers, and caps. The mixture of oil, water, and soap is detrimental to the gears, bearings, and cases of the gearboxes.

High pressure washers will push water past grease-coupling seals and fill the coupling with water and soap. It will also push water past the electrical connectors and backshells. Corroded connectors, pins, and receptacles are liable to cause multiple electrical failures and faults.

Some of our customers have experienced fuel system contaminations attributed to high pressure washers (OSN-GEN-95-26).

It is possible that high pressure washers will push water underneath paint coatings through minute cracks. Trapped water and soap will induce corrosion that will be unnoticed during a visual inspection. When the damage appears, it might be too late to salvage the affected part.

With this information, Bell Helicopter Textron wants to place emphasis on the importance of the proper procedures and advise operators to review their processes and equipment.

5-7. HYDRAULIC ASSEMBLIES AND SERVICING UNITS

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent

CAUTION

DO NOT USE ISOPROPYL ALCOHOL TO CLEAN HYDRAULIC ASSEMBLIES. A STICKY ACRYLIC RESIN WILL FORM AND CAN PREVENT CORRECT OPERATION OF COMPONENTS.

Clean hydraulic assemblies and servicing units with drycleaning solvent (C-304).

5-8. BEARINGS

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent
C-305	Aliphatic Naphtha

CAUTION

DO NOT ROTATE BEARINGS WITH COMPRESSED AIR.

1. Clean ball bearings and roller bearings with drycleaning solvent (C-304) and blow dry with compressed air.

2. Clean du-metal and fabric lined (Teflon) rod end, and other bearings with aliphatic naphtha (C-305) or drycleaning solvent (C-304). Blow dry thoroughly with compressed air or hair dryer.

5-9. METALS (EXCEPT TITANIUM)

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent
C-305	Aliphatic Naphtha
C-385	Isopropyl Alcohol
C-563	Perchloroethylene

1. Bare metals — no paint, adhesive, rubber etc.:

a. Grease, oil, and corrosion preventive compounds may be removed by vapor degreasing or solvent cleaning.

NOTE

Make sure materials used are inhibited vapor degreasing quality solvents.

b. Vapor degreasing may be accomplished by using the following chlorinated solvent:

(1) Perchloroethylene (C-563) — use at 248 to 252°F (120 to 122°C).

c. Solvent cleaning may be accomplished using the above materials or similar solvents at ambient temperature or by using aliphatic naphtha (C-305), drycleaning solvent (C-304), mineral spirits, paint thinners, etc.

2. Painted metal parts:

a. If part is to be stripped and repainted any solvent suitable for bare metal may be used.

b. If the painted part is to be installed without stripping and repainting, solvents must be used at ambient temperature only. Also, solvents such as MEK (C-309), acetone (C-316), lacquer thinner (C-206) and other strong solvents which attack the paint must be avoided.

CAUTION

SOLVENTS MUST BE USED AT AMBIENT TEMPERATURE. DO NOT USE STRONG SOLVENTS, SUCH AS MEK, ACETONE, LACQUER THINNER, ETC.

3. Metal parts with adhesive bonded joints shall be cleaned with aliphatic naphtha (C-305), or drycleaning solvent (C-304).

CAUTION

DO NOT SOAK RUBBER PARTS IN SOLVENT. DO NOT VAPOR DEGREASE AND DO NOT USE CHLORINATED SOLVENTS SUCH AS, TRI-CHLOROETHANE, TRICHLORO-ETHYLENE AND PERCHLORO-ETHYLENE. USE SOLVENTS SPARINGLY.

4. Metal parts containing rubber such as, elastomeric bearings, grease and oil seals, and rubber boots shall be cleaned using aliphatic naphtha (C-305), isopropyl alcohol (C-385), or drycleaning solvent (C-304).

5-10. TITANIUM

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent
C-305	Aliphatic Naphtha
C-306	Toluene
C-309	MEK
C-385	Isopropyl Alcohol
C-395	Cleaner

CAUTION

DO NOT VAPOR DEGREASE AND DO NOT USE CHLORINATED SOLVENTS.

1. Clean titanium parts using cleaner (C-395), isopropyl alcohol (C-385), aliphatic naphtha (C-305), drycleaning solvent (C-304), or toluene (C-306).

NOTE

If vapor degreasing or chlorinated hydrocarbons are used inadvertently, part should be alkaline cleaned, rinsed and dried, or scrubbed with soap and water, rinsed and thoroughly dried, before assembly.

2. If paint or solid film lubricant must be removed from titanium, use MEK (C-309) or nonchlorinated paint remover.s

5-11. TREATMENT OF FUNGUS

Fungi growth is ideal in an environment with a temperature between 68 to 104°F (20 to 40°C) with relative humidity of 85 to 100%. Most paint type coatings used in the helicopter are resistant to fungi, but small amounts of dust, debris, oils or lubricants may accumulate and promote fungal growth. Paint damage may result.

5-12. INSPECTION FOR FUNGUS

Inspect all closed compartments and areas for fungus growth. Pay particular attention to the following:

1. Nose section interior

2. Baggage compartment

3. Under the floor

4. Tailboom interior

5. Behind sound deadening on the bulkheads and overhead

6. Closed compartment interiors

7. Cowling interiors

8. Float covers

9. In and around doors

10. Under and behind auxiliary tanks.

5-13. CLEANING OF FUNGUS

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent
C-355	Detergent
C-385	Isopropyl Alcohol

CAUTION

99% ISOPROPYL ALCOHOL (C-385) MAY REMOVE LUBRICANTS AND PRESERVATIVES, BUT MAY SOFTEN SOME PLASTICS. DO NOT USE ON ACRYLIC OR POLYCARBONATE WINDOWS OR WINDSHIELDS.

1. Clean the area of fungus growth with drycleaning solvent (C-304) to remove grease and oil residue.

2. Remove debris or foreign matter with detergent (C-355) and water.

3. Allow area to dry or wipe dry with clean cloth.

4. Treat area of fungal growth with 99% isopropyl alcohol (C-385) and wipe with a clean cloth or sponge.

CHAPTER 6 — NON-DESTRUCTIVE INSPECTION

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NON-DESTRUCTIVE INSPECTION

6-1. GENERAL

Non-Destructive Inspections (NDI) included in this chapter are fluorescent penetrant, magnetic particle, Eddy Current, and ultrasonic.

NDI of a part or component of any assembly is required only when the Maintenance Manual or another Bell Helicopter Textron (BHT) approved document specifically instructs the maintainer to do so (e.g., when written steps on an inspection or other procedure call for NDI procedures to be carried out on specific parts). However, NDI is to be accomplished when indications resulting from a visual inspection convey that a crack or other defect may exist and that further inspection is required using NDI procedures to ensure the airworthiness of the part or component.

6-2. FLUORESCENT PENETRANT INSPECTION METHOD (ASTM E1417)

6-3. INTRODUCTION

Penetrant inspection is a Non-Destructive Test (NDT) for discontinuities open to the surface in parts made of non-porous materials. This is done by applying penetrant to the surface of the part, which then penetrates the surface discontinuity. Excess penetrant is removed from the part surface with penetrant remaining in the discontinuities. Developer is then applied to the part surface to provide a blotting action, which allows the penetrant to emerge from the discontinuities. Indications become visible by the fluorescence of the penetrant under ultraviolet light.

6-4. SAFETY PRECAUTIONS

1. Make sure safety requirements for using electrical equipment near aircraft fuel cells, oxygen systems, and stores have been met.

2. Use only low sulfur and low halogen content penetrant materials. Penetrant containing excessive sulfur or halogens may cause stress corrosion cracking in titanium parts.

3. Black lights generate considerable heat during use. Be sure to grasp the black light only by the handle.

4. To prevent injury to the eyes, do not look directly into the black light as unfiltered black lights or a damaged filter on a black light may damage eyes.

5. Prolonged or repeated inhalation of vapors or powders may result in irritation of mucous membrane areas of the body. Provide adequate ventilation when handling cleaner, emulsifier, penetrants, or developers.

6. Continual exposure to penetrant inspection materials may cause skin irritation. Avoid contact with penetrant inspection materials by wearing gloves. Wash exposed areas of body with soap and water.

7. Temperatures in excess of 120°F (48.8°C) may cause bursting of pressurized spray cans and injury to personnel. Store all pressurized spray cans in a cool, dry area protected from direct sunlight. Avoid exposure of pressurized spray cans to open flame.

8. Exercise extreme caution when handling penetrants that have been heated to a point where some lighter constituents are driven off. Volatile fumes may occur, creating both a fire and health hazard.

6-5. PERSONNEL QUALIFICATION/ CERTIFICATION

All personnel performing NDI shall be certified to meet or exceed Level II requirements as established in the latest revision of NAS 410 or alternate approved document. Personnel that have successfully completed the Level I Special NDI training course at Bell Helicopter Textron (BHT) are qualified to perform fluorescent penetrant inspections in accordance with the applicable maintenance and overhaul manuals, or as specifically authorized in an ASB or other BHT approved written directive. The ASB or other BHT approved written directive must indicate in the document that a BHT trained Level I Special individual is qualified to perform such task and may be responsible for product acceptance. The employer of NDI Level I Special personnel must have an established written practice that meets the requirements of ATA 105 for qualification and training of NDT personnel as described in the BHT Customer Training Academy (CTA) NDI training course.

Individuals who have passed the Level I Special BHT training course may perform routine inspections for acceptance on components as listed in the Chapter 4 Airworthiness Limitations Schedule for retirement life parts and as listed in Chapter 5 Component Overhaul Schedule for components requiring an overhaul interval providing the applicable MM and or the CR&O provides the detailed instructions to perform the inspection.

Individuals who have successfully completed and passed the Level I Special Bell Helicopter training course may only perform evaluations on components if the MM or CR&O do not provide the required detailed instructions. An evaluation is performed for information purposes only, and is not intended as a final means of acceptance or rejection. Examples include assessment of a damaged bare metallic skin for evidence of cracking, and to characterize indications found visually (crack versus scratch). Actual inspection of such parts needs to be supported by a certified Level II in the method employed. If during the course of the evaluation an indication is found, a person certified to meet or exceed a Level II requirement will be responsible for the acceptance or rejection of that indicated part.

6-6. EQUIPMENT REQUIREMENTS

1. General. Fluorescent Penetrant Inspection (FPI) equipment shall be designed specifically for the purpose intended and constructed from materials compatible with the chemicals used. The equipment shall be arranged to facilitate part flow through the process and be capable of providing a repeatable operation. All tanks shall be provided with covers to avoid contamination of the materials when not in use. Penetrant, emulsifier, and aqueous developer tanks shall have drain racks. Adequate ventilation and personal protective devices shall be provided as instructed by the penetrant materials manufacturer. Portable kits (Method C) may be employed for inspection of localized areas of components and parts installed on the helicopter.

a. Penetrant/emulsifier application equipment — Penetrant application equipment shall provide a means of application by immersion, brushing, flowing, conventional or electrostatic spraying so that the entire part is covered with penetrant. Prior to electrostatic spray application refer to the manufacturer's product data to determine if the penetrant is compatible with this method of application.

b. Equipment for applying lipophilic emulsifiers shall provide complete part coverage by immersion or flowing. Brush application is prohibited.

c. Equipment for applying hydrophilic emulsifiers shall provide complete part coverage by immersion or spraying. If application is by immersion, the bath or parts shall be agitated during immersion. If application is by spraying, the spray unit shall be capable of dispensing the concentration recommended by the manufacturer. Hydro-air nozzles may be used with a maximum of 20 PSI added air pressure.

d. Rinsing/wash apparatus — Excess penetrant and penetrant/emulsifier mixtures shall be removed by manual spraying. Water temperature shall be between 50 to 100°F (10 to 37.7°C). The rinsing apparatus shall deliver a coarse spray of water having a maximum pressure of 40 PSI (276 kPa). Hydro-air nozzles may be used with a maximum of 20 PSI (138 kPa) added air pressure. The rinsing area shall be provided with a black light to monitor the progress of penetrant removal and to prevent over-washing/under-washing.

Temperature/pressure indicators and controls shall be calibrated at 6-month maximum intervals in accordance with ISO 10012-1, NCSL Z540-1, or a calibration system approved by Bell Helicopter Textron.

6-7. DEVELOPER APPLICATION EQUIPMENT

1. Aqueous type developers — The equipment shall provide a means of application by immersion, flowing, or spraying so that the entire part is completely covered. Equipment used to apply suspension type developers shall be capable of agitating the mixture to maintain a uniform suspension.

2. Non-aqueous type developers — The preferred application of non-aqueous developers is by commercially available aerosol containers. Air pressure type spray units equipped with a means to continuously agitate the developer mixture during use may be used so that a thin, uniform coating can be applied.

3. Dry type developers — Developer shall be applied in an enclosed cabinet, which disperses the powder in a manner resulting in a uniform coating being applied to the entire surface of the part. The cabinet shall be equipped with a viewing window to allow for visual verification of cloud formation.

6-8. STANDARD EQUIPMENT

1. Drying ovens — Drying equipment shall be recirculating hot air ovens, electrically heated and thermostatically controlled. Drying oven temperatures shall be at least 120°F (48.8°C) and shall not exceed 160°F (71.1°C). The temperature controller shall be capable of maintaining the oven temperature at ±15°F (±8.3°C) from set point and the temperature indicator shall be accurate to ±10°F (±5.5°C) of the oven temperature. The drying oven shall be equipped with a safety shut off, visible alarm, or audible alarm that operates should the oven temperature exceed 160°F (71.1°C). The oven shelves (if so equipped) shall allow free air circulation.

2. Inspection viewing area — The area where parts are inspected shall be kept clean at all times and free from excessive fluorescent contamination. Stationary inspection areas shall be shielded adequately to assure the white light background does not exceed 2 foot-candles at the examination surface.

3. When portable inspection is required, the inspection area shall be darkened adequately with dark canvas, photographer's black cloth, or other methods to provide satisfactory viewing of indications.

4. Black light source — Black light sources shall be filtered to pass a wave band of 3200 to 4000 Angstrom units.

a. Portable black light units — Portable black light units shall be of the spot bulb type. They shall provide a black light intensity level of not less than 1000 microwatts per square centimeter ($\mu W/cm^2$) when tested at a distance of 15 inches (38.1 cm).

b. Fixed black light sources — Fixed black lights shall provide a black light intensity level of not less than 1000 $\mu W/cm^2$ at the surface of the inspection work table.

5. Black light meter — The black light meter shall be capable of measuring black light intensity in μW/cm2 within the spectral range of 3200 to 4000 Angstroms. The DSE-100X light meter (Spectronics Co., Westbury, NY) or equivalent is acceptable.

6. Visible light meter — The visible light meter for measuring white light background in the inspection area shall be capable of measuring a light level of at least 1 foot-candle. The DSE-100X light meter (Spectronics Co., Westbury, NY) or equivalent is acceptable.

7. System performance test panels — Panels used for testing system performance shall be Chrome, NiCr, or those conforming to Pratt & Whitney Aircraft drawing number TAM 146040.

6-9. INSPECTION MATERIAL REQUIREMENTS

NOTE

All penetrant materials shall conform to MIL-I-25135.

Penetrant systems — FPI systems covered by this document shall be of the following types, methods, and sensitivity levels.

1. Penetrants:

NOTE

Method B (Lipophilic Emulsifier) may be substituted in place of Method D (Hydrophilic Emulsifier) provided Sensitivity Level 4 penetrant is used.

Type I — Fluorescent dye

Method A — Water washable

Method B — Post emulsified, lipophilic

Method C — Solvent removable

Method D — Post emulsified, hydrophilic

Sensitivity Level 3 — High

Sensitivity Level 4 — Ultrahigh

2. Developers:

NOTE

Developers shall be of the following forms.

Form a — Dry powder

Form b — Water soluble

Form c — Water suspendable

Form d — Non-aqueous

CAUTION

WHEN PORTABLE INSPECTION KITS ARE USED ON TITANIUM OR NICKEL BASE ALLOYS, THE USE OF A HALOGENATED SOLVENT REMOVER (CLASS 1) OR A HALOGENATED NON-AQUEOUS DEVELOPER IS PROHIBITED.

3. Solvent removers:

NOTE

Solvent removers shall be of the following classes.

Class 1 — Halogenated

Class 2 — Non-halogenated

6-10. PREINSPECTION CLEANING

The inspection surface shall be clean, dry, and free of contaminants such as grease, oil, etc. Organic coatings such as paint may be removed by hand sanding, plastic media blast, and/or liquid strippers to reveal the bare metal for inspection. After contaminants are removed, the inspection area shall be precleaned using solvent and a clean, dry cloth (Chapter 5). Allow the inspection area to dry completely before applying penetrant.

6-11. PENETRANT INSPECTION

CAUTION

DO NOT PERFORM PENETRANT INSPECTION AT TEMPERATURES BELOW 40°F (4.4°C).

CAUTION

DUE TO EXCESSIVE BACKGROUND RELATED TO HIGH SENSITIVITY PENETRANT MATERIALS WHEN USED FOR INSPECTION OF COMPONENTS MANUFACTURED FROM SAND CASTINGS, SENSITIVITY LEVELS IN EXCESS OF LEVEL 2 SHOULD NOT BE USED (E.G., MAGNESIUM TRANSMISSION CASES).

1. Minimum penetrant sensitivity levels for inspection shall be Level 2 or greater. For components identified in Chapter 4 and Chapter 5 (Airworthiness Limitations/Inspections and Component Overhaul Schedule), minimum penetrant sensitivity levels for inspection shall be Level 3 or greater, except as stated in the previous caution.

2. Penetrant may be applied to the inspection surface by dipping, flow-on, brushing, or spraying. For localized inspections on assemblies, the preferred method of application is brushing. After the penetrant is applied, check the inspection area for adequate coverage and to assure that the penetrant does not contaminate non-inspection areas.

3. The penetrant dwell time shall be a minimum of 30 minutes, unless otherwise specified. Dwell time shall be doubled when the part temperature is between 40 and 60°F (4.4 and 15.5°C). For specific components, which have been identified in Bell Helicopter Textron manuals as having potential for stress corrosion cracking, dwell times shall be a minimum of 60 minutes.

4. Water washable penetrant systems (Method A) shall be removed by a coarse water spray with a minimum of 12 inches (30.5 cm), when possible, between the spray nozzle and the part. Maximum water pressure shall be 40 psi. Water temperature shall be between 50 and 100°F (10 and 38°C). If a hydro-air nozzle is used, the added air pressure shall be 25 psi maximum. The water shall be free of contaminants that will leave an interfering residue after drying. Rinsing shall be conducted under a black light so the progress of the penetrant removal can be observed. Care shall be taken to not over rinse parts. After rinsing, drain the water which may have pooled in cavities or recesses of the part(s). Removal of pooled water may be facilitated by using suction, blotting with clean absorbent material, or filtered shop air at less than 20 psi. Parts shall be placed into a drying oven within 10 minutes from the start of penetrant removal using water rinse. Room temperature air drying is prohibited.

5. Lipophilic post emulsified penetrant systems (Method B) shall be removed by water immersion or with a water spray rinse after application of an emulsifier and an appropriate emulsifier dwell time. Lipophilic emulsifiers shall be applied by immersion or flowing. Lipophilic emulsifiers shall not be applied by spray or brush and shall not be agitated while on the surface of the part. Maximum dwell times, unless otherwise specified, shall be 3 minutes. Actual dwell times shall be the minimum necessary to produce an acceptable background. After the emulsifier dwell time, emulsification shall be stopped by agitated immersion rinse or water spray. Parts that have excessive background or appear to be over-emulsified must be cleaned and reprocessed.

CAUTION

THE INSPECTION AREA SHALL NOT BE FLUSHED WITH SOLVENT OR WIPED WITH SOLVENT-SATURATED CLOTH WHEN PERFORMING PENETRANT REMOVAL.

6. Solvent removable penetrant systems (Method C) shall be removed by using a clean, dry cloth followed by a cloth moistened with solvent. Wipe again with a dry cloth to remove any solvent residue. Check the inspection area with a black light for adequate penetrant removal. If over-removal is suspected, the area shall be cleaned and reprocessed.

7. Hydrophilic post emulsified penetrant systems (Method D) shall be removed with a water prerinse, application of the hydrophilic emulsifier, and then a postrinse. The prerinse shall be applied for the minimum amount of time to achieve removal of the bulk surface penetrant. The hydrophilic emulsifier shall be applied by immersion or spray. For immersion applications, the concentration shall not exceed 35% by volume. For immersion applications, the emulsifier or part shall be mildly agitated. Dwell time shall be the minimum required for adequate penetrant removal, but unless otherwise specified, shall not exceed 2 minutes. For spray applications, the concentration shall not exceed 5%. After the application and dwell of the emulsifier, the part shall be rinsed with water. Evidence of over-removal shall require the part to be cleaned and reprocessed. Excessive background may be removed by additional (touch-up) application of the emulsifier provided the maximum dwell time is not exceeded, followed by a rinse. If touch-up application of the emulsifier does not produce an acceptable background, the part shall be cleaned and reprocessed.

8. The parts shall be dried prior to the application of dry or non-aqueous developer. Parts shall be air dried or dried in an oven. The oven temperature shall not exceed 160°F (70°C) and drying time shall not exceed that necessary to adequately dry the part.

9. Dry developer shall be applied by lightly dusting the areas to be inspected. Developer dwell time shall be a minimum of 10 minutes and a maximum of 4 hours. Parts that are not inspected before the maximum dwell time shall be cleaned and reprocessed.

CAUTION

A HEAVY COATING OF DEVELOPER WILL MASK INDICATIONS. DO NOT OVER APPLY DEVELOPER.

10. Non-aqueous developer shall be applied by lightly spraying. If excessive application of developer has occurred, then the part shall be cleaned and reprocessed. Developer dwell time shall be a minimum of 10 minutes and a maximum of 1 hour. Parts that are not inspected before the maximum dwell time shall be cleaned and reprocessed.

CAUTION

DO NOT WEAR PHOTOSENSITIVE OR PERMANENTLY SHADED LENSES WHEN PERFORMING INSPECTION.

11. Perform inspection under black light. Observe any obvious bleed-out as the developer dwells. Complete inspection after developer dwell time is complete.

6-12. EVALUATION

Penetrant indications may be evaluated by wiping once with a solvent-moistened cotton swab followed

by redevelopment. Mark relevant indications of concern for further evaluation and/or disposition.

6-13. ACCEPTANCE CRITERIA

Unless allowed by a specific procedure, indications of cracks shall be cause for rejection.

6-14. POST INSPECTION CLEANING

Remove developer residues as soon as practical after completion of inspection. Non-aqueous or dry developer residues may be removed by wiping with a clean cloth, or brush (with soft, non-metallic bristles), and water as necessary. If determined to be detrimental to the service of a component, other penetrant residues shall be removed from the inspection area using solvent or other approved methods.

6-15. PROCESS CONTROL REQUIREMENTS

1. Specific process controls — The following specific process control tests shall be accomplished according to the minimum frequency indicated in Table 6-1. FPI materials dispensed from closed containers and discarded after one use are exempt from the testing requirements of step 4 through step 10. FPI materials used in open containers (tanks) and/or materials that are reused shall be tested as required.

Inspectors shall be continually alert to any changes in performance, color, odor, consistency, or appearance of all penetrant materials being used. Appropriate tests shall be conducted if their quality is believed to have deteriorated.

2. Black light intensity — Black lights used for inspection shall be checked using a black light meter conforming to paragraph 6-8, step 5. The test shall be conducted in the inspection booth/area in which the black light is normally used. All black lights shall be checked after bulb replacement. Black light reflectors and filters shall be checked for cleanliness and integrity. Damaged or dirty reflectors or filters shall be replaced or cleaned as appropriate.

a. Portable light sources — Portable light sources shall be tested with the meter 15 inches from the face of the filter.

b. Fixed light sources — For fixed light sources, the black light intensity shall be measured at the surface of the work table.

3. Visible light intensity — The intensity of the spurious visible light in the inspection area shall be measured at the surface of the work table with a visible light meter conforming to paragraph 6-8, step 6.

4. System performance test — The system performance shall be checked by processing a test panel conforming to paragraph 6-8, step 7 through each inspection line in use. A comparison test is made by processing a similar test panel through exactly the same processing steps and times using unused materials of the same designation. After developing, a comparison is made between the panels. Alternately, comparison may be made between a panel processed through the in-use material and a photograph of the same panel previously processed through unused material. The comparison test may also be made by dividing a panel (if using NiCr or chrome panels) into two equal sections by means of a wax line or narrow vinyl tape.

The comparison shall reveal no appreciable difference in background fluorescence, brilliance of indications, or extent to which the defects are shown. If a difference exists, inspection shall be stopped and all of the solutions and procedures shall be checked to determine which of the used solutions or the procedures are discrepant, and the discrepancy shall be corrected before resuming inspection.

Immediately after each use, the test panels shall be cleaned according to the following Instructions as the minimum requirement:

a. Soak in alkaline cleaner for 1/2 to 1 hour.

b. Rinse.

c. Vapor degrease, ultrasonic clean for 5 minutes, or solvent soak for 1 hour.

d. Store panel(s) immersed in solvent or dry at 120 to 160°F (48.8 to 71.1°C) for 10 minutes.

5. Water content of lipophilic emulsifier — The water content of in-use emulsifier shall be determined in accordance with the test procedures in ASTM-D-95 or ASTM-D-1744.

6. Hydrophilic emulsifier concentration — The concentration of hydrophilic emulsifiers (applied by immersion or spraying) shall be checked using a calibrated refractometer. Spray concentrations shall be within the manufacturer's recommended limits and emulsifier concentration shall not exceed 5%. For immersion applications, the emulsifier concentration shall be no higher than specified by the penetrant system supplier and shall not exceed 35% by volume. Variation of immersion solution concentrations shall not be greater than 3 percentage points from the initial, unused concentration.

7. Penetrant fluorescence tests — The brightness of the in-use penetrant shall be determined according to ASTM E1135 with a sample of the unused penetrant serving as the reference.

8. Developer contamination — Aqueous developers shall be checked for fluorescence by immersing a clean aluminum panel approximately 3 x 10 inches (7.6 x 25.4 cm) into the bath, drying, and observing the panel under black light. Additionally, failure of aqueous developers to uniformly wet part surfaces shall be cause for FPI to cease until the problem is corrected.

Dry developers shall be checked for fluorescence by spreading a thin layer on a flat, 4-inch (10.2-cm) diameter circular area and observing under a black light. Dry developers shall not contain more than 10 fluorescent specks. Dry developers shall be fluffy and not caked. Caked dry developer shall be discarded.

9. Penetrant contamination — The penetrant shall be examined visually and shall be discarded if there is any evidence of precipitates, separation of constituents, surface scum, waxy deposits, white coloration or any other evidence of contamination or breakdown.

10. Drying oven temperature — The temperature of the drying oven shall be verified daily and shall be within the range of 120 and 160°F (48.8 and 71.1°C). The oven temperature indicator (paragraph 6-8, step 1) may be used for this check. The oven temperature indicator shall be calibrated against an ASTM calibrated thermometer or a thermocouple traceable to the N.I.S.T.

11. Light meter certification — Black and visible light meters shall be certified every 6 months using standards traceable to the N.I.S.T.

Table 6-1. Fluorescent Penetrant Process Control Tests — Frequency and Requirements

TEST	FREQUENCY	REQUIREMENTS
Rinse Water Pressure/Temperature	Each Shift	Paragraph 6-6, step d
Black Light Intensity	Daily	1000 µW/cm^2@15 inches
Black Light Reflectors and Filters	Daily	Paragraph 6-15, step 2
Visible Light Intensity (Background)	Daily	≧ 2 foot-candles
System Performance	Daily	Paragraph 6-15, step 4
Developer Contamination	Daily	Paragraph 6-15, step 8
Penetrant Contamination	Daily	Paragraph 6-15, step 9
Drying Oven Temperature Verification	Daily	Paragraph 6-15, step 10
Inspection Viewing Area Cleanliness	Daily	Paragraph 6-8, step 2
Hydrophilic Emulsifier Concentration	Weekly	Paragraph 6-15, step 6
Aqueous Developer Concentration	Weekly	Paragraph 6-15, step 8
Water Content of Lipophilic Emulsifier	Monthly	5%

Table 6-1. Fluorescent Penetrant Process Control Tests — Frequency and Requirements (Cont)

TEST	FREQUENCY	REQUIREMENTS
Drying Oven Temperature Indicator Calibration	6 months	Paragraph 6-15, step 10
Light Meter Certification	6 months	Paragraph 6-15, step 11
Drying Oven Controller Calibration	6 Months	Paragraph 6-8, step 1 and paragraph 6-15, step 10

6-16. RECORDS

1. Process Control Test Records. Records shall be maintained showing the dates and results of all tests required. Records shall be maintained for a length of time prescribed by Bell Helicopter. When inspection is performed by an independent facility, an inspection report with information similar to that specified for the inspection log must be prepared.

2. Inspection Records. An inspection log shall be maintained for all parts inspected showing the part number, lot identification or traveler number, quantity in lot, date of inspection, the number of parts accepted or rejected, reference to any rejection documents and the identity of the inspector.

3. Personnel Certification Records. Records shall be maintained on each inspector showing experience, formal training, examination results, vision tests results, performance evaluations and inspection stamp identification.

6-17. FLUORESCENT MAGNETIC PARTICLE INSPECTION METHOD (ASTM E1444)

6-18. INTRODUCTION

Magnetic particle inspection is effective in detecting surface and near surface discontinuities in ferromagnetic parts. Inspection is accomplished by inducing a magnetic field into the part and applying a liquid suspension of fluorescent iron oxide particles to the surface to be inspected. By controlling the direction of the magnetizing current, the lines of magnetic force can be induced at right angles to the discontinuity. Direction of the magnetic field should be at right angles to the discontinuity to obtain the best inspection results. During magnetization of the part, the fluorescent magnetic particles are aligned along the flaw or discontinuity due to a leakage field and are visible under ultraviolet or black light. Unless otherwise directed, components shall be subjected to magnetization in at least two directions, 90° apart, to insure 100% inspection of the part. All inspections shall be of the wet continuous method using fluorescent magnetic particles. Types of defects that can be detected are cracks, laps, seams, folds, and nonmetallic inclusions that are either surface or slightly subsurface.

6-19. SAFETY PRECAUTIONS

1. Make sure safety requirements for using electrical equipment near aircraft fuel cells, oxygen systems, and stores have been met.

2. Black lights generate considerable heat during use. Be sure to grasp the black light only by the handle.

3. To prevent injury to the eyes, do not look directly into the black light as unfiltered black lights or a damaged filter on a black light may damage eyes.

4. Prolonged or repeated inhalation of vapors may result in irritation of mucous membrane areas of the body. Provide adequate ventilation when handling cleaner, and magnetic particle materials.

5. Continual exposure to magnetic particle inspection materials may cause skin irritation. Avoid contact with magnetic particle inspection materials by wearing gloves. Wash exposed areas of body with soap and water.

6. Temperatures in excess of 120°F (48.8°C). may cause bursting of pressurized spray cans and injury to personnel. Store all pressurized spray cans in a cool,

dry area protected from direct sunlight. Avoid exposure of pressurized spray cans to open flame.

7. Magnetizing equipment shall be maintained properly to prevent personnel hazards from electrical short circuits.

6-20. PERSONNEL QUALIFICATION/ CERTIFICATION

All personnel performing NDI shall be certified to meet or exceed Level II requirements as established in the latest revision of NAS 410 or alternate approved document. Personnel that have successfully completed the level I Special NDI training course at Bell Helicopter are qualified to perform magnetic particle inspections in accordance with the applicable maintenance and overhaul manuals, or as specifically authorized in an ASB or other Bell Helicopter approved written directive. The ASB or other Bell Helicopter approved written directive must indicate in the document that an individual is qualified to perform such task and may be responsible for product acceptance. The employer of NDI Level I Special personnel must have an established written practice which meets the requirements of ATA 105 for qualification and training of NDT personnel as described in the Bell Helicopter Customer Training Academy (CTA) NDI training course.

Individuals who have successfully completed and passed the Level I Special Bell Helicopter training course may perform routine inspections for acceptance on components as listed in the Chapter 4 Airworthiness Limitations Schedule for retirement life parts and as listed in Chapter 5 Component Overhaul Schedule for components requiring an overhaul interval providing the applicable MM and or the CR&O provides the detailed instructions to perform the inspection.

Individuals who have successfully completed and passed the Level I Special Bell Helicopter training course may only perform evaluations on components if the MM or CR&O do not provide the required detailed instructions. An evaluation is performed for information purposes only, and is not intended as a final means of acceptance or rejection. Examples include assessment of damaged ferromagnetic components for evidence of cracking, and to characterize indications found visually (crack, vs. scratch). Actual inspection of such parts needs to be supported by a certified Level II in the method employed. If during the course of the evaluation an indication is found, a person certified to meet or exceed a Level II requirement will be responsible for the acceptance or rejection of that indicated part.

6-21. EQUIPMENT REQUIREMENTS

1. Cleaning Apparatus. Suitable solvents shall be available for degreasing parts prior to and after magnetic particle inspection (MPI).

2. Magnetizing Current. The magnetizing apparatus shall be of Wet Horizontal DC or AC Type. All equipment shall contain quick break circuitry. The equipment shall be capable of inducing a magnetic flux into the part being inspected by means of a low voltage, high amperage current passed through the part or through a conductor which passes through a hole in the part. The equipment shall also be capable of inducing a magnetic flux in the part being inspected by placing the part in a current carrying coil. Equipment other than Wet Horizontal DC or AC shall not be used without prior Bell Helicopter approval.

3. Inspection Area. The inspection area shall be equipped with a means of shielding the area from spurious visible light so as to provide a darkened area. The ambient visible light level shall not exceed two foot-candles. The area shall be provided with a black light source for inspection as required.

4. Black Light Source. The black light source shall be filtered to pass a wave band of 3200 to 4000 Angstrom units.

a. Portable Black Light Sources. Portable black light sources shall be of the spot bulb type. The black light source shall be filtered to pass a wave band of 3200 to 4000 Angstrom units. Black light intensity shall not be less than 1000 microwatts per square centimeter ($\mu W/cm^2$) when tested at a distance of 15 inches (38.1 cm).

b. Fixed Black Light Sources. Fixed black lights shall provide a black light intensity level of not less than 1000 $\mu W/cm^2$ at the surface of the work (15" minimum light to surface distance).

5. Black Light Meter. The black light meter for monitoring black light intensity shall be available. This meter shall be capable of measuring intensity in $\mu W/cm^2$. A model DSE-100X (Spectronics Corporation) or equivalent is acceptable.

6. Visible Light Meter. A visible light meter for measuring visible light at the surface of the work being inspected shall be available. This meter shall be capable of measuring an ambient light level of at least one foot-candle. A model DSE-100X (Spectronics Corp.) meter or equivalent is acceptable.

7. Test Sensitivity (Ketos) Ring. A test sensitivity ring in accordance with ASTM-E1444 shall be available.

8. Magnetic Field Strength Indicator. In order to insure the direction and magnitude of the magnetic field in the part being inspected, a field strength indicator in accordance with ASTM-E1444 shall be available. A Hall effect gauss meter (F. W. Bell Model 4048) will satisfy this requirement, as will commercially available etched shims.

9. Field Indicator. A field indicator capable of detecting a magnetic field of at least three oersteds or gauss shall be available for checking demagnetization.

10. Demagnetizing Apparatus. Demagnetizing equipment shall be available. The equipment shall be of the open coil, box or DC step decay type and shall be capable of demagnetizing all inspected parts to a level of three oersteds or gauss maximum. Demagnetization apparatus should be oriented with the axis of the coil in the East-West Direction.

11. Centrifuge Tube. A 100 ml, pear shaped centrifuge tube graduated in 0.05 ml increments for checking suspension concentrations shall be available.

6-22. INSPECTION MATERIAL REQUIREMENTS

Fluorescent wet inspection material shall be used unless otherwise specified. Fluorescent particle concentration shall be maintained in the range of 0.1 to 0.4 milliliters per 100 milliliters of suspension fluid. All suspension fluid shall conform to AMS 3045 and/or AMS 3046.

6-23. PREINSPECTION CLEANING

NOTE

Ferrous parts may be inspected through a coating of epoxy primer or epoxy polyamide primer. Normal magnetic particle inspection procedure should be followed.

The surface of the component to be inspected shall be clean and dry, and free of oil, scale, or other contaminants that might interfere with the efficiency of the inspection. Magnetic particle examination shall not be performed with coatings in place that could prevent the detection of surface defects in the ferromagnetic substrate. When such coatings are nonconductive, they must be removed where electrical contact is to be made.

6-24. MAGNETIZING CURRENT APPLICATION

1. Alternating and/or rectified alternating current (referred herein as DC) is used for the detection of surface and near surface defects.

6-25. MAGNETIC FIELD STRENGTH

The applied magnetic field shall have sufficient strength to produce satisfactory indications, but it must not be so strong that it causes the masking of relevant indications by nonrelevant accumulations of magnetic particles. Adequate magnetic field strength may be determined by one or a combination of four methods:

(1) By testing parts having known or artificial defects. This includes the use of shims with artificial defects (per ASTM E1444) placed on the part.

(2) By using a Hall effect probe gaussmeter capable of measuring the peak values of the tangent field.

(3) By using the formulas given in paragraph 6-28, step 6 (the current values given are peak current values and are applied directly to full-wave rectified current); and by using values as specified for part number specific components in applicable sections of the manual. When formulas are used, at least one additional stated method, such as the Hall effect probe gaussmeter specified in item (2), must be used in conjunction.

(4) The use of etched shims per Aerospace Standard 5371 (AS 5371) may be utilized to determine adequate field strength and direction.

NOTE

When using AC, values shall not be less than 65% of the calculated DC values.

When using a Hall effect probe gaussmeter, tangential field strengths, measured on the part surface, in the range of 30 to 60 Gauss (2.4 to 4.8 kA/m) peak values are normally adequate magnetization levels for magnetic particle examination. It is important to ensure that field strengths in this range are present in all areas to be inspected on the part.

6-26. MAGNETIC FIELD DIRECTION

Unless otherwise specified, each part must be magnetized in at least two directions 90° apart. Depending on part geometry, this may consist of circular magnetization in two or more directions, of both circular and longitudinal magnetization, or of longitudinal magnetization in two or more directions.

6-27. CIRCULAR MAGNETIZATION

CAUTION

CARE MUST BE TAKEN TO REDUCE ARCING.

1. When magnetizing by passing current directly through the part, the current shall be from 300 to 800 A/inch of part diameter (12 to 32 A/mm). The diameter of the part shall be taken as the greatest distance between any two points on the outside circumference of the part.

2. Circular magnetization may be provided by passing current through a conductor that passes through the inside of the part. When the axis of the central conductor is located near the central axis of the part, the same current levels as given in paragraph 6-27, step 1 shall apply. When the conductor passing through the inside of the part is placed against an inside wall of the part, the current levels as given in paragraph 6-27, step 1 shall apply, except that the diameter shall be considered the sum of the diameter of the central conductor and twice the wall thickness. The distance around the part circumference (interior) that is effectively magnetized shall be taken as four times the diameter of the central conductor. The entire circumference shall be inspected by rotating the part on the conductor, allowing for approximately a 10% magnetic field overlap.

3. Prods shall not be used.

6-28. LONGITUDINAL MAGNETIZATION USING COILS

1. Longitudinal magnetization is often accomplished by passing current through a coil encircling the part or section of the part. This produces a magnetic field parallel to the axis of the coil. For low or intermediate fill factor coils, the effective field extends a distance on either side of the coil center approximately equal to the radius of the coil. For high fill factor coils, the effective distance of magnetization is 9 inches (22.8 cm) on either side of the coil center. For parts longer than the effective distance, the entire length shall be inspected by repositioning the part within the coil, allowing for approximately 10% effective magnetic field overlap.

2. Longitudinal Magnetization With Low Fill Factor Coils. When the cross-sectional area of the coil is ten or more times the cross-sectional area of the part being inspected, the product of the number of coil turns, N, and the current in amperes through the coil, I, shall be as follows:

a. For parts positioned to the side of the coil:

$NI = [K/(L/D)]$ (±10%)

where:

K = 45,000 A turns,

L = length of part, and

D = diameter of the part (measured in the same units as the length).

b. For parts positioned in the center of the coil:

$NI = [KR/((6L/D)-5)]$ (±10%)

where:

R = radius of the coil, inch (or mm),

K = 43,000 A turns per inch if R is measured in inches (1690 A turns per mm),

L = length of the part, and

D = diameter of the part (measured in the same units as the length).

3. If the part has hollow portions, replace D with Deff as given in paragraph 6-28, step 6. These formulas hold only if L/D is greater than 2 and less than 15. If L/D is less than 2, pole pieces (pieces of ferromagnetic material with the same diameter as the part being tested) shall be placed on each end of the part to effectively increase the L/D to 2 or greater. If the L/D is greater than 15, the value of 15 shall be substituted for L/D.

4. Longitudinal magnetization with high fill factor coils. When the cross sectional area of the coil is less than twice the cross sectional area (including hollow portions) of the part under testing, the product of the number of coil turns, N, and the current in amperes through the coil, I, shall be as follows:

$NI = [K/((L/D)+2)]$ (±10%)

where:

K = 35,000 A turns,

L = length of the part, and

D = diameter of the part (measured in the same units as the length)

5. If the part has hollow portions, replace D with Deff as given in paragraph 6-28, step 6. These formulas hold only if L/D is greater than 2 and less than 15. If L/D is less than 2, pole pieces (pieces of ferromagnetic material with the same diameter as the part being tested) shall be placed on each end of the part to effectively increase the L/D to 2 or greater. If the L/D is greater than 15, the value of 15 shall be substituted for L/D.

6. Calculating the L/D ratio for a hollow or cylindrical part. D shall be replaced with an effective diameter, Deff, calculated using the following:

$Deff = 2[(At - Ah)/p]^{1/2}$

where:

At = total cross sectional area of the part, and

Ah = cross sectional area of the hollow portions of the part.

For cylindrical parts, this is equal to the following:

$Deff = [(OD)^2 - (ID)^2]^{1/2}$

where:

OD = outside diameter of the cylinder, and

ID = inside diameter of the cylinder.

6-29. LONGITUDINAL MAGNETIZATION USING AN ELECTROMAGNETIC PROBE

CAUTION

DUTY CYCLE FOR AN ELECTROMAGNETIC PROBE IS USUALLY 2 MINUTES ON, 2 MINUTES OFF. COIL COVER HEATING IS AN INDICATION OF EXCESSIVE ON TIME.

FALSE INDICATIONS MAY OCCUR IF PROBE LEGS ARE POSITIONED WITHIN 2 1/2 INCHES OF EACH OTHER.

DO NOT SWITCH THE PROBE FROM DC TO AC OR FROM AC TO DC WHEN THE PROBE IS TURNED ON.

1. For magnetization using the electromagnetic probe, direct current (DC) is required for all magnetic particle inspections. Adjust magnetization intensity control to maximum.

2. Position probe legs on the part. Decreasing the spacing between the legs will increase the magnetic field strength.

3. Apply inspection material to the inspection surface and immediately press ON to magnetize the part.

4. Allow a short amount of time for particle dwell and drainage.

5. Perform inspection under black light in a darkened area.

6. Reposition probe legs 90° from original position and repeat step 3 through step 6.

6-30. PARTICLE APPLICATION

1. In the fluorescent wet continuous method, the magnetizing current shall be applied simultaneously with or immediately after applying the suspension. Fluorescent particles suspended in a liquid vehicle shall be applied by flowing over the area to be inspected. Proper sequencing and timing of part magnetization and application of particle suspension are required to obtain the proper formation and

retention of indications. This generally requires that the flow of suspension be stopped simultaneously with or slightly before energizing the magnetic circuit. The magnetizing current shall be applied for a duration of at least 1/2 second, with a minimum of two shots being used. The second shot shall follow the first in rapid succession.

6-31. EVALUATION

CAUTION

DO NOT WEAR PHOTOSENSITIVE OR PERMANENTLY SHADED LENSES WHEN PERFORMING INSPECTION.

1. Following magnetization and particle application, the parts shall be examined for indications under black light in a darkened area. The black light shall be capable of a minimum intensity of 1000 microwatts per square centimeter measured 15 inches (38.1 cm) from the face of the filter or bulb. Inspection booths of stationary equipment shall not exceed 2 foot-candles of white or ambient light during inspection when measured with a white light meter. When performing portable inspections, an opaque cloth or plastic tarp shall be used to darken the inspection area to the lowest possible ambient light level. All indications will be identified as relevant or nonrelevant. Unless allowed by a specific procedure, indications of cracks shall be cause for rejection.

2. Polar effects as a result of design factors, for example; keyways, drilled holes, and abrupt changes in section, may cause indications which are nonrelevant. Adjusting the amperage (decreasing) or electromagnetic probe leg spacing (increasing) can minimize these effects by reducing the magnetic field strength.

3. Some metallurgical discontinuities and magnetic permeability variations may also cause indications which are nonrelevant.

4. When an indication is not believed to be relevant, it should be evaluated as "not acceptable" until the indication is either removed by surface conditioning or reinspected by the same or other nondestructive inspection method and shown to be nonrelevant.

6-32. ACCEPTANCE CRITERIA

Rejectable Defects. Any indication of a crack shall be cause for rejection.

6-33. DEMAGNETIZATION

1. When using AC demagnetization, the part shall be subjected to a field with a peak value greater than and in nearly the same direction as, the field used during examination. This field is then decreased gradually to zero. Hold the part approximately 1 foot (30.5 cm) in front of the coil and then move slowly through the coil and at least 3 feet (91.4 cm) beyond the coil. Repeat this process as necessary. Rotate and tumble parts of complex configuration while passing through the field of the coil.

2. When using DC demagnetization, the initial field shall be higher than and in nearly the same direction as, the field used during examination. The field shall then be reversed, decreased in magnitude, and the process repeated until an acceptably low value of residual field is reached.

3. Whenever possible, parts that have been magnetized circularly shall be magnetized in the longitudinal direction before being demagnetized. After demagnetization, a magnetic field indicator shall be used. Readings obtained equal to or greater than 3 oersteds/gauss anywhere on the part is not acceptable.

4. Demagnetization using an electromagnetic probe. For small parts, apply AC magnetization. Pass parts through area between poles of probe and withdraw parts to a minimum distance of 3 feet (91.4 cm) from probe before turning probe off. For large parts, demagnetize parts in same position as they were magnetized. Apply AC magnetization, keep magnetization switch on and slowly move probe away a minimum of 3 feet (91.4 cm), then turn probe off.

6-34. POST INSPECTION CLEANING

Clean the inspected area with solvent and wipe dry with a clean cloth to remove any magnetic particle residue that could have an adverse effect in the use of the part. Parts shall be corrosion protected to prevent the occurrence of corrosion after final inspection.

6-35. PROCESS CONTROL REQUIREMENTS

1. Specific Process Controls. The following specific process control tests shall be accomplished periodically. The frequency of testing shall be as specified in Table 6-2.

2. Black Light Intensity. The intensity of illumination of each black light source shall be measured. The measured intensity shall not be less than 1000 μW/cm^2 at 15 inches (38.1 cm).

3. Visible Light Intensity. The visible light intensity shall be determined. The measured intensity shall not exceed two foot-candles in the darkened inspection area for inspection of fluorescent magnetic particles.

4. System Sensitivity. The effectiveness of the MPI materials and procedure shall be determined.

A Ketos ring or AS 5282 ring may be used for system test sensitivity.

	AMPERAGE	MINIMUM HOLES DETECTED
△1 Ketos Ring	1400	3
	2500	5
	3400	6
△2 AS 5282 Ring	1500	6
	2500	7
	3500	9

△1 The Ketos ring at amperages of 1400, 2500 and 3400 should reveal 3, 5 and 6 holes respectively.

△2 The AS 5282 ring at amperages of 1500, 2500 and 3500 should reveal 6, 7 and 9 holes respectively.

After test, the Ketos ring or AS 5282 ring shall be demagnetized, cleaned and checked under black light to ensure residual indications do not exist.

Examples:

- When using a Ketos ring or AS 5282 ring all amperages shall be achieved with Full Wave Rectified Alternating Current (FWDC) or Half Wave Rectified Alternating Current (HWDC).
- If using a Magnaflux Magnetic Test Bar #189838 or Continuous Method Test Bar 75130, refer to manufacturers directions.

5. Suspension Concentration. The suspension concentration shall be tested. The settled volume of magnetic particles shall be from 0.10 to 0.40 ml. The high limit (0.40 ml) may be adjusted lower when using accelerated settling tests to give results equivalent to the one hour settling test.

6. Suspension Contamination. The suspension contamination shall be evaluated on the settled suspension. When examined in black light, the liquid shall not show objectionable fluorescence. If the settled particles appear as loose agglomerates a second sample shall be taken. If second sample reveals the same, the bath shall be replaced. If examination of the precipitates reveals two distinct layers, the top layer (contamination) shall not exceed 30% of the bottom layer volume nor shall the contamination layer fluoresce objectionably.

7. Current Flow. The current flow shall be between 0.5 to 1.0 second.

8. Current Output. The current output shall be within ±10% of the indicated current.

9. Internal Shorting. When the current is actuated, there shall be no deflection of the ammeter.

10. Magnetic Field Quick Break. The current decay as measured using a suitable oscilloscope or other applicable method as specified by the manufacturer shall be within the manufacturer's definition of quick break.

11. Black Light Meter. The black light meter shall be certified every six months using an illuminate standard traceable to NIST.

12. Visible Light Meter. The visible light meter shall be certified every six months using an illuminate standard traceable to NIST.

Table 6-2. Fluorescent Magnetic Particle Process Control Tests — Frequency and Requirements

TEST	FREQUENCY	REQUIREMENT
Suspension Concentration	Each Shift	0.10 – 0.40 ml*
Black Light Intensity	Daily	1000 µW/cm^2 @ 15 inches
System Sensitivity	Each Shift	paragraph 6-35, step 4
Suspension Contamination	Weekly	paragraph 6-35, step 6
Visible Light Intensity	Daily	2 foot-candles maximum
Quick Break	Six Months	Per Manufacturer
Black Light Meter	Six Months	DSE-100x or equivalent
Current Flow	Six Months	0.5 – 1.0 second
Current Output	Six Months	±10%
Internal Shorting	Six Months	No Deflection
Visible Light Meter	Six Months	DSE-100x or equivalent
Gauss Meter	Six Months	30 – 60 gauss

6-36. RECORDS

1. Process Control Test Records. Records shall be maintained showing the dates and results of all tests required. When inspection is performed by an independent facility, an inspection report, with information similar to that specified for the inspection log, must be prepared.

2. Inspection Records. An inspection log shall be maintained for all parts inspected showing the part number, lot identification or traveler number, quantity in lot, date of inspection, the number of parts accepted or rejected, reference to any rejection documents and the identity of the inspector.

3. Personnel Certification Records. Records shall be maintained on each inspector showing experience, formal training, examination results, vision tests results, performance evaluations and inspection stamp identification.

6-37. NONDESTRUCTIVE INSPECTION EDDY CURRENT METHOD

6-38. SCOPE

It is not the intent of this NDI method to provide a substitution for penetrant inspection. When the overhaul manual specifies penetrant, and/or for components off aircraft requiring inspection over 100% of the surface area, penetrant inspection (level 3 sensitivity or greater) shall be used (eddy current may not be used as a substitution). Eddy current and penetrant are somewhat complimentary methods of inspection.

Cases may arise when one or the other can be employed to provide additional NDI for evaluation of indications. In some cases, particularly for localized areas on the aircraft, eddy current is recognized as a sensitive method for the detection of fatigue cracks. When eddy current is specified in the overhaul manual, by ASB or other Bell Helicopter approved written directive, written inspection procedures shall be developed by Level III personnel per paragraph 6-47.

6-39. INTRODUCTION

Eddy currents are electrical currents induced in a conductive material by an alternating magnetic field. The eddy currents induced in a metallic part vary in magnitude and distribution in relation to the following specimen properties: electrical conductivity, magnetic permeability, geometry, and homogeneity. Therefore, by measuring the magnitude and/or distribution of eddy currents generated in a conductor, changes in one or more of these variables can be determined. During inspection with eddy currents, care must be exercised to isolate the specimen property of interest, either by eliminating the variation in the specimen properties for which inspection is not performed or by electronically suppressing or differentiating the other variables.

6-40. SAFETY PRECAUTIONS

Make sure safety precautions have been met for electrical grounding when using electrical equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores.

6-41. PERSONNEL QUALIFICATION/ CERTIFICATION

1. All personnel performing NDI shall be certified to meet or exceed Level II requirements as established in the latest revision of NAS 410 or alternate approved document. Personnel that have successfully completed the level I Special NDI training course at Bell Helicopter are qualified to perform eddy current inspections in accordance with the applicable maintenance and overhaul manuals, or as specifically authorized in an ASB or other Bell Helicopter approved written directive. The ASB or other Bell Helicopter approved written directive must indicate in the document that an individual is qualified to perform such task and may be responsible for product acceptance. The employer of NDI Level I Special personnel must have an established written practice which meets the requirements of ATA 105 for qualification and training of NDT personnel as described in the Bell Helicopter Customer Training Academy (CTA) NDI training course.

Individuals who have successfully completed and passed the Level I Special Bell Helicopter training course may perform routine inspections for acceptance on components as listed in the Chapter 4 Airworthiness Limitations Schedule for retirement life parts and as listed in Chapter 5 Component Overhaul Schedule for components requiring an overhaul interval providing the applicable MM and or the CR&O provides the detailed instructions to perform the inspection.

Individuals who have successfully completed and passed the Level I Special Bell Helicopter training course may only perform evaluations on components if the MM or CR&O do not provide the required detailed instructions. An evaluation is performed for information purposes only, and is not intended as a final means of acceptance or rejection. Examples include assessment of a damaged bare metallic skin for evidence of cracking, and to characterize indications found visually (crack, vs. scratch). Actual inspection of such parts needs to be supported by a certified Level II in the method employed. If during the course of the evaluation an indication is found, a person certified to meet or exceed a Level II requirement will be responsible for the acceptance or rejection of that indicated part.

2. Personnel responsible for the development of written eddy current inspection procedures shall be certified to meet or exceed Level III requirements as established in the latest revision of NAS-410, or alternate approved document.

6-42. EQUIPMENT REQUIREMENTS

1. Flaw Detectors. All flaw detector instrumentation shall be capable of detecting surface and/or near surface discontinuities in electrically conductive materials. The operating frequency range of the instrument shall be suitable to collect the desired information from the material under test. Instrumentation shall possess the capability of detecting impedance changes introduced by variations in material properties as well as metallurgically and mechanically induced discontinuities. Equipment shall contain a means to display detected impedance changes. Displays may include CRT's, Meters and/or LCD's.

2. Probes. Optimization of defect detection is the primary objective in the selection of probes. Defect type, size and orientation along with part geometrical and metallurgical characteristics shall be considered. All probes shall be compatible with the detection instrumentation and be identified as to type and frequency. Table 6-3 shall be used as a guideline for selection of probe frequency. When using small diameter surface probes, the use of shoes and/or

collars to prevent undesirable lift-off effects is highly recommended. When using bolthole probes, fill factor ratios shall be as close to 1:1 as possible and allow for full coverage of the hole under test. Fill factor ratios shall be within ± 10% of reference standard ratios. For eddy current inspection of magnetic materials, saturation probes are recommended.

6-43. REFERENCE STANDARDS

1. All inspections require the use of reference standards. Reference standards shall be representative of the material, and in cases where part geometry effects lift-off, geometry of the test material. Each standard shall be constructed of the same base material and have approximate conductivity values of the material under test (refer to Table 6-4 and Table 6-5). These standards may be actual parts, manufactured specimens to simulate parts, or general purpose flawed material containing natural or artificially induced flaws. All standards shall be identified and have documentation on file defining, as a minimum, base material type, condition and flaw pedigree.

2. Defects. Reference standard defects may be naturally occurring or artificially induced. For naturally occurring flaws, at least one other inspection method shall be implemented for the determination of flaw pedigree. Artificially induced flaws may be introduced through machining, drilling, etc. Electrical Discharge Machining (EMD) is the recommended method for crack simulation. Recommended crack depths are 0.010 inch (0.254 mm), 0.020 inch (0.408 mm) and 0.040 inch (1.016 mm).

3. Reference Standard Material. All eddy current instrumentation shall be capable of detecting discontinuities in the materials listed in Table 6-4 and Table 6-5.

4. Surface Preparation/Cleanliness. Reference standards shall have a surface finish representative of the component under inspection. Oxides, scale, paint or other foreign surface material which when present, prevents the inspection to be performed to its required efficiency shall be removed prior to inspection. Any surface finish which impedes reference standard defect responses greater than 10% deflection/ amplitude shall be removed (refer to Chapter 4).

5. Surface Roughness. Surface roughness of reference standards and components/material to be inspected shall be such that at least a 3:1 defect signal to noise ratio is maintained. For components listed in Chapters 4 and 5 (Airworthiness Limitations/ Inspections and Component Overhaul Schedule), eddy current inspections shall not be performed on surfaces which exceed 125 RHR. For all other components, eddy current inspections shall not be performed on surfaces which exceed 250 RHR.

6-44. INSPECTION

1. Calibration Requirements. Unless otherwise specified by overhaul manual, ASB or other Bell Helicopter approved written directive, the inspection system shall be calibrated as follows prior to inspection. Connect applicable surface probe (geometry and frequency range). Nonconductive shims shall be used to represent paint thickness when calibrating for inspection of painted surfaces. Null/ balance on a defect-free area of the appropriate reference standard. Lift-off shall be compensated for (for phase analysis displays, lift-off shall be oriented along the horizontal axis and deflections obtained from simulated cracks shall be oriented vertically). Gain shall be adjusted to provide a crack deflection (0.020 inch (0.408 mm) crack depth) with a minimum of 30% full scale from the null point.

2. Calibration shall be checked prior to inspection, after inspection and periodically within every fifteen minutes of continuous inspection. If the system is found to be out of calibration, the cause shall be determined and corrected, and all inspections performed after the last successful calibrated repeated.

3. Scanning Requirements. Areas of inspection shall be scanned 100%. Scanning may be manual or automated, when automated scanning is incorporated, alarms shall be employed. Scanning shall be accomplished in two axes. Scan indexing shall not exceed one-half of the probe diameter. Scan speeds shall not exceed calibration scan speeds. Nonconductive guides, i.e., straightedges, hole templates, etc. may be used to enhance scanning. A thin protective layer of teflon tape may be used on probe faces to reduce friction and reduce probe wear.

6-45. EVALUATION

1. All indications shall be verified after recalibration per paragraph 6-43. Penetrant, high magnification

visual and/or additional NDI methods may be employed to aid in verification process.

6-46. ACCEPTANCE CRITERIA

1. All verified indications of cracks shall be cause for rejection.

6-47. INSPECTION PROCEDURES

1. When inspection per overhaul manual, ASB or other Bell Helicopter approved directive is required, written inspection procedures shall be prepared. This specification along with the applicable inspection procedures, as a unit, govern the inspection requirements. These procedures shall be sufficiently detailed in the following areas:

a. Area to be Inspected. A description of area, cross section, surface, etc., to be inspected, as indicated from the applicable callout shall be given.

b. Equipment. All equipment, probes, recorders, etc. required to perform the inspection shall be documented.

c. Reference/Calibration Standards. List calibration/reference standards required to perform the inspection.

d. Calibration. List initial equipment control settings necessary to establish a starting point from where final calibration can be obtained.

e. Preinspection. Described steps to be performed before inspection can begin, i.e., cleaning, fixturing, etc.

f. Inspection. Describe the sequence of steps required to perform this inspection. This section shall be written in sufficient detail to assure repeatability of the inspection.

g. Evaluation. Describe techniques used to verify indications detected.

h. Accept/Reject Criteria. Identify the document and/or location of acceptance criteria applicable to this inspection.

i. Post Inspection. When applicable, describe operations necessary for clean-up/handling of part after inspection.

j. Records. Describe steps necessary for the recording and maintenance of inspection results.

k. Additional NDI. Reference other NDI methods and/or procedures, when applicable, used to provide additional evaluation of detected indications.

6-48. PROCESS CONTROL REQUIREMENTS

1. Personnel

a. All personnel performing inspections shall be certified in accordance with paragraph 6-41.

2. Equipment

3. All inspection instrumentation used to perform eddy current inspection shall have valid calibration certification traceable to procedures and/or standards required by the National Institute of Standards (NIST).

Table 6-3. Probe Frequency Selection

TEST MATERIAL	OPERATING FREQUENCY
Aluminum	100 – 500 kHz
Steel	300 – 1.0 MHz
Titanium	500 – 1.0 MHz

Table 6-4. Reference Standard Materials Non-Critical Components

TEST MATERIAL	REFERENCE STANDARD MATERIAL
All conductive nonferromagnetic alloys with conductivity's between 15% and 60% IACS.	Nonferromagnetic alloy with a conductivity that does not exceed 15% IACS of test material.
All conductive nonferromagnetic alloys with conductivity's between 0.8% and 15% IACS.	Nonferromagnetic alloy with a conductivity that does not exceed +0.5% or -0.8% IACS of test material.
High permeability steel and stainless steel alloys.	4130, 4330, 4340 or similar high permeability alloys in any heat treat condition.
Low permeablity alloys.	17-7 PH annealed.

Table 6-5. Reference Standard Materials for Components Listed in Chapter 4 and Chapter 5 (Airworthiness Limitations/Inspections and Component Overhaul Schedule)

TEST MATERIAL	MAGNETIC PROPERTIES	REFERENCE STANDARD MATERIAL	SURFACE FINISH
All Aluminum Alloys	Nonmagnetic	Same as Table 6-4	< 125 RHR
All Titanium Alloys	Nonmagnetic	Ti-6A1-4V	< 125 RHR
All 300 Stainless Steel, Nickel Alloys, A286, N155, MP35, Inconel 625 and 718 Hasteloy X	Nonmagnetic (1)	304 and 321 annealed	< 125 RHR
Precipitation Hardening Stainless Steels			
17-4 PH, 15-5 PH, PH13-8 Mo, Custom 455	Moderately Magnetic	17-4 PHH1025 condition|	< 125 RHR
17-7 PH Annealed	Slightly Magnetic	17-7PH annealed	< 125 RHR
17-7 Heat Treated	Moderately Magnetic	17-07 PHTH1050 condition	< 125 RHR
All AISI-SAE low alloy steels: i.e. 4130, 4340, 8620, 9310, 1095; H-11, H-12, M-50, 300M, 52100, 4330V, Nitralloy N, Nitralloy 135, X-53, 18 Ni Maraging grades, Aermet 100	Highly Magnetic	4340 Heat Treat to 125 KSI minimum	< 125 RHR

6-49. ULTRASONIC INSPECTION METHOD

6-50. INTRODUCTION

Ultrasonic inspection is a method of inspection using sound waves with frequencies that are above the audible range. These sound waves provide information as to the state of various materials. The inspection is accomplished by inducing the ultrasound into the part by coupling the transducer which generates high frequency ultrasonic energy. The transducer picks up the reflected sound from within the part. The detected ultrasonic reflections are electronically displayed and interpreted for indications of defects. Correct selection of transducer, sensitivity, angle and so forth, will enable inspection of surface, subsurface, and back surface of part.

6-51. SAFETY PRECAUTION

Make sure safety requirements for electrical (static) grounding have been met when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores.

6-52. PERSONNEL QUALIFICATIONS/ CERTIFICATIONS

1. All personnel performing NDI shall be certified to meet or exceed Level II requirements as established in the latest revision of NAS 410 or alternate approved document. Personnel that have successfully completed the level I Special NDI training course at Bell Helicopter are qualified to perform ultrasonic inspections in accordance with the applicable maintenance and overhaul manuals, or as specifically authorized in an ASB or other Bell Helicopter approved written directive. The ASB or other Bell Helicopter approved written directive must indicate in the document that an individual is qualified to perform such task and may be responsible for product acceptance. The employer of NDI Level I Special personnel must have an established written practice which meets the requirements of ATA 105 for qualification and training of NDT personnel as described in the Bell Helicopter Customer Training Academy (CTA) NDI training course.

Individuals who have successfully completed and passed the Level I Special Bell Helicopter training course may perform routine inspections for acceptance on components as listed in the Chapter 4 Airworthiness Limitations Schedule for retirement life parts and as listed in Chapter 5 Component Overhaul Schedule for components requiring an overhaul interval providing the applicable MM and or the CR&O provides the detailed instructions to perform the inspection.

Individuals who have successfully completed and passed the Level I Special Bell Helicopter training course may only perform evaluations on components if the MM or CR&O do not provide the required detailed instructions. An evaluation is performed for information purposes only, and is not intended as a final means of acceptance or rejection. Examples include assessment of bare metallic skin to determine thickness, or to assess suspect damage of composite laminates or honeycomb composite structures. Actual inspection of such parts needs to be supported by a certified Level II in the method employed. If during the course of the evaluation an indication is found, a person certified to meet or exceed a Level II requirement will be responsible for the acceptance or rejection of that indicated part.

6-53. EQUIPMENT REQUIREMENTS

An ultrasonic instrument having a capability for both the through transmission and the pulse-echo techniques is required. The instrument shall be capable of transmitting and receiving ultrasound of the frequency specified for the inspection. Ultrasonic instruments required for contact inspection may be specific to pulse-echo, through transmission, shear wave, contact impedance, or resonant frequency, The instruments shall have audio and/or visual flaw indicators and be commercially available. Battery operated units shall have low voltage warning.

Ultrasonic equipment shall be calibrated as recommended by the manufacturer, or as defined by the maintenance organizations quality control guidelines.

Ultrasonic transducers may be of the broadband or narrow band frequency type. Typical inspection frequencies shall be 1.0MHz, 2.25MHz, 5.0MHz, and 10.0MHz. The specific transducer frequency used for an inspection/evaluation shall be determined by the Level III individual, or as directed by the MM, CR&O, ASB, or other approved Bell Helicopter directive.

The ultrasonic couplant utilized should be water based. The grade of the couplant should be appropriate for the conditions encountered when performing routine inspection. The use of petroleum

based couplants should not be used on composite parts, but may be utilized on metallic components. Care should be taken to avoid the use of non-compatible materials.

6-54. REFERENCE STANDARDS

Reference standards representative of the part being inspected are required. The reference standard(s) shall be of known quality and shall represent all relevant characteristics of the component it is intended for. The reference standard shall be used to establish acceptable or rejectable thresholds during equipment calibration and/or setup.

6-55. INSPECTION

Unless otherwise specified by MM, CR&O, ASB or other BHTI approved written directive, the ultrasonic inspection unit shall be utilized and calibrated following the applicable written inspection procedure which outlines:

1. Area to be inspected. A description of area, cross section, surface, etc., to be inspected, as indicated from the applicable callout shall be given.

2. Equipment. All specific equipment requirements, probes, recorders, etc. required to perform the inspection shall be documented.

3. Reference/Calibration Standards. List calibration / reference standards required to perform the inspection.

4. Calibration. List initial equipment control settings necessary to establish a starting point from where final calibration can be obtained.

5. Pre-inspection. Described steps to be performed before inspection can begin, i.e., cleaning, fixturing, etc.

6. Inspection. Describe the sequence of steps required to perform this inspection. This section shall be written in sufficient detail to assure repeatability of the inspection.

7. Evaluation. Describe techniques used to verify indications detected.

8. Accept/Reject Criteria. Identify the document and/ or location of acceptance criteria applicable to this inspection.

9. Post Inspection. When applicable, describe operations necessary.

6-56. EVALUATION

All indications shall be verified after recalibration per inspection procedure. Additional NDI methods may be employed for positive defect affirmation.

6-57. ACCEPTANCE CRITERIA

Any indication found using this method should be verified, when it is possible, using another NDE method such as by visual or mechanical means. Acceptance criteria will be as stated in the MM, CR&O, or as stated on applicable safety bulletin or other approved Bell Helicopter directive.

CHAPTER 7 — BONDING

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TABLES

BONDING

7-1. GENERAL RULES

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-305	Aliphatic Naphtha
C-306	Toluene
C-309	MEK
C-423	Abrasive Cloth or Paper

1. Material that may be bonded in accordance with these procedures are metal, plastic polycarbonate, silicone, and rubber parts. Fluorocarbons (Teflon) may be bonded but may require special surface treatment prior to bonding. Refer to the special instructions in the specific manual.

2. The adhesives shall be stored and controlled as specified by the manufacturer.

3. Testing of bonded joints will include tapping and visual inspection for a continuous edge bond and quality.

4. The mating surfaces of detail parts shall be prefitted prior to cleaning and bonding. The fitted surfaces shall have good contact over the area to be bonded, and shall be free of waves, burrs, and other surface imperfections.

5. Surface preparation.

a. Cleanliness shall be carefully controlled through all phases of preparation and bonding. Clean, dry, white gloves shall be worn when handling processed parts and during the bonding operation. The gloves shall be changed when they become soiled. Contact with grease or mold release agents shall be avoided.

b. When necessary to mark detail parts or the location of bond areas prior to bonding, felt tip metal marking pens with nonpermanent ink shall be used.

CAUTION

DO NOT USE METAL SCRIBES OR LEAD PENCILS FOR MARKING IN AREAS TO BE BONDED.

c. Surfaces to be bonded shall be clean, dry, and free from oil or grease. Faying surfaces shall be cleaned for bonding as follows:

(1) Metals, when possible, shall be chemically cleaned, or abraded lightly with 400 grit abrasive cloth or paper (C-423), then cleaned with aliphatic naphtha (C-305) or MEK (C-309). Any component or parts that cannot be cleaned by abrading, shall be cleaned with suitable solvents to ensure adequate bond adhesion can be achieved.

NOTE

The integrity of this type bonded joint shall be qualified by proofload, when required by maintenance instructions.

(2) Rubber surfaces shall be wiped clean with aliphatic naphtha (C-305), toluene (C-306), or MEK (C-309), abraded with a wire brush or with 80 grit abrasive cloth or paper (C-423), and wiped with solvent. The parts shall be wiped dry with dry cloths.

(3) Silicone rubber shall be prepared in accordance with paragraph 7-6.

(4) Acrylic shall be prepared in accordance with paragraph 7-7.

(5) Materials such as fabrics, foams etc. shall be clean and dry.

(6) Painted surfaces shall have the faying area wiped with a clean cloth moistened with aliphatic naphtha (C-305). The paint shall be removed in the faying area by sanding lightly with 240 grit abrasive cloth or paper (C-423). Remove sanding residue with a cloth moistened with aliphatic naphtha. The parts shall be wiped dry with a clean, dry cloth before the naphtha evaporates. After bonding is complete, all

exposed bare metal surfaces shall be refinished the same as the surrounding painted areas.

d. Details that have been cleaned for bonding shall be protected or stored so as not to become contaminated during lag periods.

7-2. BONDING PROCEDURE

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-309	MEK

1. Two part epoxy are mixed by weight. Refer to table 7-1 for specific mixing ratio.

2. Mixed adhesive pot life at room temperature are specified in table 7-1.

3. After thoroughly mixing, the adhesive may be applied by spatula, knife coat, notched trowel, wood applicator, or by flowing into place. Adhesive shall be applied to all faying surfaces. In order to ensure a minimum cured adhesive thickness of 3 to 8 mils, spacers can be used. To control the minimum bondline thickness, place 4 mil glass yarn thread in the bondline approximately 1.0 inch apart. Fabric may be used in lieu of thread. Threads or fabric shall be spaced so edge of bond surface is supported. When threads or fabric are used for spacing, they shall not extend past the bond edge.

4. Potting insert adhesive shall be forced to fill the cavity with pressure gun, potting syringes or other suitable methods. Lower the viscosity of the mixed adhesive for easier injection. The adhesive may be heated to 125° to 130°F (52° to 54°C) and used within 10 minutes.

5. Detail and part joining shall occur while adhesive is within its pot life time. Ensure proper alignment and avoid trapping air within bondlines. Remove excessive adhesive squeeze-out prior to curing. Clean off adhesive that may have collected on surfaces outside bond regions using cheesecloth moistened with MEK (C-309). Observe safety precautions.

6. Curing procedure.

a. The cure temperature cycles and time exposure should be as specified in table 7-1.

b. Bondline pressure. The bondline pressure, as stated in table 7-1, shall be distributed over the full bond region throughout the cure cycle. Bonding pressure shall not be used for springback or form retention on rigid or semi-rigid parts. When adhesive is used for filleting or is injected into a cavity, pressure is not a requirement.

7. Accelerate curing.

NOTE

Vacuum and heat generating blankets (or similar equipment) may be used to accelerate adhesive cure in structural repairs. Not withstanding, bonding should not be considered equivalent in strength to a factory controlled hot bond.

a. Accomplish accelerated bonding in conjunction with bonding procedure set forth in appropriate Structural Repair Manual for individual BHT approved procedure.

CAUTION

DO NOT EXCEED TEMPERATURE SET FORTH IN TABLE.

b. Temperature, time exposure and pressure shall be as defined in the alternate cure cycle procedures listed in table 7-1.

8. Refer to applicable Structural Repair Manual for appropriate structural cold bonding procedures.

9. Refer to paragraphs 7-3 and 7-4 for polycarbonate part bonding procedures.

10. Refer to paragraph 7-5 for non-structural bonding procedures using rubber base cement as an adhesive.

11. Refer to paragraph 7-6 for silicone parts bonding procedures.

12. Refer to paragraphs 7-7 and 7-8 for acrylic window and windshield inspection and repair.

13. Refer to paragraph 7-9 for Kydex and Royalite repair procedures.

Table 7-1. Epoxy Adhesive, Mixing Ratio, Pot Life, and Curing Schedule

ADHESIVE	ACTIVATOR HARDENER OR CATALYST	C-CODE OR ITEM NO.	MIX RATIO BY WEIGHT	POT LIFE (MINUTES)	CURE CYCLE			ALTERNATE CURE CYCLE		
					TIME MINIMUM (HOURS)	PRESSURE PSI	TEMP °F (°C)	TIME MINIMUM (MINUTES)	PRESSURE PSI	TEMP °F (°C)
Metalset A-4	Part B	313	Equal parts A and B	30 to 40	24	Firm contact	70 to 95 (21 to 35)	30	145 to 190 Firm contact	145 to 180 (63 to 82)
EA 9340	Part B	313	Equal parts A and B	30 to 40	24	Firm contact	70 to 95 (21 to 35)	30	Firm contact	145 to 180 (63 to 82)
RP 1258	Part B	313	Equal parts A and B	30 to 40	24	Firm contact	70 to 95 (21 to 35)	30	Firm contact	145 to 180 (63 to 82)
EA 9309	Part B	C-125	100 parts A 23 parts B	30 to 45	24 (2)	Firm contact to 10	70 to 95 (21 to 35)	60	Firm contact to 10	175 to 185 (79 to 85)
EPON 934	Part B	C-100	100 parts A 33 parts B	30 to 50	24 (3)	Firm contact to 10	70 to 95 (21 to 35)	60	Firm contact to 10	175 to 190 (79 to 88)
Epibond 8510	Part B	C-100	100 parts A 30 parts B	40	24 (3)	Firm contact	70 to 95 (21 to 35)	60	Firm contact to 10	175 to 190 (79 to 88)
Film Adhesive		332	None	7 days	1	10 to 50	260 to 280 (127 to 138)	120	10 to 50	220 to 260 (104 to 127)
EC 2216	Part A (1)	322	100 parts B 140 parts A	110 to 130	24 (3)	Firm contact	70 to 95 (21 to 35)	120	Firm contact to 10	145 to 155 (63 to 68)
EPON 828	DTA	219 (828) 220 (DTA)	100 parts (828) 8 to 12 parts (DTA)	20 to 30	24 (3)	Firm contact	70 to 95 (21 to 35)	120	Firm contact	175 to 190 (79 to 88)

NOTES:

(1) For EC 2216 Part A (gray) is the catalyst or hardener, Part B (white) is the base resin.

(2) Maximum strength is obtained in 72 hours.

(3) Maximum strength is obtained in 6 to 7 days.

7-3. POLYCARBONATE PARTS

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-301	Adhesive
C-305	Aliphatic Naphtha
C-406	Abrasive Cloth or Paper
C-423	Abrasive Cloth or Paper

NOTE

This procedure shall be used for bonding polycarbonates together, not repairs. For repairs, refer to paragraph 7-4. This procedure outlines the requirements for bonding polycarbonate plastic with a liquid type urethane adhesive.

1. Urethane adhesives are two component systems capable of producing high strength bonds to polycarbonate. Typical bonding strengths at room temperature on polycarbonate surfaces are 500 PSI strength and 20 PSI peel strength.

2. Urethane adhesives, when properly cured at room or elevated temperature, are non-volatile and will not crack or craze polycarbonate surface. The materials remain flexible after curing and retain high shear and peel strengths when bonded to polycarbonate or other materials. These adhesives will not sag or run when applied to a vertical surface; they remain flexible at -67°F (-55°C) and retain normal strengths to 180°F (82°C) with a service temperature range of -67 to 250°F (-55 to 21°C).

3. The various materials that can be bonded together or in combination are as follows: polycarbonate, acrylic, urethane rubber, steels, and all wrought aluminum alloys.

4. Urethane adhesives may be stored for 6 months at 60 to 80°F (16 to 27°C) when not being used. Urethane adhesives are highly susceptible to moisture, and containers must be kept air tight when not in use.

5. Surface preparation.

a. Cleanliness shall be carefully controlled through all phases of preparation and bonding operations. The drying and storage of surface treated parts to be bonded through their assembly for final bonding shall be conducted in an area that is dust free to the extent that bonding operations are not affected. In order to ensure consistently high bond strength, the following shall be accomplished:

(1) Cover work benches and shelves with clean wrapping paper, when soiled, to reduce contamination of bond surface.

(2) The processed parts shall be wrapped in clean paper until ready for use and shall be protected during lag periods.

(3) Wear clean, dry, white cotton gloves while handling processed parts. Change gloves as they become soiled.

(4) Avoid contact with all mold release agents such as silicone, wax, oil, grease, talc, etc.

b. Metal surfaces — Abrade lightly with 400 grit abrasive cloth or paper (C-406), or abrasive cloth or paper (C-423) and clean with aliphatic naphtha (C-305).

CAUTION

DO NOT USE ANY SOLVENTS ON POLYCARBONATE SURFACES.

c. Polycarbonate and acrylic surfaces — Lightly sandblast and remove blasting residue with a soft brush or wet abrasive blast and rinse with clean water. Blot excess water from the surface and allow to air dry. Light hand sanding with fine abrasive cloth or paper (C-423) may be used.

d. Urethane rubber — Lightly sand surface with fine abrasive cloth or paper (C-423) prior to bonding.

6. Apply adhesive (C-301) with a brush or spatula. Maximum strengths are obtained with a bondline

thickness of approximately 10 mils. No voids are permitted.

7. Cure urethane adhesives in accordance with manufacturers recommendations (Table 7-2).

7-4. POLYCARBONATE PARTS — REPAIR

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-301	Adhesive
C-403	Glass Cloth
C-423	Abrasive Cloth or Paper

NOTE

This procedure is for repairs to polycarbonates. For bonding polycarbonates together, refer to paragraph 7-3.

1. Repair of cracks in polycarbonate.

Table 7-2. Urethane Adhesives, Mixing Ratio, Potlife, and Curing Schedule

ADHESIVES	CONSUMABLE ITEM NO.	MIX RATIO BY WEIGHT	POT LIFE AT ROOM TEMP. (MIN.)	CURE PRESSURE	ROOM TEMP. CURE		ALTERNATE CURE	
					TEMP°F (C)	TIME (DAYS)	MINIMUM TEMP. °F (°C)	MINIMUM TIME (HRS)
Organocerams #4-3011 (Amber)	301	2 parts "A" to 1 part "B"	30 to 40	5 to 20 psi (firm contact)	70 to 80 (21 to 27)	2	160 (71)	2
Organocerams #4-3011-1 (Black)	301	2 parts "A" to 1 part "B"	30 to 40	5 to 20 psi (firm contact)	70 to 80 (21 to 27)	2	160 (71)	2
Dapcotac #3013 (Amber to Black)	301	2 parts "A" to 1 part "B"	30 to 40	5 to 20 psi (firm contact)	70 to 80 (21 to 27)	2	160 (71)	2
Uralane 5738 A/BX (Amber or Black)	301	100 parts "A" to 50 parts "B"	20 to 30	5 to 20 psi (firm contact)	70 to 80 (21 to 27)	7	160 (71)	2

a. Stop drill crack at each end of crack with No. 40 (0.098 inch) drill bit.

b. Lightly sand area to be repaired with 400 grit abrasive cloth or paper (C-423). Wipe area clean to remove sanding residue.

c. Mix urethane adhesive (C-301) in accordance with manufacturers instructions. Refer to table 7-2.

d. Apply urethane adhesive (C-301) to repair area using a brush or spatula.

e. Allow part to cure for 2 days at 70° to 80°F (21° to 27°C). If an accelerated cure is required, increase temperature to 160°F (71°C) with a heat lamp and allow to cure for 3 hours (2 hours minimum).

2. Repair of breaks or tears in polycarbonate.

a. Prepare area around damage as described in step 1.a. and 1.b. Stop drill cracks in damaged area using a No. 40 (0.098 inch) drill bit.

b. Cut a section of 120 to 127 weave glass cloth (C-403) to overlap damaged area a minimum of 0.5 inch.

c. Apply one brush coat of urethane adhesive (C-301) to repair area.

d. Lay fiberglass cloth over repair area and rub lightly to provide proper contact between cloth and surface of part.

e. Apply a second brush coat of urethane adhesive over fiberglass cloth and repair area.

f. Cure repair as described in step 1.e.

7-5. NONSTRUCTURAL BONDING WITH RUBBER BASE CEMENT

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-305	Aliphatic Naphtha
C-306	Toluene
C-309	MEK
C-423	Abrasive Cloth

General purpose, rubber base cements are generally solvent release type adhesives. These cements are applied to a clear surface and their solvents are allowed to evaporate.

1. Process.

a. Cleanliness shall be carefully controlled through all phases of preparation and bonding. Contact with grease or mold release agents shall be avoided.

b. Faying surfaces must be cut, formed, or machined so as to join accurately, prior to cleaning and bonding.

2. Surfaces must be clean, dry, and free from oil or grease. Faying surfaces shall be cleaned for cementing as follows:

a. For metal surfaces, abrade lightly with 400 grit abrasive cloth or paper (C-423). Remove the sanding residue with aliphatic naphtha (C-305), toluene (C-306), or MEK (C-309).

b. For rubber surfaces, the area to be bonded shall be abraded with a wire brush or coarse 80 grit abrasive cloth or paper (C-423) and wiped with toluene (C-306) or MEK (C-309). The parts shall be wiped dry with clean, dry cloths.

c. For plastic surfaces, lightly abrade the faying surfaces with 400 grit abrasive cloth or paper (C-423). Remove sanding residue with a dry air blast or a dry, clean, soft cloth. Faying surfaces shall be clean and dry.

d. Fabrics, foams, etc., shall be clean and dry.

e. Painted surfaces shall have the faying area wiped with aliphatic naphtha (C-305). Wipe the area dry with a clean, dry cloth.

f. Where additional bond strength is desired, remove paint by sanding lightly with 400 grit abrasive cloth or paper (C-423). Remove sanding residue with aliphatic naphtha (C-305) or MEK (C-309).

3. Protection of surfaces cleaned for bonding shall be protected by wrapping or storing so as not to become contaminated during waiting periods.

4. Cementing Methods.

a. Solvent Reactivation.

(1) Apply a thin, even coat of cement to each surface (more than one coat may be necessary on very porous materials).

(2) Allow cement to dry tack free.

(3) Wipe the surfaces with a clean cloth dampened in solvent.

(4) Align parts and start at one edge and roll or press firmly together to ensure intimate contact.

(5) Allow bond to set 4 hours minimum.

b. Heat Reactivation.

(1) Apply cement as specified in step a., above.

(2) Allow cement to dry tack free.

(3) Align parts and hold with firm contact pressure.

(4) Heat as required.

CAUTION

DO NOT USE SPRAY ADHESIVES DIRECTLY ON ACRYLIC OR POLYCARBONATE SURFACE.

c. Spray Adhesive Application.

(1) Spray adhesive shall be applied to vinyl, felt, foam, or rubber surfaces only.

(2) Spray distance shall be 6 to 8 inches.

(3) Allow adhesive to air dry for a minimum of one minute before joining.

(4) Join while the adhesive is in an aggressively tacky state (evidenced by the adhering, but not transferring to finger when touched.)

(5) Press firmly together to ensure intimate contact.

(6) Allow bond to set 15 minutes at room temperature.

7-6. SILICONE BONDING

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-305	Aliphatic Naphtha
C-306	Toluene

MATERIALS REQUIRED (Cont)

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-307	Adhesive
C-314	Adhesive
C-346	Adhesive
C-347	Xylene
C-423	Abrasive Cloth

1. Adhesives for silicone elastomers are of two general categories according to cure mechanism:

a. Two component systems composed of a silicone resin and catalyst.

b. Single component systems in which no catalyst addition is required to affect a cure. These two general categories can be divided further according to their resistance to temperature, oil, and fuel. Typical temperature ranges for silicone adhesives are –67°F (–55°C) to 500°F (260°C) in continuous exposure. Oil and fuel resistance is obtained by using fluorinated silicones. Single component systems would not be used in lap joints over 1.0 inch in width (single component adhesive systems are unable to affect a cure in large, closed area bonds).

2. The silicone adhesives described in this paragraph are used in bonding silicones or silicone coated materials to themselves, to metals, or to fiberglass laminates. There are no specific physical properties when bonding as described in this paragraph.

3. Surface Preparation.

a. Silicone rubber.

(1) Abrade the rubber with 80 grit abrasive cloth or paper (C-423).

(2) Clean the abraded area with a toluene (C-306) or xylene (C-347) wetted cloth.

(3) Wipe the area dry with a clean, dry cloth.

b. Unpainted metals and fiberglass laminates.

(1) Abrade the surface with 80 grit abrasive cloth or paper (C-423).

(2) Clean the abraded area with a toluene (C-306) or xylene (C-347) wetted cloth.

(3) Wipe the area dry with a clean, dry cloth.

c. Painted surfaces.

NOTE

For ultimate bond strength, remove the paint to bare metal.

(1) Clean the area to be bonded by wiping with a cloth wetted with aliphatic naphtha (C-305).

(2) Wipe the area dry with a clean, dry cloth.

d. Plastics, polycarbonate, acrylic or other plastic groups.

(1) Abrade surface lightly with 400 grit abrasive cloth or paper (C-423) or lightly dry sand blast.

(2) Clean abraded area by wiping with a clean dry cloth or dry air blast.

(3) The surface to be bonded shall be clean, dry, and free from oils, grease, masking materials, etc.

4. Application of Adhesives.

a. RTV adhesives adhesive (C-307) and adhesive (C-314) may be one or two component adhesives. Single component adhesives do not require a catalyst. These adhesives may be used with or without a primed surfaces. (5 to 10 mil bondline is acceptable on silicone rubber to silicone rubber bonds.)

(1) Without primer.

(a) Brush apply a 10 to 15 mil coating of the adhesive to both surfaces. (A 5 to 10 mil bondline is acceptable on silicone rubber to silicone rubber bonds.)

(b) Press the two coated surfaces together. Apply firm pressure until cured.

(2) With primer.

(a) Brush the applicable primer to be used to the metallic surfaces only. Refer to table 7-3.

(b) Air dry the primer for 30 minutes.

(c) Brush a 10 to 15 mil coating of the proper adhesive to each surface to be bonded.

(d) Press the two coated surfaces together. Apply a firm pressure until cured.

Table 7-3. Silicone Adhesives Classification and Properties

ADHESIVE — PROCUREMENT SPECIFICATION, PART NO., AND CONSUMABLE ITEM NO.	SYSTEM	COLOR	PRIMER (WHEN REQUIRED)	REMARKS
Type I, 299-947-152 Class 1, Dapcotac 3300 (C-300)	Two Part	Colorless	S-2260	△3 △4 △6 △8
	One Part	Translucent	—	△1 △3 △4 △6
Class 2, RTV 108 (C-307)	One Part	White, Black or	—	△1 △3 △4 △6
Class 2, RTV 732 (C-307)		Clear	(C-337)	
Type II, 299-947-152 RTV 106 (C-346)	One Part	Red	SS-4004	△1 △3 △4 △7
RTV 156 (C-346)	One Part	Red	SS-4004	△1 △2 △3 △4 △7
RTV 92-024 (C-346)	One Part	Gray	1200 (C-337)	△1 △2 △3 △4 △7
Type III, 299-947-152 RTV 20-046 (C-314)	One Part	Gray	1200	△1 △3 △5 △7
FRV 1106 (C-314)	One Part	Red	(C-337)	△1 △3 △5 △7

NOTES:

△1 These adhesives are to be used in applications where lap joint is not over 1.0 inch (25.4 mm) in width.

△2 Higher strength adhesives.

△3 Primer is recommended for metallic surfaces in order to improve adhesion and improve water, heat, and weather resistance.

△4 Oil and fuel resistance — No.

△5 Oil and fuel resistance — Yes.

△6 Continuous temperature range -67°F (-55°C) to 300°F (149°C).

△7 Continuous temperature range -67°F (-055°C) to 500°F (260°C).

△8 Mix 100 parts "A" to 10 parts "B". Pot life 2 to 4 hours.

(3) Handling strength (50 percent of maximum strength) is obtained in 24 hours (table 7-3, Note 1). Maximum cure is obtained in 3 to 5 days.

b. Cure procedures.

(1) Room temperature cure. The cure time for full strength is 4 to 7 days at room temperature of 70° to 80°F (21° to 27°C). The bondline holding strength cure time is 24 hours at room temperature (50 percent of full strength is obtainable).

(2) Heat temperature cure. Cure the adhesive at 150°F (66°C) in an air circulating oven for 18 hours.

(3) RTV adhesive (C-307) and adhesive (C-346). Single component RTV adhesive (RTV's 108, 732, 106, 156, 92-024, 20-046, and 94-002) do not require a catalyst. These adhesives may be used with or without a primer system.

(4) Without primer.

(a) Brush apply a 10 to 15 mil coating of the adhesive to both surfaces. (5 to 10 mil bondline is acceptable on silicone rubber to silicone rubber bonds.)

(b) Press the two coated surfaces together. Apply firm pressure until cured.

(5) With primer.

(a) Brush the applicable primer to be used to the metallic surfaces only. Refer to table 7-3.

(b) Air dry the primer for 30 minutes.

(c) Brush a 10 to 15 mil coating of the proper adhesive to each surface to be bonded.

(d) Press the two coated surfaces together. Apply a firm pressure until cured.

(6) Cure procedures. Handling strength (50 percent of maximum strength) is obtained in 24 hours. Refer to table 7-3, Note 1. Maximum cure is obtained in 3 to 5 days.

7-7. ACRYLIC WINDOWS AND WINDSHIELDS

7-8. INSPECTION AND REPAIR ACRYLIC WINDOWS AND WINDSHIELDS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-303	Adhesive

1. Small scratches and minor abrasions on acrylic plastic panels may be considered negligible provided they do not impair or distort the pilots vision or show signs of developing cracks. Minor scratches, nicks and nonpuncturing dents in frame assemblies may be considered negligible provided such damage does not affect transparent panels.

2. Inspect windshields and windows to damage limits described in paragraph 1.

3. Tears, holes, and cracks in acrylic plastic panels less than 4.0 inches in length can be repaired provided the damage does not interfere with the pilots vision. Use acrylic adhesive (C-303).

4. Refer to FAA Advisory Circular 43.13-1 Aircraft Inspection and Repair, for repair instructions and procedures for acrylic plastics.

7-9. KYDEX AND ROYALITE TRIM PARTS

Kydex and Royalite trim panels may be bonded and repaired by procedures described for polycarbonates in paragraphs 7-3 and 7-4.

CHAPTER 8 — MISCELLANEOUS PRACTICES

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MISCELLANEOUS PRACTICES

8-1. CLAMPING OF RIGID TUBES AND FLEXIBLE HOSES

Always install clamps MS21919 in accordance with the procedure of the applicable manual, bulletin, or instruction. Paragraph 8-2 provides additional information to ensure correct installation of new clamps MS21919 or troubleshooting an installation where evidence of chafing between the tubing and the structure occurred. Refer to the BHT-ELEC-SPM for electrical applications.

8-2. CLAMPING OF RIGID TUBES AND FLEXIBLE HOSES — GENERAL PRACTICES

1. Unless it is specified in the procedure of the applicable manual, bulletin, or instruction, make sure the appropriate materials were selected for the clamp MS21919, as follows:

a. Material for the clamp band must be as follows, based on other clamps MS21919 used in a similar environment and consistent with the application:

- Aluminum band (band code D)
- Corrosion Resistant Steel (CRES) band (band code C)

b. Material for the clamp cushion must be compatible with the operating environment:

- Nitrile cushions (yellow) are used for application in fuel immersion and fuel vapors. Not resistant to synthetic hydraulic fluids and not for use on titanium tubings.
- Chloroprene cushions (black) are used for general application in areas contaminated with petroleum-based hydraulic fluid (C-002) and occasional fuel splash. Not resistant to synthetic hydraulic fluids.
- Silicone cushions (white) are used for application at high temperature in areas contaminated with synthetic hydraulic fluid. Not resistant to petroleum-based hydraulic fluid (C-002).
- Fluorosilicone cushions (blue) are used for application at high temperature in areas contaminated with petroleum-based hydraulic fluid (C-002) or hydraulic fluid (C-072). Not resistant to synthetic hydraulic fluid. Ideal for extreme temperature conditions and exposure to fuel or oil.

c. The size of the clamp MS21919 should provide a tight fit on the tube or hose without pinching. The clamp MS21919 should not slide on the tube or hose when you apply a light axial pull.

2. Unless otherwise specified in the procedure of the applicable manual, bulletin, or instruction, the general practices for installation of clamps MS21919 on rigid tubes and flexible hoses are as follows:

a. Based on the band material used for the clamp MS21919, make sure the fasteners used are in accordance with the following:

(1) For aluminum clamp bands, use a screw MS27039-1 of the appropriate length, a spacer NAS43DD3 of the appropriate length if applicable, a nut MS21042L3, and a washer NAS1149D0332J under the nut.

(2) For CRES clamp bands, use a screw MS27039C1 of the appropriate length, a spacer NAS43HT3 of the appropriate length if applicable, a nut MS21042L3, and a washer NAS1149C0332R under the nut.

b. When the tubing runs horizontally, clamps MS21919 are installed with the mounting holes above the loop to prevent the attachment legs from bending.

c. Clamps MS21919 are installed with the rear attachment leg resting on the structure.

d. Clamps MS21919 are installed so the rigid tube or flexible hose they support does not come in contact with the surrounding structure when subject to vibrations.

e. The last clamp MS21919 on a flexible line must be loose enough to allow movement through full range of the equipment it connects to.

f. Clamps MS21919 are installed with 24 inches (610 mm) or less of space between.

3. Whenever you do a major inspection in areas subject to a combination of dirt and lubricants, it is a good practice to examine rigid tubes and flexible hoses at areas covered by the clamps.

Attaching screws may be loosened or removed and clamps moved away to allow visual inspection of the rigid tubes or flexible hoses for fretting, corrosion, and mechanical damage.

8-3. CONTROL TUBE (ADJUSTABLE)

8-4. CONTROL TUBE (ADJUSTABLE) — THREAD PROTECTION

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound
C-104	Corrosion Preventive Compound

1. During assembly and adjustment procedures of adjustable control tubes, apply corrosion preventive compound (C-104) to the threads of the rod end.

2. After the adjustment of adjustable control tubes, apply corrosion preventive compound (C-101) to the rod end jam nuts and threads.

8-5. CONTROL TUBE (ADJUSTABLE) — ALIGNMENT

NOTE

Two different types of spherical bearings can be installed on adjustable control tubes. These are self-aligning and/or nonself-aligning bearings.

For control tubes that feature a spherical self-aligning bearing on each end, refer to step 1.

For control tubes that feature a spherical self-aligning bearing on one end and a spherical nonself-aligning bearing on the other end, refer to step 2.

1. Align the control tube between the two spherical self-aligning bearings as follows:

a. Loosen the locknut on the control tube.

b. Turn the control tube and the adjustable end in the same direction until both bottom out.

c. Tighten locknut.

d. Turn the control tube in both directions by hand, and make sure that each end bottoms out at the same time.

e. If one spherical self-aligning bearing has more travel and does not bottom out, loosen the locknut and reposition the adjustable end to provide equal clearance, in each direction, at the bearing having the extra travel. Tighten the locknut and do a check of the alignment again.

f. Move the controls through their full range of travel and make sure the control tube clevises have clearance at all positions.

2. Align the control tube between one spherical self-aligning bearing and one nonself-aligning bearing as follows:

a. Loosen the locknut on the control tube.

b. Position the control tube so the tangs of the clevis are parallel to the flat surface of the spherical self-aligning bearing retaining boss.

c. Tighten the locknut and do a check of the alignment again.

d. Move the controls through their full range of travel and make sure the control tube clevises have clearance at all positions.

8-6. DATA PLATES

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-305	Aliphatic Naphtha
C-309	MEK
C-317	Adhesive
C-423	Abrasive Cloth or Paper
C-486	Cheese Cloth

CAUTION

ALWAYS STAMP OR VIBROETCH THE DATA PLATE BEFORE BONDING ONTO THE COMPONENT. FAILURE TO DO SO MAY RESULT IN DAMAGE THE COMPONENT.

NOTE

Bell Helicopter Textron supplies blank data plates through spares.

If the data plate of a part/component is lost or a component is built up from serviceable detail parts, Bell Helicopter recommends that a new data plate be locally manufactured or purchased.

The data plate may be made as follows:

- Material: aluminum alloy T0 or T3
- Thickness: 0.025 or 0.032 inch (0.64 or 0.81 mm)
- or adhesive backed aluminum alloy foil

The part number to be vibroetched on the data plate must match the actual configuration of the part/component and the records on hand.

If an existing data plate was lost, you may reproduce the same serial number that appears on the component or the Historical Service Record (HSR).

NOTE

The serial number created is to be used in all of the helicopter records to provide maximum traceability for the life of the part or assembly.

If a new component is built up from spare or serviceable detail parts, you may assign a serial number of your choice.

After forming the data plate to the proper contour, bond the data plate on the component as follows:

1. Clean the back side of the data plate and the bonding surface on the component as follows:

a. Abrade lightly with a 400 grit abrasive cloth or paper (C-423).

b. Remove the residue with a clean cloth moistened with aliphatic naphtha (C-305).

NOTE

After cleaning, wear clean, dry gloves to prevent contamination of the parts.

The pot life of adhesive (C-317) is 30 to 50 minutes.

2. Apply a thin coat of adhesive (C-317) to the data plate and to the bonding surface on the component.

3. Place a 4-mil thread in the adhesive (C-317) on the data plate. Two pieces of thread positioned lengthwise on the data plate serve as a spacer and control bond line thickness.

4. Position the data plate on the component.

5. Use rubber bands to maintain a pressure of approximately 0.5 to 1.0 PSI (3 to 7 kPa) on the dataplate during the 24 hour cure period.

NOTE

Refer to Chapter 13 for accelerated cure temperature, time, and pressure data of adhesive (C-317).

6. Before the adhesive (C-317) cures, remove any excess of adhesive (C-317) outside the bonding area with a clean cheesecloth (C-486) moistened with MEK (C-309).

8-7. DE-ICING, ANTI-ICING, AND SNOW REMOVAL

WARNING

DO NOT START OR OPERATE THE HELICOPTER UNTIL YOU HAVE COMPLETED APPROPRIATE DE-ICING, ANTI-ICING, AND SNOW REMOVAL. OPERATING A HELICOPTER WITH CONTAMINATION ON THE SURFACES MAY RESULT IN REDUCED FLIGHT CONTROLABILITY AND CAUSE DEATH OR SERIOUS INJURIES TO PERSONS.

NOTE

Refer to the applicable Flight Manual (FM) for operating limitations under snow or icing conditions.

The purpose of the following section is to provide recommended guidelines for the de-icing, anti-icing, and snow removal of the helicopter. You may refer to the FAA Advisory Circular AC 120-60B, to your local regulatory requirements, or your internal procedures, as applicable, for the appropriate practices.

It is difficult to make an accurate estimate of the amount of time or Holdover Time (HOT) the de-icing/anti-icing fluid will prevent the formation of frost and ice, and accumulation of snow on the helicopter. Fluid quantity, Outside Air Temperature (OAT), precipitation rate, wind speed, and other factors affect the HOT. Table 8-1 provides an approximate HOT for different weather conditions.

8-8. DE-ICING, ANTI-ICING, AND SNOW REMOVAL — SNOW REMOVAL

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
Commercial	Soft Bristle Broom or Brush

CAUTION

DO NOT REMOVE SNOW WITH OTHER TOOLS THAN THOSE SPECIFIED. HARD BRISTLE BROOMS OR BRUSHES MAY CAUSE DAMAGE TO SURFACES OF THE HELICOPTER.

1. Remove all deposits of snow from the helicopter with a broom or brush. Make sure snow is removed from the following areas, as applicable:

- Exterior surfaces
- Antennas
- Pitot tubes and static ports
- Engine air inlets, particle separators, and exhausts
- Main and tail rotor blades and controls
- Exposed flight controls
- Drain and vent ports
- Landing gear bays and doors
- Inside cowlings and fairings
- Cabin and cockpit air ventilation inlets

2. If strong wind and blowing snow conditions occurred, pay special attention to inside areas of all cowlings and fairings of the fuselage and the tailboom for snow deposits.

3. Refer to procedures for de-icing (paragraph 8-9) or anti-icing (paragraph 8-10), as applicable.

8-9. DE-ICING, ANTI-ICING, AND SNOW REMOVAL — DE-ICING

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
Commercial	Spray Equipment

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-394	De-icing/Anti-icing Fluid

WARNING

DE-ICING/ANTI-ICING FLUID (C-394) IS POISONOUS. WEAR EYE AND SKIN PROTECTION. DO NOT PUT IN MOUTH AND AVOID BREATHING THE FLUID VAPORS. EXPOSURE TO HIGH CONCENTRATIONS OR INGESTION OF HIGH DOSES CAN BE HARMFUL OR FATAL TO PERSONS. GET EMERGENCY TREATMENT IN CASE OF IRRITATIONS.

NOTE

Using the approved de-icing/anti-icing fluid (C-394) and the following procedure will not damage elastomeric parts.

a. Remove snow from the helicopter (paragraph 8-8).

NOTE

For removal of light icing, a solution with 40% in volume of de-icing/anti-icing fluid (C-394) may be used.

b. Mix a solution of 50% by volume of de-icing/anti-icing fluid (C-394) and 50% of water.

CAUTION

DO NOT APPLY A HOT (180°F(82°C)) SOLUTION OF DE-ICING/ANTI-ICING FLUID (C-394) TO COLD ACRYLIC WINDOWS. THE RESULTING THERMAL SHOCK MAY CAUSE CRAZING OF THE WINDOW. USE FLUID AT OR NEAR 70°F (21°C).

NOTE

The de-icing/anti-icing fluid (C-394) may produce an unacceptable glare for the pilot on the windshield. It is recommended to remove a thin layer of frost with hot water 90 to 100°F (32 to 38°C) instead, providing the Outside Air Temperature (OAT) is not too low.

c. Heat solution to 180°F (82°C) for most efficient and effective ice removal.

CAUTION

DO NOT SPRAY DILUTED OR NON-DILUTED DE-ICING/ANTI-ICING FLUID (C-394) IN THE ENGINE AIR INLETS. IF FLUID ENTERS THE ENGINE AIR INLETS, DO A COMPRESSOR WASH.

d. Spray the diluted solution of de-icing/anti-icing fluid (C-394) to the helicopter with suitable spray equipment as follows:

(1) Start spraying from top to bottom of the helicopter and finish with the critical surfaces (main rotor blades, tail rotor blades, flight controls, horizontal stabilizer, and vertical fin).

(2) Apply a course stream to loosen and remove the ice.

(3) Avoid spraying in the direction of wind.

NOTE

Refer to Table 8-1 for the approximate Holdover Times (HOT).

e. Before you start the helicopter, do a visual inspection of all helicopter surfaces for evidence of ice and snow contamination.

f. After landing, remove the de-icing/anti-icing fluid (C-394) from the helicopter as soon as practical (paragraph 8-11).

8-10. DE-ICING, ANTI-ICING, AND SNOW REMOVAL — ANTI-ICING

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
Commercial	Spray Equipment

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-394	De-icing/Anti-icing Fluid

WARNING

DE-ICING/ANTI-ICING FLUID (C-394) IS POISONOUS. WEAR EYE AND SKIN PROTECTION. DO NOT PUT IN MOUTH AND AVOID BREATHING THE FLUID VAPORS. EXPOSURE TO HIGH CONCENTRATIONS OR INGESTION OF HIGH DOSES CAN BE HARMFUL OR FATAL TO PERSONS. GET EMERGENCY TREATMENT IN CASE OF IRRITATIONS.

CAUTION

DO NOT SPRAY DILUTED OR NON-DILUTED DE-ICING/ANTI-ICING FLUID (C-394) IN THE ENGINE AIR INLETS. IF FLUID ENTERS THE ENGINE AIR INLETS, DO A COMPRESSOR WASH.

NOTE

Using the approved de-icing/anti-icing fluid (C-394) and the following procedure will not damage elastomeric parts.

The non-diluted de-icing/anti-icing fluid (C-394) will freeze at approximately -25°F (-32°C). Some ice or slush may form at or below -25° F (-32°C).

Refer to paragraph 8-9 for instructions on de-icing/anti-icing fluid (C-394) application.

a. Spray or wipe non-diluted de-icing/anti-icing fluid (C-394) on the helicopter to prevent ice and frost from sticking.

NOTE

Refer to Table 8-1 for the approximate Holdover Times (HOT).

b. Before you start the helicopter, do a visual inspection of all helicopter surfaces for evidence of ice and snow contamination.

c. After landing, remove the de-icing/anti-icing fluid (C-394) from the helicopter as soon as practical (paragraph 8-11).

8-11. DE-ICING, ANTI-ICING, AND SNOW REMOVAL — FLUID REMOVAL

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-355	Detergent

1. Remove the de-icing/anti-icing fluid and residue from the helicopter as follows:

a. Clean the helicopter with freshwater or with a solution of detergent (C-355) and water. Rinse the solution of detergent (C-355) with freshwater.

Table 8-1. Approximate Holdover Times (HOT) for De-icing/Anti-icing Fluid

OAT △1	APPROXIMATE HOT VS. WEATHER CONDITIONS (MINUTES)			
	FROST	FREEZING FOG	LIGHT SNOW △2	MODERATE SNOW △2
>27°F (>-3°C)	45	11 to 17	11 to 16	6 to 11
27 to 21°F (-3 to -6°C)	45	8 to 14	8 to 13	5 to 8
20 to 14°F (-7 to -10°C)	45	6 to 10	6 to 10	4 to 6
<14°F (<-10°C)	45	5 to 9	4 to 6	2 to 4

NOTES:

No HOT exist for heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain, hail.

HOT is reduced in heavy weather conditions (precipitation rate, wind speed, etc.) or when the helicopter skin temperature is lower than the OAT.

The de-icing/anti-icing fluid (C-394) is not intended for and does not provide anti-ice protection during flight. Refer to the applicable Flight Manual (FM) for operating limitations under snow or icing conditions.

△1 Outside Air Temperature (OAT).

△2 To use these Holdover Times (HOT), heat the de-icing/anti-icing fluid (C-394) to a minimum of 140°F (60°C) and apply 2 gallons per 100 square-foot (1 L/m²) of diluted fluid.

8-12. ELASTOMERIC (RUBBER) PARTS

The parts defined as elastomeric are those made of elastomer (ex. packings, O-rings) or those that feature an elastomeric element (ex. seals, hose assemblies).

For the most part, elastomers are synthetic rubbers, with elastic properties used for the sealing of components after installation.

Elastomers are also age sensitive materials or materials subject to deterioration when exposed to environmental factors like oxygen, sunlight, heat, etc.

The following paragraphs provide both required and recommended procedures to follow for correct use of packings or O-rings, seals, seal assemblies, and hose assemblies before and during installation on a component.

8-13. ELASTOMERIC (RUBBER) PARTS — GENERAL PRACTICES

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-001 (1)	Grease
C-002	Hydraulic Fluid
C-003	Turbine Fuel
C-008	Petrolatum
C-024	Assembly Fluid
C-030	Lubricating Oil
C-072	Hydraulic Fluid
C-355	Detergent
C-428	Caps and/or Plugs
C-516	Low-lint Cleaning Cloth

NOTE:

(1) Mobilgrease 28 is preferred.

CAUTION

ALWAYS INSTALL NEW PACKINGS OR O-RINGS. FAILURE TO DO SO MAY RESULT IN EQUIPMENT LEAKAGE AND EARLY FAILURE.

NOTE

After installation, packings or O-rings are no longer age controlled.

1. Follow the precautions provided hereafter when you install a new preformed packing, or O-ring:

a. Never use a packing more than once. Make sure you discard the packing after removal from a component and use a new packing at installation.

b. Always examine the new packing for signs of cuts, nicks, manufacturing defects, or twists before installation.

c. Never expose a packing to solvent. This can cause deterioration or hardening of the packing and result in leakage.

d. To install a preformed packing in the groove of an outer or inner diameter, always stretch or collapse the packing, as applicable. Never twist the preformed packing during installation. To prevent a twist in the packing, never roll a preformed packing into a groove. A twist in the packing will reduce its cross section area and cause leakage.

e. Never substitute a preformed packing. A preformed packing can look the same but can be made of a different material that is not compatible with the fluid used in the system or component.

NOTE

Refer to the applicable Flight Manual (FM) for approved fuels and system lubricants.

f. Lubrication of packings must be as follows, unless otherwise specified in the procedure of the applicable manual, bulletin, or instruction:

(1) Always use an assembly fluid (C-024) to lubricate a packing. Exceptions are:

(a) For packings operating in contact with hydraulic fluid, lubricate with hydraulic fluid (C-002) or petrolatum (C-008).

(b) For packings operating in contact with fuel, lubricate with turbine fuel (C-003).

(2) If assembly fluid (C-024) is not available or specified, use the applicable system lubricant as an alternate (ex. lubricating oil (C-030)).

2. Follow the precautions provided hereafter when you remove and install (elastomeric) seals and seal assemblies:

a. Only touch the outer surface of a seal.

b. Never expose a seal to solvent. This can cause deterioration or hardening of the sealing surfaces and result in leakage.

c. If applicable, always keep the protective cup installed on the sealing surfaces, until installation in the next assembly.

d. Always examine the sealing surfaces of a new seal for signs of cuts, nicks, or manufacturing defects before installation.

NOTE

Refer to applicable manual, bulletin or instruction for the brand of grease (C-001) to apply.

e. Lubricate single and double lip seals with grease (C-001). Unless stated otherwise, Mobil 28 is preferred.

3. If necessary, clean (elastomeric) seals as follows:

a. Wipe the sealing surfaces of the seal lightly with a clean low-lint cleaning cloth (C-516) to remove contaminated oil and/or grease.

b. Clean the seal with a detergent (C-355) and water.

c. Rinse the seal with water and dry with a clean low-lint cleaning cloth (C-516).

4. Always put protective caps and/or plugs (C-428) on the open ends of hose assemblies when removed from the helicopter.

8-14. ELASTOMERIC (RUBBER) PARTS — GUIDELINES FOR STORAGE

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-427	Barrier Material

NOTE

The purpose of the section that follow is to provide recommendations for the storage of elastomeric parts. You may refer to the latest revision of the SAE specification AS5316 and AS1933, or to your personal judgment/experience, for the appropriate practices.

Uninstalled (stored) packings or O-rings, hose assemblies, seal assemblies, and seals are age controlled.

1. Follow the precautions provided hereafter for the storage of elastomeric parts:

a. Each elastomeric part should be individually stored in the original heat-sealed envelope or an equivalent that uses barrier material (C-427).

NOTE

If the cure date of an elastomeric part cannot be identified, discard the part.

b. Each envelope should show the cure date (i.e. date of manufacture) of the elastomeric part.

NOTE

If the storage temperature is less than 59°F (15°C), the temperature of an elastomeric part should be raised to 68°F (20°C) before installation on the component.

c. Storage temperature should be 59 to 100°F (15 to 38°C) and humidity not to exceed 75%, or 65% if polyurethanes are being stored.

d. For hose assemblies, the storage temperature must not exceed 125°F (52°C).

e. Stock rotation of elastomeric parts should comply with the First In First Out (FIFO) principle.

f. During storage or when you handle packings, make sure of the following:

(1) Never expose elastomeric parts to direct sources of heat (radiator) or light (sunlight).

(2) Do not let elastomeric parts make contact with liquids or liquid vapors (fuel, oil, grease, solvents, etc.), unless otherwise specified.

(3) Avoid contact between elastomeric parts made of different elastomers, contact with metals (copper, iron, etc.), and contact with adhesive tapes.

(4) Avoid incorrect stacking of elastomeric parts, i.e. compression and/or flattening under heavy

loads and creases could occur when forced against corners and edges of storage containers.

8-15. ELASTOMERIC (RUBBER) PARTS — GUIDELINES FOR DETERMINATION OF THE USEFUL AGE

NOTE

The purpose of the section that follow is to provide recommendations to determine the useful age of elastomeric parts. You may refer to the latest revision of the SAE specification AS5316 and AS1933, or to your personal judgment/experience, for the appropriate practices.

The useful age of elastomeric parts is considered the maximum amount of time, from the cure date (date of manufacture) to the date the part is installed in components.

Within the useful age, the elastomeric part is expected to retain its characteristics as originally specified. Examine the part for damage and signs of aging, and discard the part as required, if any of the following conditions occur:

- The age is in question and the part is not yet installed on a component.
- The cure date cannot be identified.
- The heat-sealed envelope used for storage is not correctly sealed or is damaged.

NOTE

After installation in component, elastomeric parts, including packings, O-rings, seals, seal assemblies and hose assemblies, are no longer age controlled.

Please, refer to the latest revision of SAE specification AS5316, for applicability of the following recommended age to the material specification of the elastomers. SAE specifications may be obtained from:

IHS Inc.
321 Inverness Drive South
Englewood, Colorado 80112
www.ihs.com

Customer Care:
+1 800 447 2273 (U.S./Canada)
+44 (0) 1344 328 300 (Europe and Middle East)
+604 293 3600 (Asia Pacific)

Using the latest revision of SAE specification AS5316, the useful age of uninstalled (stored) packings or O-rings, seals, seal assemblies, and hose assemblies (AS1933) is based on the cure date and should not be more than one of the following recommended age limits:

1. Packings (O-rings), seals, and seal assemblies:

From the cure date of the packing to the date of installation on a component, and depending on the type of material, the useful age should not exceed one of the following:

- 12 Quarters (or 3 years)
- 20 Quarters (or 5 years)
- 60 Quarters (or 15 years)
- Unlimited (i.e. on-condition)

2. Hose assemblies:

With reference to AS1933, bulk hose, from the cure date of the bulk hose to the time of installation into hose assemblies, components, accessories, engines or helicopters should not exceed 32 quarters (8 years).

3. Hose assemblies are not preferred to be stored for an extended period of time. Elastomers may take a compression set. If the date of assembly of an unfilled, stored hose assembly is more than one quarter (3 months), before installation or a periodic pressure test, the following is recommended:

NOTE

Refer to the applicable Flight Manual (FM) for approved system fluids.

a. Fill the hose assembly with the applicable system fluid for 24 hours before installation and any pressurization.

8-16. ELECTRIC ARC ETCHING — UNAUTHORIZED PROCEDURE

The electric arc (pencil marking) etching of the components is not authorized for the reasons that follow:

1. Electric arc is a high temperature source.

2. Electric arc blasts away surface metal and causes a notch.

3. Heating causes three zones of weakness:

- Cast zone
- Re-hardened zone
- Tempered zone

4. In service, the notched metal under high residual tensile strength is prone to cracking. Cracks grow in the re-hardened brittle metal below the surface and cause failure of the component.

8-17. GEARS

8-18. GEARS — SPLINE AND TEETH WEAR MEASURING PINS

1. Measuring pins of different diameters are required to examine wear of gear teeth and spline during components and parts overhaul.

Each kit (Table 8-2) includes sets of pins, one set for each size of pin required. Each set of pins is stored in a labeled plastic container and all of the sets are stored in a single container designed to accommodate, protect, and identify each set.

Table 8-2 provides the different sizes of pins required for each model of helicopter and included in each kit.

Diameter of pins has a tolerance of 0 inch to 40 microinches (1.016 µm). Length is not critical.

Figure 8-1 shows the correct position for the pair of measuring pins when measuring the spline/teeth wear of internal and external gears.

2. Measuring pins are procurable as follows:

NOTE

Make sure to specify the kit designation letter and helicopter model when you order (Table 8-2).

a. To order kits, U.S. operators may contact the following:

Machinists Tools and Supplies
1000 Quaker St.,
Dallas, Texas, 75207
www.machinists-tools.com

b. To order kits, foreign operators may contact the following:

Bell Helicopter Textron, Inc.
Customer Support and Service
Spare Parts Department
P.O. Box 482
Fort Worth, Texas 76101-0482
1-817-280-2919
1-817-280-2551

NOTE

Each set has two pins and the pins are of the same length and diameter.

c. Sets of two pins can also be purchased separately. Make sure to specify the pin length and diameter for each set you may want to order.

d. Individual pins can be purchased from any machinist supplier.

8-19. GEARS — WEAR PATTERN CHECK

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-028	Dry Film Lubricant

1. Spray three gear teeth, approximately 120° apart, with dry film lubricant (C-028).

2. Assemble the component only to the extent necessary to rotate the gear.

3. Manually operate the component.

4. Disassemble as required and examine the wear pattern of the gear teeth.

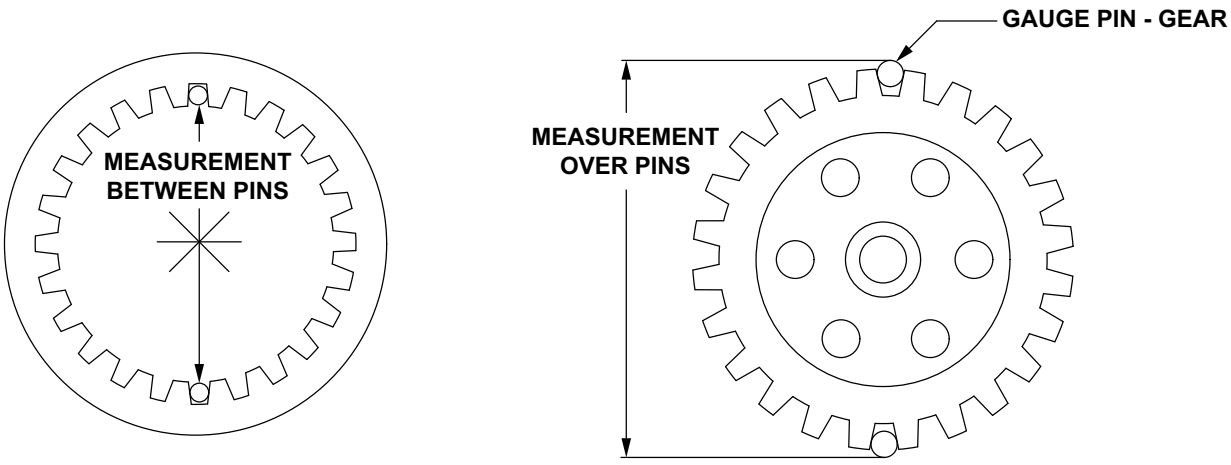

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Figure 8-1. Gears — Methods for Spline and Teeth Wear Measurement

Table 8-2. Gears — Measuring Pins Versus Helicopter Models and Kit Designation Letters

MEASURING PINS			47	206	204 205 212	47 206	47/206 204/205 212	407	427	429
LENGTH (INCH)	DIAMETER (INCH)		KIT A	KIT B	KIT C	KIT D	KIT E	–	–	–
1	0.0240							X	X	X
1	0.0360									X
1	0.0432									X
1	0.0450		X	X	X	X	X			
1	0.0480									X
1	0.0540			X		X	X	X	X	X
1	0.0600			X	X	X	X	X	X	X
1	0.0710				X		X			
1	0.0720				X		X			
1	0.0800							X		X
1	0.0864								X	X
1	0.0900				X		X			
1	0.0960			X	X	X	X	X		X
1	0.1080			X	X	X	X	X	X	X
1	0.1200			X	X	X	X	X	X	X
1	0.1309				X		X			
1/4	0.1440			X	X	X	X	X	X	X
1	0.1440		X	X	X	X	X	X	X	X
1	0.1440	⚠1							X	X
1/4	0.1600			X	X	X	X	X	X	X
1	0.1600		X	X		X	X	X	X	X
1	0.1680		X		X	X	X			
1/4	0.1728			X		X	X	X	X	X
1	0.1728		X	X	X	X	X	X	X	X
1	0.1800							X	X	

Table 8-2. Gears — Measuring Pins Versus Helicopter Models and Kit Designation Letters (Cont)

MEASURING PINS		47	206	204 205 212	47 206	47/206 204/205 212	407	427	429
LENGTH (INCH)	DIAMETER (INCH)	KIT A	KIT B	KIT C	KIT D	KIT E	–	–	–
1	0.1920	X	X	X	X	X	X	X	X
1	0.2057		X		X	X		X	X
1	0.2065	X			X	X			
1	0.2160		X	X	X	X			
1	0.2400	X			X	X			
1	0.2880	X			X	X			
1	0.3000	X							

NOTES:

There is no kit available for the 407, 427, and 429 models. Sets of pins can only be purchased individually.

△1 Flattened pins.

8-20. GREASE

8-21. GREASE — CHANGING TYPES OR BRANDS

NOTE

Refer to the procedure of the applicable manual, bulletin, or instruction to make sure the correct grease type or brand is used for the specific component.

MIL-PRF-81322 grease (C-001) is recommended for use in all applications which previously used MIL-G-25537 bearing grease (C-007).

Intermixing of greases is prohibited. When you change from one grease to the other, purge until previous grease is depleted. Be careful the same way when you switch brands of grease as when you switch types of grease.

8-22. GREASE — STORAGE LIFE

1. Grease, 204-040-755-005 lubricant (tube pack) (C-015) has a shelf storage life of 4 years, whether stored in the original container or in a component. If a component is not put into service before expiration of the 4 year shelf life of the grease, the component must be purged and lubricated before installation on the helicopter.

After initial operation of the component on the helicopter, refer to the appropriate lubrication chart for lubrication intervals.

2. Before installation of bearings, lubricated with MIL-G-25013 lubricant (C-026) or MIL-PRF-81322 grease (C-001), do the following:

a. Clean the bearings (Chapter 5).

b. Examine the bearings for corrosion.

c. Lubricate again the bearings with the applicable grease (C-001) or lubricant (C-026).

Components with bearings installed must be purged and lubricated before installation on the helicopter.

After initial operation of the component on the helicopter, refer to the appropriate lubrication chart for lubrication intervals.

8-22A. GREASE FITTING — INSPECTION

Prior to and following grease lubrication, visually examine grease fittings for presence of the spring loaded steel ball. If the steel ball is not visible, does not spring back to the closed position, the grease fitting indicates excessive leakage, or it is difficult to inject grease during lubrication, replace the grease fitting. Refer to paragraph 8-22B for replacement of NAS516 type grease fittings.

If the grease fitting is removed due to the spring loaded steel ball not being visible, insert a small steel probe into the back of the grease fitting to confirm the presence of the steel ball. If it is identified that the steel ball is not present in the grease fitting, further investigation is required to ensure that the steel ball has not migrated into the component and caused damage. Discard grease fittings that have been removed.

8-22B. GREASE FITTING (NAS516) — REPLACEMENT

MATERIALS REQUIRED

Refer to BHT-ALL-SPM for specifications.

NUMBER	NOMENCLATURE
C-204	Epoxy Polyamide Primer
C-304	Drycleaning Solvent
C-516	Clean Cloth

1. If required, disassemble the component to the extent necessary for repair using the instructions provided in the applicable manual.

CAUTION

DO NOT EXCEED THE MAXIMUM ALLOWABLE TEMPERATURE WHEN YOU HEAT A PART OR DAMAGE TO THE PART MAY OCCUR. DO NOT EXCEED 2 HOURS AT THE MAXIMUM SPECIFIED TEMPERATURE.

NOTE

Refer to Table 8-19 for information on material versus maximum temperature. If you are unsure of the material of the part, contact Product Support Engineering.

2. Ensuring not to exceed the specified maximum allowable temperature for the material of the part (Table 8-19), heat the part adjacent to the grease fitting.

CAUTION

ACCESS TO SOME GREASE FITTINGS IS LIMITED DUE TO INSTALLATION IN A COUNTERBORED AREA. DO NOT DAMAGE THE PART OR THE BORE FOR THE GREASE FITTING DURING REMOVAL OF THE GREASE FITTING. DAMAGE TO THE PART MAY REQUIRE REPAIR OR REPLACEMENT.

NOTE

If required, return the part to Bell Helicopter Textron (BHT) for evaluation and possible installation of replacement grease fitting.

Refer to General Information Letter (IL) GEN-04-98 for the applicable shipping information and to obtain a Return Material Authorization (RMA) number.

3. Pull the grease fitting out of the part with a small self-tapping screw and pliers. As an alternate means, good quality pliers may be used to grasp and pull the fitting from the part. Discard the grease fitting.

4. Make sure the bore of the part, for the grease fitting, is not obstructed or damaged.

5. Clean the mating surfaces of the bore and the grease fitting with drycleaning solvent (C-304) and a clean cloth (C-516).

CAUTION

MAKE SURE THE TEMPERATURE OF THE PART DOES NOT EXCEED 265°F (129°C) WHEN WET INSTALLING GREASE FITTING WITH PRIMER. EXCEEDING THE TEMPERATURE LIMIT CAN DAMAGE THE CHARACTERISTICS AND THE CURE OF THE PRIMER.

6. Wet install a new grease fitting in the part with epoxy polyamide primer (C-204) while the area is still heated. Press or use a soft material punch and lightly tap the grease fitting into position.

7. Make sure the grease fitting is tight in the part and functions properly by injecting specified grease.

8. If required, reassemble component using the instructions provided in the applicable manual.

9. Lubricate the part or component per the applicable servicing instructions.

8-23. PLACARDS AND MARKINGS

The requirements and procedures given in paragraph 8-24 concern the application of pressure-sensitive (adhesive-backed) decals to internal and external surfaces of helicopters.

8-24. APPLICATION OF DECALS

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-233	Polyurethane Enamel
C-305	Aliphatic Naphtha
C-306	Toluene
C-349	Edge Sealer
C-385	Isopropyl Alcohol
C-426	Masking Tape
C-516	Low-lint Cleaning Cloth

NOTE

Bonding surfaces must be nonporous.

1. Remove dirt, grease, wax, or other contaminants from the surfaces to be bonded as follows:

a. For non-metallic and painted surfaces, clean with a clean cloth moistened with aliphatic naphtha (C-305). Dry the surfaces with a clean clean cloth (C-516) before the aliphatic naphtha (C-305) evaporates.

CAUTION

DO NOT ALLOW TOLUENE TO MAKE CONTACT WITH PAINTED OR NON-METALLIC SURFACES OR DAMAGE TO THE SURFACE MAY OCCUR.

b. For bare metal surfaces, clean with a clean cloth moistened with toluene (C-306). Dry the surfaces with a clean clean cloth (C-516) before the toluene (C-306) evaporates.

2. Apply the pressure-sensitive (adhesive-backed) decal to the bonding surface as follows:

a. Apply the decal at temperatures above 60°F (16°C) for best results. Otherwise, first apply solvent (refer to the manufacturer's instructions) or isopropyl alcohol (C-385) to the decal.

b. Remove the adhesive protection from one edge of the decal with a quick smooth movement.

c. Carefully align the decal in the correct position.

d. Put the peeled edge of the decal on the edge of the bonding surface and apply a firm pressure with your finger along the same edge.

NOTE

For application of large decals, use a plastic squeegee with a firm pressure.

e. While you continue to remove the adhesive protection, apply finger pressure to the remaining part of the decal until the entire decal is applied. For best result, hold the opposite edge away from the surface until the entire decal is applied.

f. Make sure there is no air bubbles trapped under the decal. Otherwise, make a hole in the bubble with a pin and press with your finger or a squeegee to remove the air.

3. Edge seal or fully coat the decal with the applicable coating as follows:

a. Apply masking tape (C-426) 1/8 inch (3 mm) away from the edge and all around the decal.

NOTE

A clear polyurethane enamel (C-233) may be used to seal decals applied to all types of exterior finishes.

b. For the sealing of exterior decals, apply the same material used for the exterior painting. For example, if the exterior paint is polyurethane enamel (C-233), then use a clear polyurethane enamel (C-233).

c. For the sealing of interior decals, apply a clear edge sealer (C-349).

d. Remove the masking tape (C-426) from around the decal when the coating is dry.

8-25. RETAINING COMPOUNDS

Retaining compounds are single component liquid materials used in locking, retaining, bonding, and sealing of parts at assembly.

These adhesive/sealants are anaerobic compounds, or compounds that become solid in absence of air. They remain liquid on metal or other surfaces as long as they are in contact with air.

Confining the compound between closely fitting surfaces prevents contact with air and the compound will harden to a strong permanent bond.

Retaining compounds are formulated to give a wide range of strengths, viscosities, degrees of adhesion, and cure time. Refer to the procedure in the applicable manual, bulletin, or instruction for correct selection of the compound.

8-26. RETAINING COMPOUNDS — APPLICATION

1. Apply retaining compounds as follows:

a. Make sure all bonding surfaces are clean. Otherwise, refer to Chapter 5.

b. Mix the compound and use the applicator nozzle provided with the container, or a cotton swab soaked in the compound, to apply the retaining compound to the bonding surfaces.

c. Assemble the parts.

d. When the retaining compound is used for retention of bearings in conjunction with staking, stake the bearing within 30 minutes. Do not stake parts after the retaining compound has cured.

e. If staking of the bearing is not required, allow the compound to fully cure before use.

NOTE

Parts or assemblies with greased bearings may be heated to a maximum of 200°F (93°C).

f. Within 30 minutes after assembly or bearing staking, as applicable, heat cure at one of following times and temperatures.

Table 8-3. Retaining Compounds — Heat Cure Temperature and Time

TEMPERATURE	TIME
300°F (149°C)	5 minutes
250°F (121°C)	10 minutes
200°F (93°C)	15 minutes
175°F (79°C)	20 minutes
150°F (66°C)	30 minutes

8-27. SAFETYING

NOTE

Not all applications of fasteners require safety wire or cotter pins. Refer to the procedure in the specific manual, bulletin, or instruction for applicability.

Unless otherwise specified in the procedure of the applicable manual, bulletin, or instruction, refer to the FAA Advisory Circular AC 43.43-1 and, as applicable, paragraph 8-28 or paragraph 8-29 for proper use of safety wires and cotter pins. Refer to the BHT-ELEC-SPM for electrical applications.

8-28. SAFETYING — SAFETY WIRE

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
Commercial	Wire Twister
Commercial	Wire Cutter
Commercial	Pliers

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-405	Lockwire
C-414	Shear Wire
C-447	Lockwire
C-508	Lockwire

WARNING

ALWAYS WEAR EYE PROTECTION WHEN YOU REMOVE AND INSTALL SAFETY WIRE. FAILURE TO DO SO MAY RESULT IN INJURIES TO PERSONS.

1. Unless it is specified in the procedure of the applicable manual, bulletin, or instruction, select the appropriate wire to use as follows:

a. Select a material for the wire, based on the application:

NOTE

Shear wiring of emergency equipment is used to prevent actuation of the equipment.

Seal wiring of equipment is used to report actuation of the equipment.

- For shear and seal wiring, use a copper shear wire (C-414) (MS20995CY).
- For safety (or lock) wiring, use a Corrosion Resistant Steel (CRES) safety wire (AS1000).

NOTE

Wire sizes provided hereafter are to be used for safety wiring with the double-twist method, except where indicated.

b. Select the size of the safety wire as follows:

- For general safety wiring, use a 0.032 inch (0.81 mm) diameter lockwire (C-405).
- For safety wiring of a part with a hole diameter more than 0.062 inch (1.57 mm), use a 0.040 inch (1.02 mm) diameter lockwire (C-447).
- For safety wiring of a part with a hole diameter less than 0.045 inch (1.14 mm), use a 0.020 inch (0.51 mm) diameter lockwire (C-508).
- For safety wiring of parts with 2 inches (50.80 mm) or less of space between, use a 0.020 inch (0.51 mm) diameter lockwire (C-508).
- For safety wiring of closely-spaced fasteners, 0.25 inch (6.35 mm) diameter and less, use a 0.020 inch (0.51 mm) diameter lockwire (C-508).
- For safety wiring with the single-wire method, use the largest size of wire that the hole can accommodate.

NOTE

The single-wire method may be used if there is less than 2 inches (50.80 mm) between holes in a closed-geometrical pattern (triangle, rectangle, circle, etc.).

Procedure for the single-wire method is the same as the double-twist method except that the wire is not twisted.

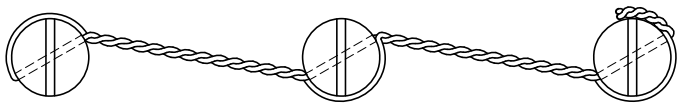
2. Safety wire the part(s) using the double-twist method as follows (Figure 8-2):

CAUTION

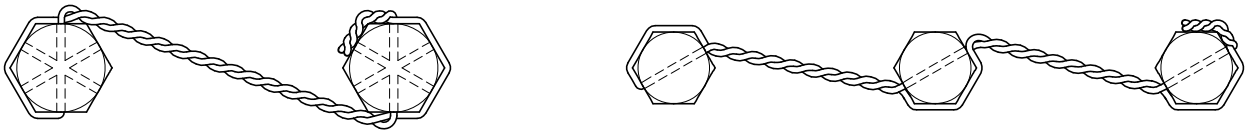
ALWAYS INSTALL A NEW WIRE WHEN YOU SAFETY WIRE EQUIPMENT OR FASTENERS. FAILURE TO DO SO WILL RESULT IN UNSAFE SECURING AND POSSIBLE DAMAGE TO THE EQUIPMENT.

a. Make sure to use new safety wire.

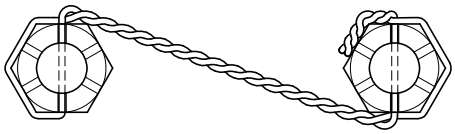
b. Loop the wire through and around the part to be secured.



SCREW HEADS EXAMPLE

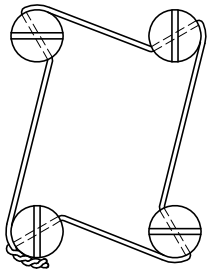


BOLT HEADS EXAMPLES

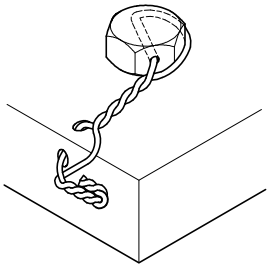


CASTELLATED NUTS EXAMPLE

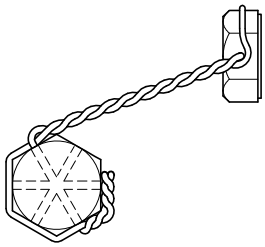
SAFETY WIRING OF FASTENERS
DOUBLE-TWIST METHOD



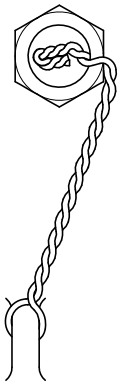
SAFETY WIRING
SINGLE-WIRE METHOD



SAFETY WIRING OF
SINGLE PARTS



SAFETY WIRING IN
DIFFERENT PLANES



SAFETY WIRING OF
HOLLOW-HEAD PLUGS

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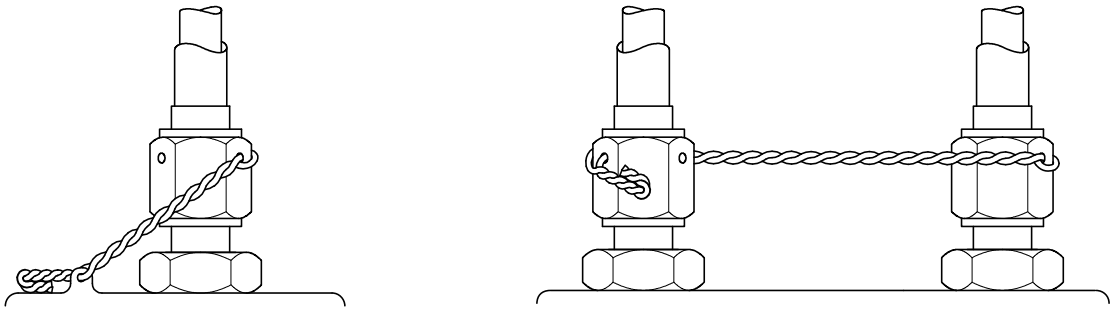
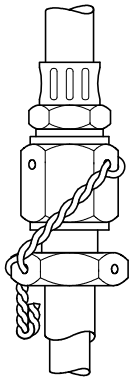
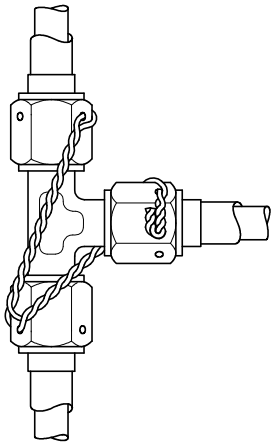
Figure 8-2. Safetying — Safety Wire Installation (Sheet 1 of 3)



STRAIGHT CONNECTIONS

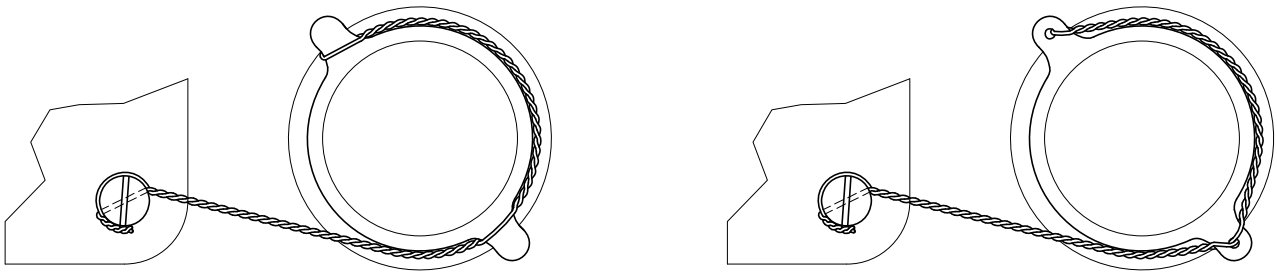


FLEXIBLE HOSE
TO RIGID TUBE
CONNECTION



TEE FITTING
CONNECTION

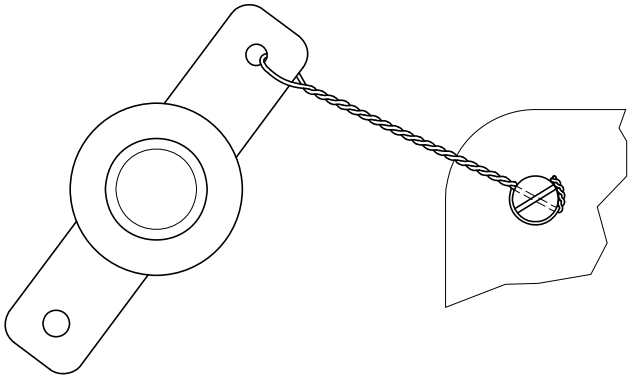
SAFETY WIRING
APPLICATION TO COUPLING NUTS



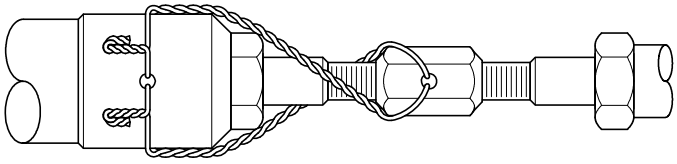
SAFETY WIRING
APPLICATION TO OIL CAPS

ALL_SPM_08_0002

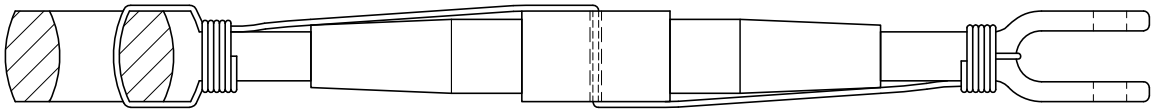
Figure 8-2. Safetying — Safety Wire Installation (Sheet 2 of 3)



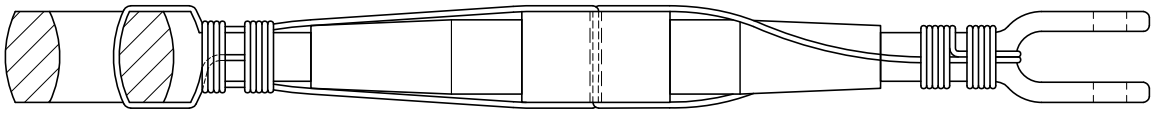
**SAFETY WIRING
APPLICATION TO DRAIN
COCKS AND PLUGS**



**SAFETY WIRING
APPLICATION TO CONTROL LINKS**



SINGLE WRAP METHOD



DOUBLE WRAP METHOD

ALL_SPM_08_0003

Figure 8-2. Safetying — Safety Wire Installation (Sheet 3 of 3)

c. Twist the wire 6 to 8 twists per inch (3 twists per centimeter) and make sure the loop around the head of the fastener(s) stays down and fits closely to the contour.

d. Route the twisted wire in a manner that prevents the part(s) from loosening.

e. Apply a light tension to the twisted-wire so it is tight but not over-stressed.

f. Wire single parts to another adjacent part. Wire multiple parts as follows:

(1) Wire together a maximum of three parts if the groups of parts are 4 to 6 inches (102 to 152 mm) spaced.

(2) For groups of parts with 2 inches (50 mm) or less of space between, the maximum number of parts that can be wired together is the number of parts that can be wired with a 24 inch (610 mm) long wire.

g. Connect the wire ends together so it makes a pigtail of 0.25 to 0.5 inch (6.35 to 12.70 mm) in length (3 to 6 twists).

h. Always bend and fold the pigtail in a manner that prevents snags and possible injuries to persons.

3. Ensure the installed position of the safety wire and pigtail will not cause chafing or interference with adjacent parts or installations.

8-29. SAFETYING — COTTER PINS

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
Commercial	Wire Cutter
Commercial	Plier

1. Unless it is specified in the procedure, select the appropriate cotter pin to use as follows:

a. Select a material for the cotter pin, based on the application:

- For any of the following, use a Corrosion Resistant Steel (CRES) cotter pin (MS24665). Refer to Table 8-4 for the dash number.

  - Non-magnetic requirements

  - Contact with CRES fasteners

  - Exposure to the relative wind

  - Operation in corrosive environments

  - Exposure to high temperatures, up to 800°F (426°C)

- For general applications, use a cadmium plated steel cotter pin (MS24665). Refer to Table 8-5 for the dash number.

b. For the size of the cotter pin, select the largest diameter that the hole can accommodate. The length must be compatible with the installation method used.

2. Install cotter pins in castellated nuts using the general installation method that follows (Figure 8-3):

a. Tighten the nut to the minimum of the specified or calculated torque range (Chapter 2), unless otherwise specified.

CAUTION

MAKE SURE YOU DO NOT EXCEED THE MAXIMUM PERMITTED TORQUE VALUE. OTHERWISE THE FASTENERS MAY OVERSTRESS (CHAPTER 2).

b. Continue to torque the nut until a slot aligns with the hole in the bolt. Do not exceed the maximum permitted torque value.

Table 8-4. Safetying — CRES (MS24665) Cotter Pin Dash Numbers

COTTER PIN LENGTH INCH (MM)	COTTER PIN DIAMETER INCH (MM)				
	0.031 (0.79)	0.047 (1.19)	0.062 (1.59)	0.094 (2.38)	0.125 (3.17)
0.250 (6.35)	-18	-82	-1010	-	-
0.312 (7.93)	-1001	-	-1011	-	-
0.375 (9.52)	-1002	-	-1012	-	-
0.437 (11.11)	-1003	-	-1013	-	-
0.500 (12.70)	-22	-86	-151	-298	-366
0.750 (19.05)	-24	-88	-153	-300	-368
1.000 (25.40)	-26	-90	-155	-302	-370
1.250 (31.75)	-27	-91	-157	-304	-372
1.500 (38.10)	-28	-92	-159	-306	-374
1.750 (44.45)	-29	-93	-161	-308	-376
2.000 (50.80)	-30	-94	-162	-309	-377

Table 8-5. Safetying — Cadmium Plated Steel (MS24665) Cotter Pin Dash Numbers

COTTER PIN LENGTH INCH (MM)	COTTER PIN DIAMETER INCH (MM)				
	0.031 (0.79)	0.047 (1.19)	0.062 (1.59)	0.094 (2.38)	0.125 (3.17)
0.5000 (12.70)	-5	-69	-132	-281	-349
1.000 (25.40)	-9	-73	-136	-285	-353
1.500 (38.10)	-11	-75	-140	-289	-357
2.000 (50.80)	-13	-77	-143	-292	-360

CAUTION

ALWAYS INSTALL A NEW COTTER PIN WHEN YOU SECURE FASTENERS. FAILURE TO DO SO WILL RESULT IN UNSAFE SECURING AND POSSIBLE DAMAGE TO THE EQUIPMENT.

c. Make sure to use a new cotter pin.

d. Insert the cotter pin in the slot of the nut and through the hole of the bolt. Do not flatten the eye.

e. Turn the cotter pin so the axis of the eye is at a right angle (90°) to the bolt shank.

f. Bend the upper prong over the end of the bolt and cut so it does not extend beyond the diameter.

g. Bend the lower prong down and cut so it does not rest on the washer or any other material.

3. If the upper prong may act as a snag or if a clearance is required at the end of the bolt, you may want to use one of the following alternate installation methods:

NOTE

The bend and tuck method is the preferred method due to less risk of injury. All other methods are acceptable alternates.

a. Bend the tip of the upper prong sideways and insert it into an adjacent slot of the nut (preferred method).

b. Turn the cotter pin so the axis of the eye is parallel to the shank of the bolt and bend the prongs around the contour of the nut (alternate method No. 1).

c. Cut the upper prong flush with the top of the bolt (alternate method No. 2).

4. Install cotter pins in pins using the installation procedure that follows:

CAUTION

ALWAYS INSTALL A NEW COTTER PIN WHEN YOU SECURE FASTENERS. FAILURE TO DO SO WILL RESULT IN UNSAFE SECURING AND POSSIBLE DAMAGE TO THE EQUIPMENT.

a. Make sure to use a new cotter pin.

b. Insert the cotter pin in the slot of the pin. Do not flatten the eye.

c. Turn the cotter pin so the axis of the eye is parallel to the shank of the pin.

d. Bend the prongs around the shank of the pin and into the closest castellation of the nut.

e. Make sure the installed position of the cotter pin will not chafe or interfere with adjacent parts or installations.

8-30. STUDS AND INSERTS

8-31. STUDS AND INSERTS — STANDARD STUDS IDENTIFICATION

1. Studs are identified with a mark on both ends (AN studs) or on one end only (Bell studs) (Figure 8-4). Characteristics for each type of stud is identified as follows:

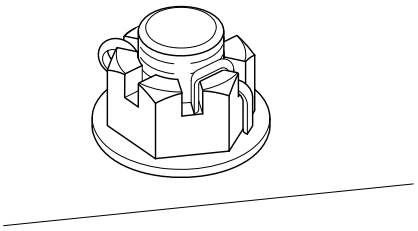
a. AN studs have a mark on the top end of the stud to give the stud material. The mark is visible when the stud is installed.

b. AN studs have a mark on the opposite end of the stud. The mark shows if the stud is oversized or undersized.

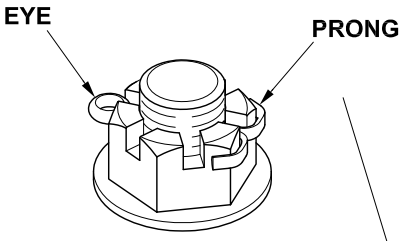
c. Bell studs have no mark on the top end of the stud.

d. Bell studs have a mark on the opposite end of the stud. The mark shows if the stud is oversized or undersized.

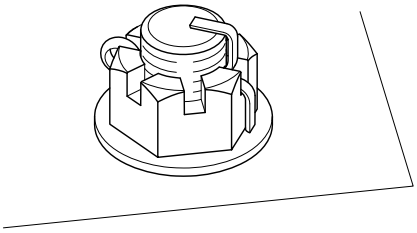
e. Studs installed during manufacturing are usually standard size. If it is not possible to get the required height and torque with a standard size stud, an oversized or undersized stud can be installed.



PREFERED METHOD

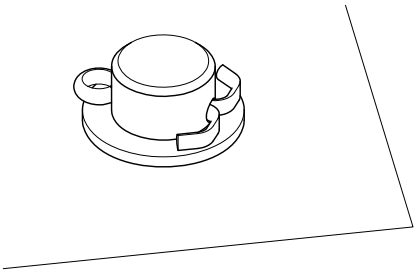


ALTERNATE METHOD NO. 1



ALTERNATE METHOD NO. 2

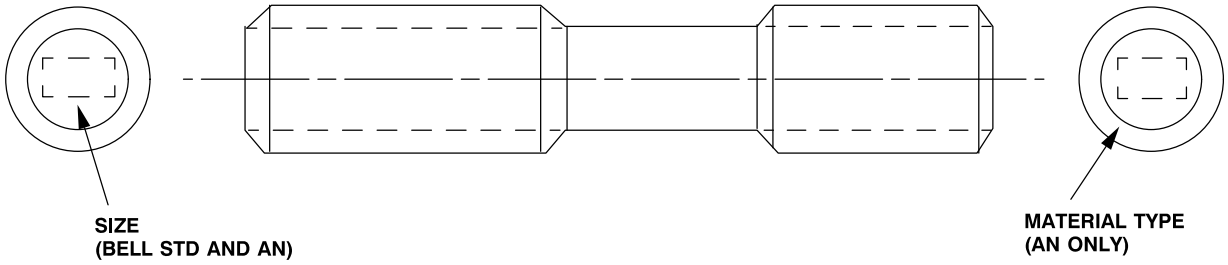
COTTER PINNING - APPLICATION
TO CASTELLATED NUT ON BOLT



COTTER PINNING
PIN APPLICATION

ALL_SPM_08_0004_c01

Figure 8-3. Safetying — Cotter Pin Installation



	-.003	STANDARD	+.003	+.006	+.009	+.012
UNDERSIZE AND OVERSIZE IDENTIFICATION	-3		3	6	9	12

AN STUD

	-.003	STANDARD	+.003	+.006	+.009	+.012
	-101	-103	-105	-107	-109	-111
UNDERSIZE AND OVERSIZE IDENTIFICATION						

BELL HELICOPTER STUD

SPM-00080-00010-001-C00

Figure 8-4. Studs and Inserts — Standard Studs Identification

8-32. STUDS AND INSERTS — STANDARD STUDS REPLACEMENT

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-204	Epoxy Polyamide Primer

CAUTION

DO NOT REPAIR A DAMAGED STUD OR A STUD THAT DOES NOT MEET THE MINIMUM INSTALLATION TORQUE AND HEIGHT REQUIREMENTS. ONLY THE STUD REPLACEMENT IS PERMITTED.

NOTE

The following instructions are applicable to studs of the standard type, which thread directly into cases or sleeves.

1. Measure and record the height of the damaged stud before removal.

NOTE

If the stud is broken off, drill a hole in the center of the stud and extract with an "EZY-Out" type of extractor.

2. Grip the damaged stud with an appropriate tool and turn it slowly to avoid seizure and breakage.

NOTE

The correct size for a replacement stud is the size that allows the stud to meet the minimum driving torque requirement.

Usually, the correct size for a replacement stud is the next larger size of stud.

The applicable Illustrated Parts Breakdown (IPB) manual provides the list of the standard studs and four oversize studs by increments of 0.003 inch (0.076 mm).

3. Select the correct size for the replacement stud.

4. Finger tighten the new stud in the tapped hole. If the stud fails to engage in one or two turns, remove the stud and select the next oversized stud.

5. Temporarily remove the stud and coat the course threaded end of the stud with wet unreduced epoxy polyamide primer (C-204).

6. Clean out the small vent hole in the bottom of the tapped hole.

NOTE

Refer to Chapter 2 for the standard torque range of values applicable to the stud.

7. At the same time, install the stud with the applicable stud driving tool and make sure the driving torque is within the required torque range.

8-33. STUDS AND INSERTS — RING LOCKED STUDS AND INSERTS REPLACEMENT

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
△1 △2	Removal Tool
	Step Drill
	Wrench
	Lockring Drive Tool

NOTES:

△1 Refer to the stud/insert manufacturer for the special tools applicable part numbers. Ex. Rosan Products, P.O. Box 25225, 3130 W. Harvard St., Santa-Anna, California, 92799

△2 If special tools are not available, replacement is possible with other tools. Be careful when you use other tools for replacement of studs/inserts.

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-204	Epoxy Polyamide Primer

NOTE

The following instructions are applicable to studs and threaded inserts installed with a lockring. The lockring inner teeth engage the serrated collar on the stud or insert and the lockring outer teeth broach into the material of the case.

1. Remove a ring locked insert as follows:

a. Select a drill, same diameter as the serrations between the lockring and the insert.

b. Drill to a depth equal to the lockring thickness.

c. Remove the insert and the remaining portion of the lockring.

2. Remove a ring locked stud as follows:

NOTE

If no tool is available to mill the lockring, saw off the stud, drill a hole in the stud center, and extract the stud with an "EZY-Out" type of extractor.

a. Select the applicable removal tool. If not available, select a hollow mill with an outside diameter 0.015 inch (0.381 mm) less than the root diameter of the lockring outer serrations.

b. Mill to a depth equal to the lockring thickness. For best results, do not mill completely through the lockring.

c. Apply the removal torque to the stud. If you did not mill completely through the lockring, removal torque will jack out the lockring.

NOTE

Holes are tapped with a standard class 3 tap and the counter bore has a 90° shoulder.

3. Examine the tapped hole and the counterbore for condition. If necessary, clean up minor damage but do not enlarge the holes.

4. Apply a layer of unreduced epoxy polyamide primer (C-204) to the threads of the new stud or insert that will contact the case.

5. Wet install the stud or insert in the tapped hole until the upper surface of the serrated collar is 0.010 to 0.020 inch (0.254 to 0.508 mm) below the case surface.

6. Apply a layer of unreduced epoxy polyamide primer (C-204) to the new lockring.

7. Align the lockring serrations with the stud/insert serrations.

8. Wet install the lockring into the case with the drive tool until it is flush with the upper surface of the stud/insert serrations.

8-34. SURFACE ROUGHNESS

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
2 to 250 microinches	Surface Roughness Tester
2 to 250 microinches	Surface Finish Scales or Microfinish Comparators

Surface roughness may be identified in one of the following nomenclatures:

- Root Mean Square (RMS)
- Roughness Height Rating (RHR)
- Microinches

The three nomenclatures refer to the average linear deviation of the actual surface. The surface roughness height is the arithmetical average deviation expressed in microinches measured normal to the center line. A microinch is one millionth of an inch (0.000001) inch. Table 8-6 gives the different machining methods and corresponding roughness numbers that will normally be achieved.

Table 8-6. Surface Roughness — Machining Method Versus Roughness

MACHINING METHOD	ROUGHNESS (MICROINCHES)
Rough Machine	250 (6.350 µm)
Medium Machine, Drill	125 (3.175 µm)
Smooth Machine, Ream	63 (1.600 µm)
Grind, Fine Machine	32 (0.813 µm)
Grind, Hone	16 (0.406 µm)
Hone	8 (0.203 µm)
Lap, Polish	4 (0.102 µm)
Polish, Superfinish	2 (0.051 µm)

8-35. SYSTEMS OF UNITS

The following charts (Table 8-7 through Table 8-18) provide formulas and tables to convert a quantity to one of the following systems, as applicable:

- Metric or International System of Units (SI)
- US or English System of units
- Imperial System of units

Table 8-7. Systems of Units — Conversion Formulas

MULTIPLY	BY	TO GET
LENGTH OR DISTANCE (US TO SI)		
microinch	0.0254	micrometers (μm)
mil	25.4	micrometers
	0.0254	millimeters (mm)
inch	25.4	millimeters
foot	0.3048	meters (m)
yard	0.9144	meters
mile	1.609	kilometers (km)
LENGTH OR DISTANCE (SI TO US)		
micrometer	3.937	microinches
	0.0394	mils
millimeter	39.37	mils
	0.0394	inches
meter	3.281	feet
	1.0936	yards
kilometer	0.6214	miles
AREA OR SURFACE (US TO SI)		
square-inch	645.16	mm^2
	6.4516	cm^2
square-foot	0.0929	m^2
square-yard	0.8361	m^2
AREA OR SURFACE (SI TO US)		
mm^2	0.0015	square-inches
cm^2	0.1550	square-inches
m^2	10.764	square-feet
	1.196	square-yards
VOLUME OR CAPACITY (US TO SI)		
cubic-inch	16.387	cm^3
	16.387	milliliters (ml)
	0.0164	liters (l)

Table 8-7. Systems of Units — Conversion Formulas (Cont)

MULTIPLY	BY	TO GET
VOLUME OR CAPACITY (US TO SI) (CONT)		
fluid-ounce	29.574	milliliters
pint	0.4732	liters
quart	0.9464	liters
gallon	3.7854	liters
cubic-foot	0.0283	m^3
cubic-yard	0.7646	m^3
VOLUME OR CAPACITY (SI TO US)		
cm^3	0.0610	cubic-inch
milliliters	0.0610	cubic-inch
	0.0338	fluid-ounce
liters	61.024	cubic-inch
	2.1134	pint
	1.0567	quart
	0.2642	gallon
m^3	35.315	cubic-foot
	1.3080	cubic-yard
VOLUME OR CAPACITY (US TO IMPERIAL)		
fluid-ounce	1.041	fluid-ounces
pint	0.833	pints
quart	0.833	quarts
gallon	0.833	gallons
VOLUME OR CAPACITY (IMPERIAL TO SI)		
fluid-ounce	28.413	milliliters
pint	0.5683	liters
quart	1.136	liters
gallon	4.546	liters
MASS OR WEIGHT (US TO SI)		
ounce (oz)	28.35	grams (g)
pound (lb)	0.4536	kilograms (kg)

Table 8-7. Systems of Units — Conversion Formulas (Cont)

MULTIPLY	BY	TO GET
MASS OR WEIGHT (SI TO US)		
gram	0.0353	ounces
kilogram	2.2046	pounds
FORCE (US TO SI)		
ounce-force (ozf)	0.278	newtons (N)
pound-force (lbf)	4.448	newtons
FORCE (SI TO US)		
newton	3.597	ounce-force
	0.225	pound-force
TORQUE (US TO SI)		
inch-pound	0.1129	newton-meters (Nm)
foot-pound	1.3558	newton-meters
TORQUE (SI TO US)		
newton-meter	8.8507	inch-pounds
	0.7375	foot-pounds
POWER		
horsepower (hp)	0.7457	kilowatts (kW)
kilowatt	1.3410	horsepower
PRESSURE OR STRESS (US TO SI)		
inches of mercury	3.3864	kilopascals (kPa)
pound-force per square-inch (PSI)	6.8947	kilopascals
PRESSURE OR STRESS (SI TO US)		
kilopascal	0.2953	inches of mercury
	0.1450	pound-force per square-inch
TEMPERATURE		
Degree Fahrenheit (°F)	(°F - 32) x 0.555	Degrees Celsius (°C)
Degree Celsius	(°C x 1.8) + 32	Degrees Fahrenheit

Table 8-8. Systems of Units — Inch (Fraction) to Millimeter (MM) Conversions

INCH (FRACTION)	INCH (DECIMAL)	MM
1/64	0.015625	0.39688
1/32	0.03125	0.79375
3/64	0.046875	1.19062
1/16	0.0625	1.58750
5/64	0.078125	1.98437
3/32	0.09375	2.38125
7/64	0.109375	2.77812
1/8	0.125	3.17500
9/64	0.140625	3.57187
5/32	0.15625	3.96875
11/64	0.171875	4.36562
3/16	0.1875	4.76250
13/64	0.203125	5.15937
7/32	0.21875	5.55625
15/64	0.234375	5.95312
1/4	0.250	6.35000
17/64	0.265625	6.74687
9/32	0.28125	7.14375
19/64	0.296875	7.54062
5/16	0.3125	7.93750
21/64	0.328125	8.33437
11/32	0.34375	8.73125
23/64	0.359375	9.12812
3/8	0.375	9.52500
25/64	0.390625	9.92187
13/32	0.40625	10.31875
27/64	0.421875	10.71562
7/16	0.4375	11.11250
29/64	0.453125	11.50937
15/32	0.46875	11.90625
31/64	0.484375	12.30312
1/2	0.500	12.70000

INCH (FRACTION)	INCH (DECIMAL)	MM
33/64	0.515625	13.09687
17/32	0.53125	13.49375
35/64	0.546875	13.89062
9/16	0.5625	14.28750
37/64	0.578125	14.68437
19/32	0.59375	15.08125
39/64	0.609375	15.47812
5/8	0.625	15.87500
41/64	0.640625	16.27187
21/32	0.65625	16.66875
11/16	0.6875	17.46250
45/64	0.703125	17.85937
23/32	0.71875	18.25625
47/64	0.734375	18.65312
3/4	0.750	19.05000
49/64	0.765625	19.44687
25/32	0.78125	19.84375
51/64	0.796875	20.24062
13/16	0.8125	20.63750
53/64	0.828125	21.03437
27/32	0.84375	21.43125
55/64	0.859375	21.82812
7/8	0.875	22.22500
57/64	0.890625	22.62187
29/32	0.90625	23.01875
59/64	0.921875	23.41562
15/16	0.9375	23.81250
61/64	0.953125	24.20937
31/32	0.96875	24.60625
63/64	0.984375	25.00312
1	1.00	25.40000

Table 8-9. Systems of Units — Inch to Millimeter (MM) Conversions

INCH	0	.0001	.0002	.0003	.0004	.0005	.0006	.0007	.0008	.0009
	MM	MM	MM	MM	MM	MM	MM	MM	MM	MM
.0000	–	.00254	.00508	.00762	.01016	.01270	.01524	.01778	.02032	.02286
.0010	.02540	.02794	.03048	.03302	.03556	.03810	.04064	.04318	.04572	.04826
.0020	.05080	.05334	.05588	.05842	.06096	.06350	.06604	.06858	.07112	.07366
.0030	.07620	.07874	.08128	.08382	.08636	.08890	.09144	.09398	.09652	.09906
.0040	.10160	.10414	.10668	.10922	.11176	.11430	.11634	.11938	.12192	.12446
.0050	.12700	.12954	.13208	.13462	.13716	.13970	.14224	.14478	.14732	.14986
.0060	.15240	.15494	.15748	.16002	.16256	.16510	.16764	.17018	.17272	.17526
.0070	.17780	.18034	.18288	.18542	.18796	.19050	.19304	.19558	.19812	.20066
.0080	.20320	.20574	.20828	.21082	.21336	.21590	.21844	.22098	.22352	.22606
.0090	.22860	.23114	.23368	.23622	.23876	.24130	.24384	.24638	.24892	.25146

INCH	0	.0010	.0020	.0030	.0040	.0050	.0060	.0070	.0080	.0090
	MM	MM	MM	MM	MM	MM	MM	MM	MM	MM
.0100	.2540	.2794	.3048	.3302	.3556	.3810	.4064	.4318	.4572	.4826
.0200	.4080	.5334	.5588	.5842	.6096	.6350	.6604	.6858	.7112	.7366
.0300	.7620	.7874	.8128	.8382	.8636	.8890	.9144	.9398	.9652	.9906
.0400	1.0160	1.0414	1.0668	1.0922	1.1176	1.1430	1.1684	1.1938	1.2192	1.2446
.0500	1.2700	1.2954	1.3208	1.3462	1.3716	1.3970	1.4224	1.4478	1.4732	1.4986
.0600	1.5240	1.5494	1.5748	1.6002	1.6256	1.6510	1.6764	1.7018	1.7272	1.7526
.0700	1.7780	1.8034	1.8288	1.8542	1.8796	1.9050	1.9304	1.9558	1.9812	2.0066
.0800	2.0320	2.0574	2.0828	2.1082	2.1336	2.1590	2.1844	2.2098	2.2352	2.2606
.0900	2.2860	2.3114	2.3368	2.3622	2.3876	2.4130	2.4384	2.4638	2.4892	2.5146

INCH	0	.0100	.0200	.0300	.0400	.0500	.0600	.0700	.0800	.0900
	MM	MM	MM	MM	MM	MM	MM	MM	MM	MM
.1000	2.540	2.794	3.048	3.302	3.556	3.810	4.064	4.318	4.572	4.826
.2000	5.080	5.334	5.588	5.842	6.096	6.350	6.604	6.858	7.112	7.366
.3000	7.620	7.874	8.128	8.382	8.636	8.890	9.144	9.398	9.652	9.906
.4000	10.160	10.414	10.668	10.922	11.176	11.430	11.684	11.938	12.192	12.446
.5000	12.700	12.954	13.208	13.462	13.716	13.970	14.224	14.478	14.732	14.986
.6000	15.240	15.494	15.748	16.002	16.256	16.510	16.764	17.018	17.272	17.526
.7000	17.780	18.034	18.288	18.542	18.796	19.050	19.304	19.558	19.812	20.066
.8000	20.320	20.574	20.828	21.082	21.336	21.590	21.844	22.098	22.352	22.606
.9000	22.860	23.114	23.368	23.622	23.876	24.130	24.384	24.638	24.892	25.146

Table 8-10. Systems of Units — Ounce-Force (OZF) and Pound-Force (LBF) to Newtons (N) Conversions

OZF	0	1	2	3	4	5	6	7	8	9
	N	N	N	N	N	N	N	N	N	N
0	–	0.28	0.56	0.83	1.11	1.39	1.67	1.95	2.22	2.50
10	2.78	3.06	3.34	3.61	3.89	4.17	4.45	4.73	5.00	5.28

LBF	0	1	2	3	4	5	6	7	8	9
	N	N	N	N	N	N	N	N	N	N
0	–	4.4	8.9	13.3	17.8	22.2	26.7	31.1	35.6	40.0
10	44	49	53	58	62	67	71	76	80	85
20	89	93	98	102	107	111	116	120	125	129
30	133	138	142	147	151	156	160	165	169	173
40	178	182	187	191	196	200	205	209	214	218
50	222	227	231	236	240	245	249	254	258	262
60	267	271	276	280	285	289	294	298	302	307
70	311	316	320	325	329	334	338	343	347	351
80	356	360	365	369	374	378	383	387	391	396
90	400	405	409	414	418	423	427	431	436	440
100	445	449	454	458	463	467	472	476	480	485

LBF	0	10	20	30	40	50	60	70	80	90
	N	N	N	N	N	N	N	N	N	N
200	890	934	979	1023	1068	1112	1157	1201	1246	1290
300	1334	1379	1423	1468	1512	1557	1601	1646	1690	1735
400	1779	1824	1868	1913	1957	2002	2046	2091	2135	2180
500	2224	2269	2313	2358	2402	2447	2491	2535	2580	2624
600	2669	2713	2758	2802	2847	2891	2936	2980	3025	3069
700	3114	3158	3203	3247	3292	3336	3381	3425	3470	3514
800	3559	3603	3648	3692	3737	3781	3825	3870	3914	3959
900	4003	4048	4092	4137	4181	4226	4270	4315	4359	4404
1000	4448	4493	4537	4582	4626	4671	4715	4760	4804	4849

Table 8-10. Systems of Units — Ounce-Force (OZF) and Pound-Force (LBF) to Newtons (N) Conversions (Cont)

LBF	0	100	200	300	400	500	600	700	800	900
	N	N	N	N	N	N	N	N	N	N
1000	4448	4893	5338	5783	6228	6672	7117	7562	8007	8452
2000	8896	9341	9786	10,231	10,676	11,121	11,565	12,010	12,455	12,900
3000	13,345	13,789	14,234	14,679	15,124	15,569	16,014	16,458	16,903	17,348
4000	17,793	18,238	18,683	19,127	19,572	20,017	20,462	20,907	21,351	21,796
5000	22,241	22,686	23,131	23,576	24,020	24,465	24,910	25,355	25,800	26,245
6000	26,689	27,134	27,579	28,024	28,469	28,913	29,358	29,808	30,248	30,693
7000	31,138	31,582	32,027	32,472	32,917	33,362	33,806	34,251	34,696	35,141
8000	35,586	36,031	36,475	36,920	37,365	37,810	38,255	38,700	39,144	39,589
9000	40,034	40,479	40,924	41,368	41,813	42,258	42,703	43,148	43,593	44,037
10,000	44,482	44,927	45,372	45,817	46,262	46,706	47,151	47,596	48,041	48,486
11,000	48,930	49,375	49,820	50,265	50,710	51,155	51,599	52,044	52,489	52,934
12,000	53,379	53,823	54,268	54,713	55,158	55,603	56,048	56,492	56,937	57,382
13,000	57,827	58,272	58,717	59,161	59,606	60,051	60,496	60,941	61,385	61,830
14,000	62,275	62,720	63,165	63,610	64,054	64,499	64,944	65,389	65,834	66,279
15,000	66,723	67,168	67,613	68,058	68,503	68,947	69,392	69,837	70,282	70,727
16,000	71,172	71,616	72,061	72,506	72,951	73,396	73,840	74,285	74,730	75,175
17,000	75,620	76,065	76,509	76,954	77,399	77,844	78,289	78,734	79,178	79,623
18,000	80,068	80,513	80,958	81,402	81,847	82,292	82,737	83,182	83,627	84,071
19,000	84,516	84,961	85,406	85,851	86,296	86,740	87,185	87,630	88,075	88,520
20,000	88,964	89,409	89,854	90,299	90,744	91,189	91,633	92,078	92,523	92,968

Table 8-11. Systems of Units — Ounce (OZ) and Pound (LB) to Kilogram (KG) Conversions

OZ	0	1	2	3	4	5	6	7	8	9
	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG
0	–	0.028	0.057	0.085	0.113	0.142	0.170	0.198	0.227	0.255
10	0.283	0.312	0.340	0.369	0.397	0.425	0.454	0.482	0.510	0.539

LB	0	1	2	3	4	5	6	7	8	9
	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG
0	–	0.45	0.91	1.36	1.81	2.27	2.72	3.18	3.63	4.08
10	4.5	5.0	5.4	5.9	6.4	6.8	7.3	7.7	8.2	8.6
20	9.1	9.5	10.0	10.4	10.9	11.3	11.8	12.2	12.7	13.2
30	13.6	14.1	14.5	15.0	15.4	15.9	16.3	16.8	17.2	17.7
40	18.1	18.6	19.1	19.5	20.0	20.4	20.9	21.3	21.8	22.2
50	22.7	23.1	23.6	24.0	24.5	24.9	25.4	25.9	26.3	26.8
60	27.2	27.7	28.1	28.6	29.0	29.5	29.9	30.4	30.8	31.3
70	31.8	32.2	32.7	33.1	33.6	34.0	34.5	34.9	35.4	35.8
80	36.3	36.7	37.2	37.6	38.1	38.6	39.0	39.5	39.9	40.4
90	40.8	41.3	41.7	42.2	42.6	43.1	43.5	44.0	44.5	44.9
100	45	46	46	47	47	48	48	49	49	49

LB	0	10	20	30	40	50	60	70	80	90
	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG
200	91	95	100	104	109	113	118	122	127	132
300	136	141	145	150	154	159	163	168	172	177
400	181	186	191	195	200	204	209	213	218	222
500	227	231	236	240	245	249	254	259	263	268
600	272	277	281	286	290	295	299	304	308	313
700	318	322	327	331	336	320	345	349	354	358
800	363	367	372	376	381	386	390	395	399	404
900	408	413	417	422	426	431	435	440	445	449
1000	454	458	463	467	472	476	481	485	490	494

Table 8-11. Systems of Units — Ounce (OZ) and Pound (LB) to Kilogram (KG) Conversions (Cont)

LB	0	100	200	300	400	500	600	700	800	900
	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG
1000	454	499	544	590	635	680	726	771	816	862
2000	907	953	998	1043	1089	1134	1179	1225	1270	1315
3000	1361	1406	1451	1497	1542	1588	1633	1673	1724	1769
4000	1814	1860	1905	1950	1996	2041	2087	2132	2177	2223
5000	2268	2313	2359	2404	2449	2495	2540	2585	2631	2676
6000	2722	2767	2812	2858	2903	2948	2994	3039	3084	3130
7000	3175	3221	3266	3311	3357	3402	3447	3493	3538	3583
8000	3629	3674	3719	3765	3810	3856	3901	3946	3992	4037
9000	4082	4128	4173	4218	4264	4309	4354	4400	4445	4491
10,000	4536	4581	4627	4672	4717	4763	4808	4853	4899	4944
11,000	4990	5035	5080	5126	5171	5216	5262	5307	5352	5398
12,000	5443	5488	5534	5579	5625	5670	5715	5761	5806	5851
13,000	5897	5942	5987	6033	6078	6123	6169	6214	6260	6305
14,000	6350	6396	6441	6486	6532	6577	6622	6668	6713	6759
15,000	6804	6849	6895	6940	6985	7031	7076	7121	7167	7212
16,000	7257	7303	7348	7394	7439	7484	7530	7575	7620	7666
17,000	7711	7756	7802	7847	7893	7938	7983	8029	8074	8119
18,000	8165	8210	8255	8301	8346	8391	8437	8482	8528	8573
19,000	8618	8664	8709	8754	8800	8845	8890	8936	8981	9026
20,000	9072	9117	9163	9208	9253	9299	9344	9389	9435	9480

Table 8-12. Systems of Units — Microinch (MIN) to Micrometer (MM) Conversions

MIN	0	1	2	3	4	5	6	7	8	9
	MM	MM	MM	MM	MM	MM	MM	MM	MM	MM
0		0.0254	0.051	0.076	0.102	0.127	0.152	0.178	0.203	0.229
10	0.254	0.279	0.305	0.330	0.356	0.381	0.406	0.432	0.458	0.483
20	0.508	0.533	0.559	0.584	0.610	0.635	0.660	0.686	0.711	0.737
30	0.762	0.787	0.813	0.838	0.864	0.889	0.914	0.940	0.965	0.991
40	1.02	1.04	1.07	1.09	1.12	1.14	1.17	1.19	1.22	2.24
50	1.27	1.30	1.32	1.35	1.37	1.40	1.42	1.45	1.47	1.50
60	1.52	1.55	1.57	1.60	1.63	1.65	1.68	1.70	1.73	1.75
70	1.78	1.80	1.83	1.85	1.88	1.91	1.93	1.96	1.98	2.01
80	2.03	2.06	2.08	2.11	2.13	2.16	2.18	2.21	2.24	2.26
90	2.29	2.31	2.34	2.36	2.39	2.41	2.44	2.46	2.49	2.51
100	2.54	2.57	2.59	2.62	2.64	2.67	2.69	2.72	2.74	2.77
110	2.79	2.82	2.84	2.87	2.90	2.92	2.95	2.97	3.00	3.02
120	3.05	3.07	3.10	3.12	3.15	3.18	3.20	3.23	3.25	3.28

Table 8-13. Systems of Units — Pound-Force per Square-Inch (PSI) to Kilopascal (KPA) Conversions

PSI	0	1	2	3	4	5	6	7	8	9
	KPA	KPA	KPA	KPA	KPA	KPA	KPA	KPA	KPA	KPA
		6.9	13.8	20.7	27.6	34.5	41.4	48.3	55.2	62.1
10	69	76	83	90	97	103	110	117	124	131
20	138	145	152	159	165	172	179	186	193	200
30	207	214	221	228	234	241	248	255	262	269
40	276	283	290	296	303	310	317	324	331	338
50	345	352	359	365	372	379	386	393	400	407
60	414	421	427	434	441	448	455	462	469	476
70	483	490	496	503	510	417	524	531	538	545
80	552	558	565	572	579	586	593	600	607	614
90	621	627	634	641	648	655	662	669	676	683
100	689	696	703	710	717	724	731	738	745	752

Table 8-14. Systems of Units — Inch-Pound (IN-LB) and Foot-Pound (FT-LB) to Newton-Meter (NM) Conversions

IN-LB	0	1	2	3	4	5	6	7	8	9
	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
	–	0.11	0.23	0.34	0.45	0.56	0.68	0.79	0.90	1.02
10	1.13	1.24	1.36	1.47	1.58	1.69	1.81	1.92	2.03	2.15
20	2.26	2.37	2.49	2.60	2.71	2.82	2.94	3.05	3.16	3.28
30	3.39	3.50	3.62	3.73	3.84	3.95	4.07	4.18	4.29	4.41
40	4.52	4.63	4.75	4.86	4.97	5.08	5.20	5.31	5.42	5.54
50	5.65	5.76	5.88	5.99	6.10	6.21	6.33	6.44	6.55	6.67
60	6.78	6.89	7.01	7.12	7.23	7.34	7.46	7.57	7.68	7.80
70	7.91	8.02	8.13	8.25	8.36	8.47	8.59	8.70	8.81	8.93
80	9.04	9.15	9.26	9.38	9.49	9.60	9.72	9.83	9.94	10.06
90	10.17	10.28	10.39	10.51	10.62	10.73	10.85	10.96	11.07	11.19
100	11.30	11.41	11.52	11.64	11.75	11.86	11.98	12.09	12.20	12.32

IN-LB	0	10	20	30	40	50	60	70	80	90
	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
200	22.60	23.73	24.86	25.99	27.12	28.25	29.38	30.51	31.64	32.77
300	33.90	35.03	36.16	37.28	38.41	39.54	40.67	41.80	42.93	44.06
400	45.19	46.32	47.45	48.58	49.71	50.84	51.97	53.10	54.23	55.36
500	56.49	57.62	58.75	59.88	61.01	62.14	63.27	64.40	65.53	66.66

FT-LB	0	1	2	3	4	5	6	7	8	9
	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
	–	1.4	2.7	4.1	5.4	6.8	8.1	9.5	10.8	12.2
10	14	15	16	18	19	20	22	23	24	26
20	27	28	30	31	33	34	35	37	38	39
30	41	42	43	45	46	47	49	50	52	53
40	54	56	57	48	60	61	62	64	65	66
50	68	69	71	72	73	75	76	77	79	80
60	81	83	84	85	87	88	89	91	92	94
70	95	96	98	99	100	102	103	104	106	107
80	108	110	111	113	114	115	117	118	119	121
90	122	123	125	126	127	129	130	132	133	134

FT-LB	0	100	200	300	400	500	600	700	800	900
NM	–	136	271	407	542	678	813	949	1085	1220
FT-LB	**0**	**1000**	**2000**	**3000**	**4000**	**5000**	**6000**	**7000**	**8000**	**9000**
NM	–	1356	2712	4067	5423	6779	8135	9491	10,847	12,202

Table 8-15. Systems of Units — Fluid-Ounce (OZ) to Milliliter (ML) Conversions

OZ (US)	OZ (IMPERIAL)	ML
0.1	0.1	3.0
0.2	0.2	5.9
0.3	0.3	8.9
0.4	0.4	11.8
0.5	0.5	14.8
0.6	0.6	17.7
0.7	0.7	20.7
0.8	0.8	23.7
0.9	0.9	26.6
1.0	1.0	29.6
2.0	2.1	59
3.0	3.1	89
4.0	4.2	118
5.0	5.2	148
6.0	6.2	177
7.0	7.3	207
8.0	8.3	237
9.0	9.4	266
10.0	10.4	296
20.0	20.8	591
30.0	31.2	887
40.0	41.6	1 183
50.0	52.0	1 479

Table 8-16. Systems of Units — Gallon (GAL) to Liter (L) Conversions

GAL (US)	GAL (IMPERIAL)	L
1	0.83	3.79
2	1.67	7.57
3	2.50	11.36
4	3.33	15.14
5	4.16	18.93
6	5.00	22.71
7	5.83	26.50
8	6.66	30.28
9	7.49	34.07
10	8.3	37.85
20	16.7	76
30	25.0	114
40	33.3	151
50	41.6	189

Table 8-17. Systems of Units — Degree Fahrenheit (°F) to Degree Celsius (°C) Conversions

°F	°C	°F	°C	°F	°C	°F	°C
-100	-73.3	425	218.1	950	509.5	1475	800.9
-85	-64.9	440	226.4	965	517.8	1490	809.2
-70	-56.6	455	234.8	980	526.1	1505	817.5
-55	-48.3	470	243.1	995	534.5	1520	825.8
-40	-40.0	485	251.4	1010	542.8	1535	834.2
-25	-31.6	500	259.7	1025	551.1	1550	842.5
-10	-23.3	515	268.1	1040	559.4	1565	850.8
5	-15.0	530	276.4	1055	567.8	1580	859.1
20	-6.7	545	284.7	1070	576.1	1595	867.5
35	1.7	560	293.0	1085	584.4	1610	875.8
50	10.0	575	301.4	1100	592.7	1625	884.1
65	18.3	590	309.7	1115	601.1	1640	892.4
80	26.6	605	318.0	1130	609.4	1655	900.8
95	35.0	620	326.3	1145	617.7	1670	909.1
110	43.3	635	334.7	1160	626.0	1685	917.4
125	51.6	650	343.0	1175	634.4	1700	925.7
140	59.9	665	351.3	1190	642.7	1715	934.1
155	68.3	680	359.6	1205	651.0	1730	942.4
170	76.6	695	368.0	1220	659.3	1745	950.7
185	84.9	710	376.3	1235	667.7	1760	959.0
200	93.2	725	384.6	1250	676.0	1775	967.4
215	101.6	740	392.9	1265	684.3	1790	975.7
230	109.9	755	401.3	1280	692.6	1805	984.0
245	118.2	770	409.6	1295	701.0	1820	992.3
260	126.5	785	417.9	1310	709.3	1835	1000.7
275	134.9	800	426.2	1325	717.6	1850	1009.0
290	143.2	815	434.6	1340	725.9	1865	1017.3
305	151.5	830	442.9	1355	734.3	1880	1025.6
320	159.8	845	451.2	1370	742.6	1895	1034.0
335	168.2	860	459.5	1385	750.9	1910	1042.3
350	176.5	875	467.9	1400	759.2	1925	1050.6
365	184.8	890	476.2	1415	767.6	1940	1058.9
380	193.1	905	484.5	1430	775.9	1955	1067.3
395	201.5	920	492.8	1445	784.2	1970	1075.6
410	209.8	935	501.2	1460	792.5	1985	1083.9

Table 8-18. Systems of Units — Degree Celsius (°C) to Degree Fahrenheit (°F) Conversions

°C	°F	°C	°F	°C	°F	°C	°F
-100	-148	180	356	460	860	740	1364
-90	-130	190	374	470	878	750	1382
-80	-112	200	392	480	896	760	1400
-70	-94	210	410	490	914	770	1418
-60	-76	220	428	500	932	780	1436
-50	-58	230	446	510	950	790	1454
-40	-40	240	464	520	968	800	1472
-30	-22	250	482	530	986	810	1490
-20	-4	260	500	540	1004	820	1508
-10	14	270	518	550	1022	830	1526
0	32	280	536	560	1040	840	1544
10	50	290	554	570	1058	850	1562
20	68	300	572	580	1076	860	1580
30	86	310	590	590	1094	870	1598
40	104	320	608	600	1112	880	1616
50	122	330	626	610	1130	890	1634
60	140	340	644	620	1148	900	1652
70	158	350	662	630	1166	910	1670
80	176	360	680	640	1184	920	1688
90	194	370	698	650	1202	930	1706
100	212	380	716	660	1220	940	1724
110	230	390	734	670	1238	950	1742
120	248	400	752	680	1256	960	1760
130	266	410	770	690	1274	970	1778
140	284	420	788	700	1292	980	1796
150	302	430	806	710	1310	990	1814
160	320	440	824	720	1328	1000	1832
170	338	450	842	730	1346	1010	1850

8-36. THERMAL FIT PARTS

Unless otherwise specified in the procedure of the applicable manual, bulletin, or instruction, the cooling of the inner (male) part should be enough to get the required dimensional changes (paragraph 8-37).

If necessary, it is permitted to heat the outer (female) part provided the following restrictions:

- Do not exceed the maximum temperature specified in Table 8-19 for the material.
- Do not heat the outer part to the maximum temperature specified in Table 8-19 for more than 2 hours.

8-37. THERMAL FIT PARTS — METHODS OF SECURING DIMENSIONAL CHANGES

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-020	Lubricating Oil
C-326	Denatured Alcohol
C-516	Clean Cloth
C-517	Nitrogen (Liquid)

1. Parts shall be clean prior to assembly (Chapter 5).

NOTE

When the instructions specify the use of primers or sealant on the thermal fit assembly, the specified primer or sealant shall be applied in lieu of oil, and may be applied before or after cooling or may be applied to the housing. If primer/sealant is applied to the housing, the housing temperature shall not be greater than 265°F (129°C).

NOTE

When using liquid nitrogen for cooling, oiling of the inner part is not practical.

2. Apply a film of lubricating oil (C-020) by dipping, brushing, or wiping with an oil-saturated clean cloth (C-516) to either the outer part (e.g., housing, sleeve, etc.) or the inner part (e.g., bushing, liner, etc.).

3. Cooling shall be accomplished as follows:

a. Cool inner parts, as required, using a refrigerator, cold box, a mixture of dry ice and denatured alcohol (C-326), or nitrogen (liquid) (C-517).

4. If necessary, heating shall be accomplished as follows:

a. Heat outer parts by placing in an oven, using a heat lamp, or by immersion in a bath of hot lubricating oil (C-020). Parts shall not be allowed to remain at the temperature specified in Table 8-19 for longer than 2 hours.

5. Assemble the parts immediately after you remove the part(s) from the cooling and/or heating media, as applicable.

8-38. UNWANTED PARTICLES

Particles can be found in any of the following parts:

- Chip detector(s) of the component
- Oil drained from the component
- Oil filter element for transmission assemblies
- Screen housing at the oil pump inlet of transmission assemblies
- Screens on the oil jets of transmission assemblies

The presence of unwanted particles may indicate the failure of one or more parts of the component. However, it does not necessarily mean that the component is not serviceable.

To determine the serviceability of a component, you must consider the following:

- Quantity, source, form, and type of material found
- Amount of time in service since the component was new or overhauled
- Previous failures
- Type of operation

Table 8-19. Thermal Fit Parts — Material Versus Maximum Temperature

MATERIAL	MATERIAL ALLOY	HEAT TEMPER GRADE	MAXIMUM TEMPERATURE
Magnesium	AZ61	T6	275°F (135°C)
	AZ63	T6	275°F (135°C)
	AZ80	T6	275°F (135°C)
	AZ91	T6	275°F (135°C)
	AZ92	T6	275°F (135°C)
	ZK60A	T5	275°F (135°C)
	ZE41A	T5	275°F (135°C)
	QE22A	T6	275°F (135°C)
	WE-43	T6	275°F (135°C)
	EV-31A	T6	275°F (135°C)
Aluminum	40E	T5	300°F (149°C)
	195	T6	300°F (149°C)
	A357/357	T6X	300°F (149°C)
	2014	T6	300°F (149°C)
	2024	T6	300°F (149°C)
	6061	T6	300°F (149°C)
	7050	T7X	300°F (149°C)
	7075	T73	300°F (149°C)
	7075	T6	250°F (121°C)
	7075	T76	250°F (121°C)
	A356/356	T6	295°F (146°C)
	A357/357	T6X	295°F (146°C)
	2024	T3	200°F (93°C)
	2024	T4	200°F (93°C)
	△1	–	200°F (93°C)
Steel	△2	△2	275°F (135°C)
	All other steel parts	All other steel parts	450°F (232°C)
Titanium	All	All	450°F (232°C)

NOTES:

△1 All shot peened aluminum.

△2 Carburized parts, induction hardened parts, and parts tempered at 300° to 450°F (149° to 232°C).

The type of material for the particles can be steel, silver, aluminum, magnesium, bronze, copper, phenolic, or rubber (paragraph 8-39).

8-39. UNWANTED PARTICLES — VISUAL IDENTIFICATION

1. Visually identify the unwanted particles in shape, size, quantity, and type of material as follows:

a. Visually examine the color and hardness of the particles.

b. Refer to Table 8-20 to determine the probable cause and the corrective action to perform after you identify the particles.

NOTE

There is evidence of ferrous metal particles on a chip detector if the related caution indication (message/annunciator) is shown on the display unit or caution and warning panel, as applicable.

c. Identify and collect ferrous metal particles from screens or filter elements with a permanent magnet.

d. Refer to Figure 8-5 to identify the ferrous particles on chip detectors, the probable cause, and the corrective action to perform.

e. A small amount of minute particles is a sign of normal wear. If the particles are too small to be visually identified, do a chemical identification of the particles (paragraph 8-40).

2. When the particles are large enough to be identified as fragments of a part such as a gear, a bearing, etc., you must replace or repair the component. Refer to the applicable Component Repair and Overhaul manual (CR&O).

3. If there is evidence of metallic particles but you are not sure about the serviceability of the component, do a serviceability check. Refer to the applicable Maintenance Manual (MM).

8-40. UNWANTED PARTICLES — CHEMICAL IDENTIFICATION

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
Commercial	Test Tubes (Qty 2)

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-431	Hydrochloric Acid
C-432	Nitric Acid
C-501	Sodium Chloride

NOTE

The process of chemical identification allows you to identify minute particles that are too small to be examined for color and hardness.

NOTE

Identification of silver plate flakes in the oil is not cause for replacement of the component.

Silver plate is a soft material that is used as an additional lubricant for gear meshing, therefore it is not critical to the component.

1. To identify a silver particle, do the following:

WARNING

ALWAYS ADD ACID TO WATER. NEVER ADD WATER TO ACID. IF WATER IS ADDED TO ACID, A VIOLENT CHEMICAL REACTION CAN OCCUR AND CAUSE INJURIES TO PERSONS.

a. Mix a solution of 50% by volume of nitric acid (C-432) and 50% of water in a test tube.

b. Mix a solution of 5% by weight of sodium chloride (C-501) and 95% of water in a second test tube.

Table 8-20. Unwanted Particles — Visual Identification

MATERIAL	DESCRIPTION	CORRECTIVE ACTION	CAUSE
Aluminum Magnesium	Particles are in granular form or particles look like miniature lathe turnings.	No action is required if the quantity is small and the particles are found at the first inspection after an overhaul or major maintenance. Replace or repair the component if the quantity is large or if particles are found at subsequent inspections. ⚠1	This can be the result of the use of mallets or drifts at assembly. It can also indicate wear on the oil pump internal surfaces or an unusual interference.
Silver	Small amount of particles in flake form or powder.	No action is required if you find the particles during the first 100 hours of operation, at overhaul, or at first inspection. Replace or repair the component if you find the particles after the first inspection of the first 100 hours and the quantity is large. ⚠1	This can be the result of wear on silver plated parts such as bearing cages and input pinion gear teeth. The quantity can be relatively large until the part is fully "broken-in".
Copper (Bronze)	Particles are in a granular form.	Replace or repair the component if the quantity is large. ⚠1	This can be the result of wear on the oil pump sleeve bearings or the bronze cages.
	Chips.	None	This can be the result of the use of mallets or drifts at assembly.
Phenolic	Chips, flakes, or powder.	None	This can be the result of the use of mallets or drifts at assembly.
Rubber	Different shapes and sizes; usually have one rounded side.	None	Material cut from the packings at assembly.

NOTE:

⚠1 Refer to the applicable Component Repair and Overhaul manual (CR&O) for repair information.

MATERIAL (STEEL) FOUND ON THE CHIP DETECTORS

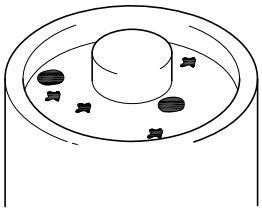
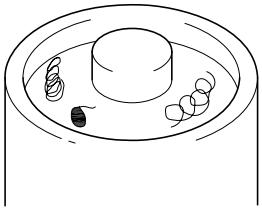
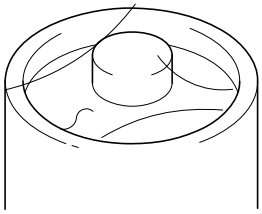
DETAIL	DESCRIPTION	SIGNIFICANCE	CORRECTIVE ACTION
	Tiny whisker-like particles. Groups of dark microscopic particles. Chips disappear into a large black smudge when removed. The common term for this condition is sludge or fuzz.	Insignificant debris. Generally microscopic wear particles caused by normal wear within the drive system components. The particles are often grouped by the magnetic field of the chip detector magnet and take on the shape of apparently larger chips.	If the component has several hundred operating hours, no maintenance is necessary. Clean and install the chip detector. If the component is relatively new or recently overhauled, do a serviceability check.
	Spiral curls or comma-shaped particles. Under magnification, the particles are often smooth and shiny on their convex surfaces and quite rough on other surfaces and edges. The color of the particles is usually dull gray on the rough surfaces. The common term for this condition is manufacture debris.	Insignificant debris. The particles are fragments of chips or shavings caused by machining of ferrous metal components. Such contamination is often introduced into the drive system components on the tools at the compressed air dust operations within the component assembly area.	The same procedure as above if you find the particles within the first 50 hours of operation of a new or overhauled component. If you find the particles after the first 50 hours of operation, do a serviceability check.
	Hair-like ferrous debris. Subject debris can have a rectangular or triangular cross section gradually reaching 0.080 inch (2.03 mm) or less in thickness. The length can range from 0.10 inch (2.54 mm) to over 1.0 inch (25.4 mm). The color of the debris is usually light gray, although one or more sides can have a black appearance. The common name for this condition is hairs.	Insignificant debris. This debris is normally scrap that is made as the components are interference fitted together at the assembly of the drive system components. The debris of this general shape is also made after a long term operation at the corners of the wear surfaces. This type of debris can also be made at the opening of lubrication oil cans and can be introduced into the components at the fill procedure.	The same procedure as above.

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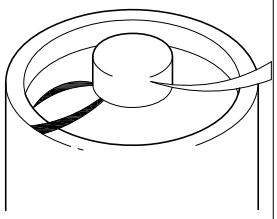
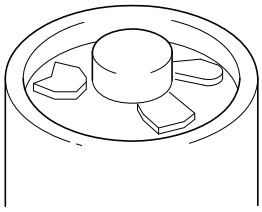
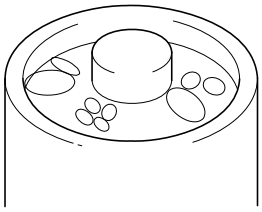
Figure 8-5. Visual Identification of Ferrous Particles on Chip Detectors (Sheet 1 of 2)

MATERIAL (STEEL) FOUND ON THE CHIP DETECTORS

DETAIL	DESCRIPTION	SIGNIFICANCE	CORRECTIVE ACTION
	Irregular shaped ferrous metal particles. The particles are usually trlangular In cross section. The particles are often spike-like in appearance. Under magnification, one side of a triangular section will usually look sheared. The color of the particles can be silver gray or black with one or more silver sides. Existence of two or more particles of this type on the chip detector at one time is rare. The common name for this condition is manufacture debris.	Insignificant debris. The particles of this type are commonly a result of tool slippage at assembly of the drive system components.	The same procedure as above.
	Irregular shaped ferrous chunks of different sizes and shapes. Under magnification, one or more sIdes of the particles look rough and grainy. The color of the partIcles Is often sIlvery gray with one or more black sides. No common term for this condition.	Significant debris. Existence of this type of debris shows that the gear and/or bearing is damaged within the drive system components.	Repair or replace the component.
	Few moderately sized and/or numerous small nearly flat pieces. Under magnification, one side of the flake appears very smooth. The flakes are silvery in color with black sides. The common name for this condition is flakes.	Significant debris. The particles of this description are classic signs of the rolling element bearing fallure. They are also less common signs of gear tooth spalling.	Repair or replace the component.

SPM_08_0002+

Figure 8-5. Visual Identification of Ferrous Particles on Chip Detectors (Sheet 2 of 2)

c. Add a particle of the material to be tested to the nitric acid solution. If the particle does not dissolve, slightly warm the solution.

d. When the particle dissolves, add a few drops of the sodium chloride solution to the nitric acid solution.

e. If a white precipitate forms, the particle is silver.

2. Empty the two test tubes and rinse with water until they are clean.

3. To identify a copper or bronze particle, do the following:

a. Put a small quantity of nitric acid (C-432) in a test tube.

b. Add a particle of the material to be tested to the nitric acid (C-432).

c. If a green precipitate forms, the particle is copper or bronze.

4. Empty the test tube and rinse with water until it is clean.

5. To identify an aluminum particle, do the following:

a. Put a small quantity of Hydrochloric acid (C-431) in a test tube.

b. Add a particle of the material to be tested to the Hydrochloric acid (C-431).

c. If the particle gradually disintegrates with a rapid emission of bubbles and forms a black residue (aluminum chloride), then it is aluminum.

6. Empty the test tube and rinse with water until it is clean.

7. To identify a magnesium particle, do the following:

a. Put a small quantity of nitric acid (C-432) in a test tube.

b. Add a particle of the material to be tested to the nitric acid (C-432).

NOTE

If the particle is aluminum, there will be no effect with the nitric acid (C-432).

c. If a rapid emission of bubbles occurs, the particle is magnesium.

d. Remove flakes of magnesium oxide with the Plastic Media Blasting (PMB) method. For PMB procedures, refer to Chapter 3 and for additional information on paint removers, refer to Chapter 4 (Figure 8-6).

8. Empty the test tube and rinse with water until it is clean.

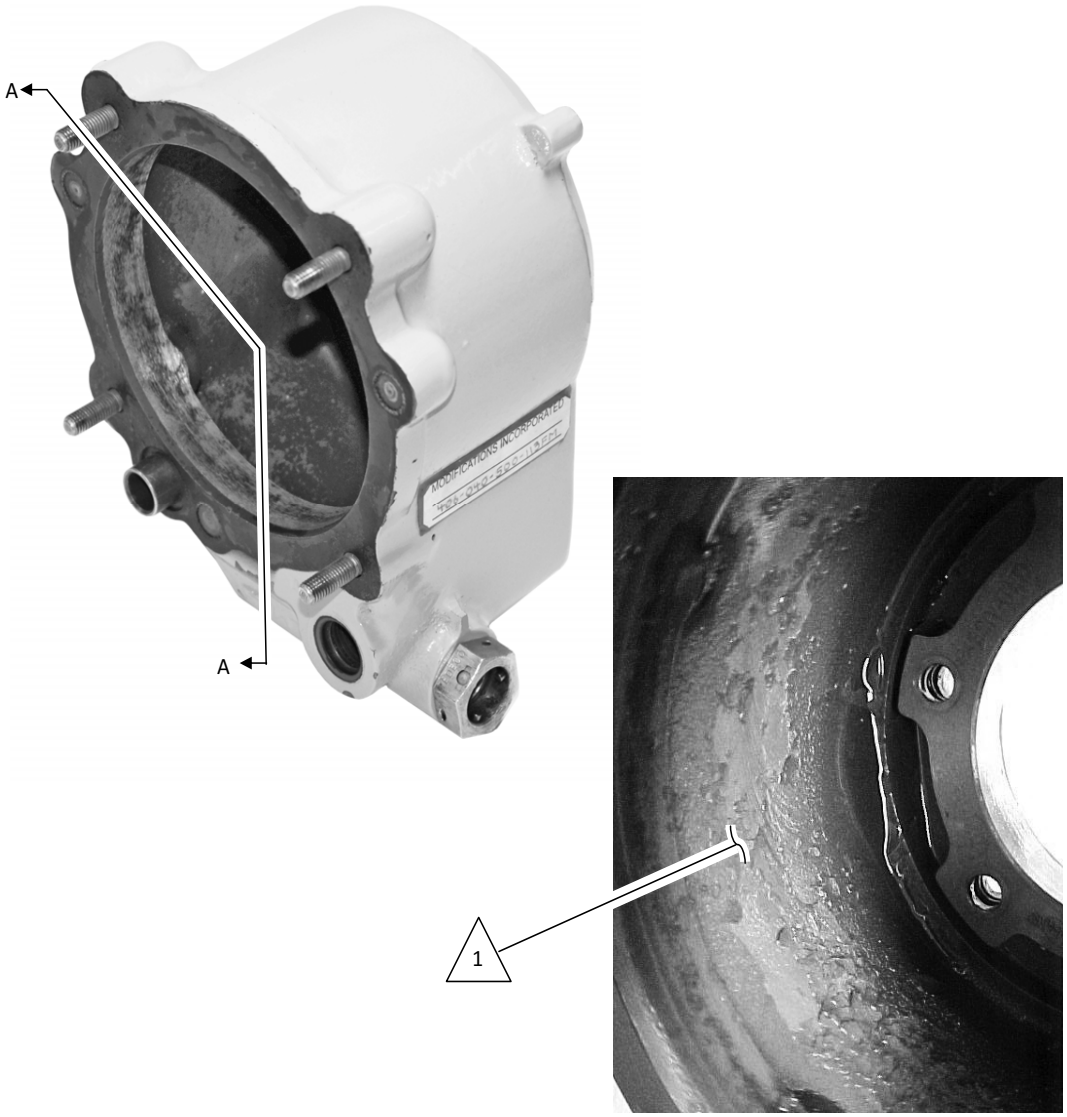
8-41. HYDRAULIC PRESS PRESSURE GAUGE — MEASURING UNIT CONVERSION

Hydraulic presses in the industry are equipped with a pressure gauge to monitor the pressure applied to the compontn that is assembled or disassembled.

These pressure gauges use different measuring units for graduation. Some use ton-force (newton), pound-force (newton), while others use PSI (KPa).

Bell Helicopter Textron manuals also use these different measuring units.

While converting ton-force to pound-force is relatively simple (1 ton-force (8896 N) = 2000 pound-force (8896 N), converting pound-force (N) to PSI (kPa) requires more calculations (paragraph 8-42).



Section A-A

1 Remove flakes of magnesium oxide with the plastic media blasting method. Refer to the BHT-ALL-SPM, Chapter 3 for Plastic Media Blasting (PMB) procedures and to the BHT-ALL-SPM, Chapter 4 for additional information on paint removers.

SPM_08_0008

Figure 8-6. Magnesium Oxide Flakes — Visual Identification

8-42. MEASURING UNIT CONVERSION — POUND-FORCE (N) TO PSI (KPA)

CAUTION

WHEN YOU USE A HYDRAULIC PRESS, MAKE SURE YOU APPLY THE REQUIRED PRESSURE. FAILURE TO USE THE CORRECT PRESSURE GAUGE MEASURING UNITS CAN RESULT IN COSTLY DAMAGE AND POSSIBLE INJURY.

1. To use the following conversion formulas you must know the diameter, or the surface area of the piston (1, Figure 8-7) in the servo actuator of the hydraulic press.

NOTE

The diameter that is needed for the calculation is the diameter of the piston (1) not the ram (4).

2. The diameter or surface area of this piston (1) is usually printed on the servo actuator or the hydraulic press. It can also can be found in the operator's manual or obtained from the manufacturer. As a last resort, the servo actuator can be disassembled and the piston diameter measured.

3. Once obtained, print the diameter and the surface area of the piston (1) on the hydraulic press for future reference.

NOTE

If you already have the piston (1) surface area go to step 5.

4. Calculate the piston (1) surface area with the following formula. The calculation to one decimal place is sufficient:

A = Surface area of the piston (1)

d = Diameter of the piston (1)

$$A = \frac{3.1416 \times (d^2)}{4}$$

5. To complete the conversion from pound-force (N) to PSI (kPa), use the following formula:

P = Pressure on the pressure gauge in PSI (KPa)

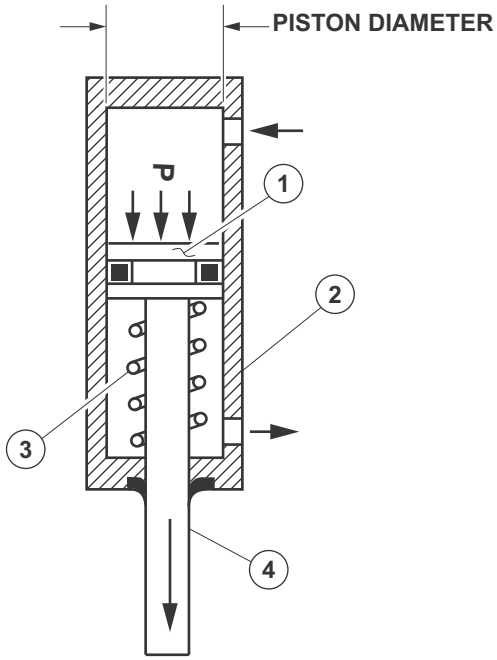
F = Force to be applied in pound-force (N)

A = Surface of the piston (1) in square inch (cm^2)

$$P = \frac{F}{A}$$

6. For examples of the pressure required in PSI (kPa) to get 8000 pound-force (35,586 N) of pressure for different piston (1) diameters, refer to the following:

DIAMETER	SURFACE AREA	PRESSURE
1.0 inch (2.5 cm)	0.8 square inch (5.1 cm^2)	10,000 PSI (68,948 kPa)
2.0 inches (5.08 cm)	3.1 square inches (20.3 cm^2)	2581 PSI (17,795 kPa)
3.0 inches (7.62 cm)	7.1 square inches (45.6 cm^2)	1127 PSI (7770 kPa)
4.0 inches (10.16 cm)	12.6 square inches (81.1 cm^2)	635 PSI (4378 kPa)



1. Piston
2. Cylinder
3. Spring
4. Ram

ALL_SPM_08_0007

Figure 8-7. Hydraulic Press Servo Actuator

CHAPTER 9 — BEARINGS, SLEEVES, AND BUSHINGS

TABLE OF CONTENTS

FIGURES

TABLES

TABLES (CONT)

BEARINGS, SLEEVES, AND BUSHINGS

9-1. INTRODUCTION

Instructions for the inspection and replacement of bearings are provided in the following paragraphs. Specific data for each model of helicopter is presented in tabular form following the text.

9-2. BEARINGS

9-3. BEARINGS — INSPECTION

1. Inspect bearings for defects and replace as described herein. Inspect and replace bearings as indicated in Table 9-1.

a. A pit is a small, irregular cavity in the active part of the race or rolling element that can definitely be felt with a 0.020 inch (0.51 mm) radius scribe. A pit that can be readily felt with a 0.020 inch (0.51 mm) scribe is approximately 0.015 inch (0.38 mm) wide. Pits are usually dark in appearance. Replace ball bearings when any one pit on the action surface exceeds 0.008 inch (0.21 mm). Replace roller bearings that have pits on the active parts of the rollers or races when any pit exceeds 0.015 inch (0.38 mm) in width or a cluster of more than three pits are in an area of 0.250 inch (6.35 mm) diameter. Pits sufficient to cause a loss of more than 20% of the area of contact on the bore or the outside diameter surface, or pits that affect face squareness over more than 20% of the circumference are cause for replacement.

b. Dents are slight depressions caused by pressure or blows by hard objects against the finish surfaces. Dents appear the same as unmarred surfaces around them and are visible only by light reflection. Replace bearings that have dents exceeding 0.003 inch (0.076 mm) in length.

c. Scratches are linear abrasions of the surface caused by other than grinding, honing, polishing, or lapping marks. Replace bearings that have scratches that can be felt with a 0.003 inch (0.076 mm) radius scribe.

d. Replace bearings that have circumferential bands on balls when they can be felt with a 0.003 inch (0.076 mm) radius scribe.

e. Corrosion may be recognized by a black or reddish rust. Replace corroded bearings.

f. Bearing fatigue is recognized by spalling of the metal appearing on load-carrying surfaces. Replace spalled bearings.

g. Replace the bearings when the retainer pockets are elongated, when the retainer is charred or cracked, or when the retainer is plated and plating has started to peel. Also replace bearings when the retainer face is chipped or the bore is warped, causing rubbing in two or more spots.

h. Brinelling is defined as follows:

(1) True brinelling may be recognized as small, smooth depressions on the surface of loaded area. Examine ball bearings by reflected light to determine when brinelling is present. Replace bearings that show evidence of true brinelling.

(2) False brinelling occurs only at rolling contact surfaces of the bearing races, and may be recognized by the occurrence of a series of shallow indentations in the race at each roller position on the loaded side of the bearing. Replace only when the bearings show evidence of failure.

i. Replace bearings that show evidence of heat failure recognized by discoloration (blueing).

j. Replace bearings that have a cracked or broken inner ring, rolling element, or retainer.

k. Replace bearings that show evidence of a carboned surface.

l. Inspect the bearing for excessive radial and axial wear in accordance with the appropriate bearing wear limits in Table 9-2. Radial wear is measured 90° from the shaft or the bolt that mates with the inner race or spherical ball of the bearing. Axial wear is measured parallel to the shaft or the bolt that mates with the inner race or spherical ball of the bearing. Maximum wear limit values will typically be lower for radial wear than for axial wear.

CAUTION

BEARINGS THAT ARE SUBJECT TO HEAVY LOAD OR HIGH SPEEDS SHALL NOT BE REUSED WHEN CONDITION IS QUESTIONABLE. BEARINGS AUTHORIZED FOR EMERGENCY REUSE SHALL BE REPLACED WHEN REPLACEMENT BEARINGS ARE AVAILABLE.

2. Inspect all parts to receive a new bearing as follows:

NOTE

Damage must be removed without exceeding the limit of the maximum bore diameter specified in Table 9-5.

a. Examine the bore of the part for damage and cracks with a 10X magnifying glass. No cracks are permitted and refer to the applicable manual for damage limits.

b. Inspect the edge chamfer for damage. If required, deburr or rework the edge chamfer to ensure a proper staking.

Table 9-1. Bearing Inspection and Replacement Criteria

DEFECT	CAUSE	CORRECTIVE MAINTENANCE
Cracked bearing components	Improper installation or maintenance or excessive loading	Replacement
Damaged seals	Improper installation or maintenance or excessive loading	Replacement
Charred seals	Overheating	Replacement
Roughness or binding	Grease soap deposits, fatigue spalling, contamination, corrosion, brinelling, or friction oxidation (fretting)	Lubrication or replacement
Noise	Same as previous plus lack of lubricant	Lubrication or replacement
Excessive looseness	Wear (from lack of lubricant or from contamination)	Replacement
Discoloration	Overheating	Replacement
Loose shafts or bolts	Worn bolts or bearing bores	Replacement
Corrosion	Loss of plating, lack of lubricant, or exposure to corrosive elements	Replacement

Table 9-2. Bearing Wear Limits

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
A1460A	0.012	(0.31)	0.030	(0.76)
ABYT5-1003	0.012	(0.31)	0.030	(0.76)
AB4E59	0.005	(0.13)	0.012	(0.31)
AB4E60	0.005	(0.13)	0.012	(0.31)
AB4-75W	0.005	(0.13)	0.012	(0.31)
ADBY5V302	0.008	(0.21)	0.024	(0.61)
ADSB5V305			0.020	(0.51)
ADNE-3-306	0.012	(0.31)	0.030	(0.76)
ADN3-306	0.012	(0.31)	0.030	(0.76)
ADSB14-302			0.030	(0.76)
ADW9	0.005	(0.13)	0.010	(0.25)
AG10V64	0.005	(0.13)	0.012	(0.31)
AHT3	0.005	(0.13)	0.012	(0.31)
AJT-27930				
ALK4-33	0.003	(0.08)	0.010	(0.25)
ALK4-37-101	0.010	(0.25)	0.010	(0.25)
ALK4-69-101	0.010	(0.25)	0.010	(0.25)
ALK4-111	0.005	(0.13)	0.010	(0.25)
ALK4-128			0.015	(0.39)
ALK4-156DHS/FSP			0.020	(0.51)
ALK4-172DHS-101			0.015	(0.39)
AM2002-DHS	None	None	0.010	(0.25)
AM2004-DHS	0.010	(0.25)	0.010	(0.25)
AM2011-DHS			0.020	(0.51)
AM2013-DHS			0.015	(0.39)
AM2014-DHS	0.005	(0.13)	0.030	(0.76)
AM2042-DHS			0.015	(0.39)
ARY4-35	0.005	(0.13)	0.012	(0.31)
ASBY-6-16	None	None	0.015	(0.39)

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
ASBY7V23			0.015	(0.39)
ASBV22			0.015	(0.39)
ASB8V22			0.015	(0.39)
ATBY4AAVN	0.012	(0.31)	0.030	(0.76)
ATBY4AAV7	0.012	(0.31)	0.030	(0.76)
ATBY5AAV4	0.012	(0.31)	0.030	(0.76)
ATBY5V17DHS	0.005	(0.13)	0.010	(0.25)
ATB-4	0.012	(0.31)	0.030	(0.76)
ATDY4AAV7	0.012	(0.31)	0.030	(0.76)
ATHE4-11	0.012	(0.31)	0.030	(0.76)
ATNE3-16	0.005	(0.13)	0.008	(0.21)
ATNE3-17	0.012	(0.31)	0.030	(0.76)
ATNE4-17	0.012	(0.31)	0.030	(0.76)
ATNE4-18	0.012	(0.31)	0.030	(0.76)
ATN-4-77	0.012	(0.31)	0.030	(0.76)
ATGA-107D	0.005	(0.13)	0.010	(0.25)
ATSB4AAV6	0.005	(0.13)	0.030	(0.76)
ATSB5AA2	0.012	(0.31)	0.030	(0.76)
ATSB10-301DHS			0.020	(0.51)
BR5R (Replaced by DAS5-20A-41)	△1		0.015	(0.39)
BSH-16-ATC32ZM	0.005	(0.13)	0.030	(0.76)
BSSN9003G	0.015	(0.38)	0.030	(0.76)
B542DD	0.005	(0.13)	0.030	(0.76)
B542ZZ	0.005	(0.13)	0.030	(0.76)
B543DD	0.005	(0.13)	0.015	(0.39)
B545DD	0.005	(0.13)	0.015	(0.39)
DAS7-27A1-501			0.015	(0.39)
DPP3	0.006	(0.16)	0.030	(0.76)
DPP4	0.005	(0.13)	0.030	(0.76)

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
DPP8	0.005	(0.13)	0.030	(0.76)
DPP8W				
DRX-22			0.015	(0.39)
DSP3	0.006	(0.16)	0.030	(0.76)
DSP4	0.006	(0.16)	0.030	(0.76)
DSP5	0.012	(0.31)	0.030	(0.76)
DSRP4	0.006	(0.16)	0.030	(0.76)
DS-6-1	None	None	0.020	(0.51)
DW4	0.005	(0.13)	0.030	(0.76)
DW4K	0.005	(0.13)	0.030	(0.76)
DW4K2	0.005	(0.13)	0.030	(0.76)
DW5	0.005	(0.13)	0.030	(0.76)
DW6	0.005	(0.13)	0.030	(0.76)
DXV4-14A	0.003	(0.08)	0.010	(0.25)
GDW4K	0.005	(0.13)	0.030	(0.76)
GDW5	0.005	(0.13)	0.030	(0.76)
GDW6	0.005	(0.13)	0.006	(0.16)
HB4ETL141	0.012	(0.31)	0.030	(0.76)
HB4ETL142	0.012	(0.31)	0.030	(0.76)
HB4ETL144	0.012	(0.31)	0.030	(0.76)
HE6-130	0.005	(0.13)	0.030	(0.76)
HJTT162416-X1	△5			
HJ162416	△1			
HMXKV4A	0.012	(0.31)	0.030	(0.76)
NMXVAD	0.012	(0.31)	0.030	(0.76)
HSBY5TL103	0.012	(0.31)	0.030	(0.76)
HT5V-101			0.020	(0.51)
JH-1412-OH	△1			
JHT-1413	△1			

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
JT-1213			0.020	(0.51)
KBNE-6W	0.006	(0.16)	0.012	(0.31)
KDSY5-18	0.010	(0.25)	0.010	(0.25)
KLS-4	0.004	(0.11)		
KMDB8-8			0.015	(0.39)
KMVD-8-8			0.015	(0.39)
KP3A	0.005	(0.13)	0.030	(0.76)
KP4	0.006	(0.16)	0.030	(0.76)
KP4A	0.012	(0.31)	0.030	(0.76)
KP4B	0.006	(0.16)	0.030	(0.76)
KP5	0.006	(0.16)	0.030	(0.76)
KP5A	0.006	(0.16)	0.030	(0.76)
KP6A	0.005	(0.13)	0.030	(0.76)
KP8	0.006	(0.16)	0.030	(0.76)
KP-8-A	0.006	(0.16)	0.030	(0.76)
KP8ADBA2605	⚠1			
KP10A	0.005	(0.13)	0.030	(0.76)
KPWD14P	0.012	(0.31)	0.030	(0.76)
KSP4	0.012	(0.31)	0.045	(1.14)
KSP4A	0.006	(0.16)	0.030	(0.76)
KSP5	0.005	(0.13)	0.030	(0.76)
KSP6A	0.006	(0.16)	0.030	(0.76)
KSP10	0.006	(0.16)	0.030	(0.76)
KWB9N	0.005	(0.13)	0.010	(0.25)
KWDB5-21				
KWDB5-48				
LHR-4-14A	0.012	(0.31)	0.030	(0.76)
LHRA-5-26	0.012	(0.31)	0.030	(0.76)
LHSSR-3	0.012	(0.31)	0.030	(0.76)

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
LHSSV-4	0.012	(0.31)	0.030	(0.76)
LHSSVV-4	0.012	(0.31)	0.030	(0.76)
LHVA-5-26	0.012	(0.31)	0.030	(0.76)
LHV-4-14	0.012	(0.31)	0.030	(0.76)
LHV-4-28	0.005	(0.13)	0.030	(0.76)
LHV5-23	0.012	(0.31)	0.030	(0.76)
LHVG5-23	0.012	(0.31)	0.030	(0.76)
LHVV-4-17A	0.010	(0.25)	0.010	(0.25)
LS-4	0.004	(0.11)		
LVH-4-14	0.012	(0.31)	0.030	(0.76)
M81935/2-4	0.012	(0.31)	0.030	(0.76)
MDW4	0.005	(0.13)	0.030	(0.76)
MDW5	0.005	(0.13)	0.030	(0.76)
MKP4	0.030	(0.76)	0.006	(0.127)
MR-16-RSS-1	△5			
MR-1761	△1			
MR-686	△1			
MS14101-3	0.012	(0.31)	0.030	(0.76)
MS14101-4	0.012	(0.31)	0.030	(0.76)
MS14101-6	0.005	(0.13)	0.012	(0.31)
MS14101-7	0.012	(0.31)	0.030	(0.76)
MS14101-9	0.015	(0.39)	0.030	(0.76)
MS14103-3	0.012	(0.31)	0.030	(0.76)
MS14103-4	0.012	(0.31)	0.030	(0.76)
MS14104-3	0.012	(0.31)	0.030	(0.76)
MS20201-1	0.005	(0.13)	0.030	(0.76)
MS20206-1	0.006	(0.16)	0.030	(0.76)
MS20206DSP4	0.005	(0.13)	0.030	(0.76)
MS21150-1	0.006	(0.16)	0.015	(0.39)

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
MS21151-8	0.012	(0.31)	0.030	(0.76)
MS21151-9	0.012	(0.31)	0.030	(0.76)
MS21153-2	0.012	(0.31)	0.030	(0.76)
MS21153-6	0.005	(0.13)	0.030	(0.76)
MS21153-6C	0.012	(0.31)	0.030	(0.76)
MS21153-8	0.006	(0.16)	0.030	(0.76)
MS212345-4K	0.012	(0.31)	0.030	(0.76)
MS27640-4	0.006	(0.16)	0.030	(0.76)
MS27640-5	0.006	(0.16)	0.030	(0.76)
MS27640-8	0.006	(0.16)	0.030	(0.76)
MS27641-3	0.005	(0.13)	0.030	(0.76)
MS27641-4	0.006	(0.16)	0.030	(0.76)
MS27641-5	0.006	(0.16)	0.030	(0.76)
MS27641-6	0.005	(0.13)	0.030	(0.76)
MS27641-8	0.005	(0.13)	0.030	(0.76)
MS27641-8A	0.006	(0.16)	0.030	(0.76)
MS27641-10	0.005	(0.13)	0.030	(0.76)
MS27642-42	0.006	(0.16)	0.030	(0.76)
MS27643-3	0.006	(0.16)	0.030	(0.76)
MS27643-4	0.012	(0.31)	0.030	(0.76)
MS27643-5	0.006	(0.16)	0.030	(0.76)
MS27644-3	0.005	(0.13)	0.030	(0.76)
MS27644-4	0.005	(0.13)	0.030	(0.76)
MS27644-8	0.005	(0.13)	0.030	(0.76)
MS27645-3A	0.005	(0.13)	0.030	(0.76)
MS27645-4	0.006	(0.16)	0.030	(0.76)
MS27645-4A	0.005	(0.13)	0.034	(0.86)
MS27645-5	0.006	(0.16)	0.030	(0.76)
MS27645-6A	0.005	(0.13)	0.034	(0.86)

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
MS27645-10	0.006	(0.16)	0.030	(0.76)
MS27646-38	0.005	(0.13)	0.030	(0.76)
MS27646-40	0.005	(0.13)	0.030	(0.76)
MS27646-41	0.005	(0.13)	0.030	(0.76)
MS27646-42	0.005	(0.13)	0.030	(0.76)
MS27646-43	0.005	(0.13)	0.030	(0.76)
MS27646-45	0.005	(0.13)	0.015	(0.39)
MS27647-4	0.005	(0.13)	0.030	(0.76)
MS27647-4A	0.005	(0.13)	0.030	(0.76)
MS27647-5	0.005	(0.13)	0.030	(0.76)
MS27647-5G	0.005	(0.13)	0.006	(0.15)
MS27647-6	0.005	(0.13)	0.030	(0.76)
MS27647-6G	0.005	(0.13)	0.006	(0.16)
MS27648-24	0.005	(0.13)	0.030	(0.76)
MS27648-25	0.012	(0.31)	0.030	(0.76)
MS28913-4B			0.003	(0.08)
MS28913-4C	△1		0.015	(0.39)
MS28913-5C (Replaced by DAS5-20A-41)	△1		0.015	(0.39)
MV34-14A	0.005	(0.13)	0.008	(0.21)
MV34-14B	0.012	(0.31)	0.030	(0.76)
MXLR-46-14H	△3 0.003	(0.08)	0.030	(0.76)
MXLV46-14E	0.012	(0.31)	0.030	(0.76)
MXV46-14B	0.012	(0.31)	0.030	(0.76)
MXV46-14D	0.012	(0.31)	0.030	(0.76)
MX46-14B	0.012	(0.31)	0.030	(0.76)
M9312W1CRDF	△1			
NHBY5AA5	0.005	(0.13)	0.010	(0.25)
NHB12V7			0.010	(0.25)
NHHE6-21W	0.006	(0.16)	0.012	(0.31)

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
NHNEL5-212	0.012	(0.31)	0.030	(0.76)
NHNE4-221	0.012	(0.31)	0.030	(0.76)
NHN5-209	0.007	(0.18)	0.015	(0.39)
NHSB8V9	0.012	(0.31)	0.030	(0.76)
NHW4V202			0.015	(0.39)
NHW5V202			0.015	(0.39)
NHW7V203			0.010	(0.25)
RAD-4T-1	0.005	(0.13)	0.030	(0.76)
RALT-4N-1	0.012	(0.31)	0.030	(0.76)
RALT5N7	0.012	(0.31)	0.030	(0.76)
RALT-5-N7V	0.012	(0.31)	0.030	(0.76)
RALT-5-4	0.012	(0.31)	0.030	(0.76)
RAPG-4N-2	0.012	(0.31)	0.030	(0.76)
RDW-5T-3V-1	0.005	(0.13)	0.015	(0.39)
RLA-4T-1	0.003	(0.08)	0.010	(0.25)
REF4THB	0.005	(0.13)	0.010	(0.25)
REM-3T-3	0.005	(0.13)	0.008	(0.21)
REM-3T-8	0.012	(0.31)	0.030	(0.76)
REM-4TH-6-1	0.012	(0.31)	0.030	(0.76)
REM-4-TH-16	0.012	(0.31)	0.030	(0.76)
REM4TH16-1	0.012	(0.31)	0.030	(0.76)
REM4TH16-2	0.012	(0.31)	0.030	(0.76)
REM4TH17	0.012	(0.31)	0.030	(0.76)
REM8ATC12-5	0.012	(0.31)	0.030	(0.76)
REM8ATC12-6	0.012	(0.31)	0.030	(0.76)
REM8ATC12-11	0.012	(0.31)	0.030	(0.76)
REML10Z12A1460A	0.012	(0.31)	0.030	(0.76)
REPB3N	0.012	(0.31)	0.030	(0.76)
REPB3N-2	0.012	(0.31)	0.030	(0.76)

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
REP3M4-9-FS21D	0.005	(0.13)	0.008	(0.21)
REP3M4-10-FS21D	0.012	(0.31)	0.030	(0.76)
REP4F5	0.005	(0.13)	0.030	(0.76)
REP4ML6	0.006	(0.16)	0.015	(0.39)
REP4M6-8	0.012	(0.31)	0.030	(0.76)
RES8ATC10-2	0.012	(0.31)	0.030	(0.76)
RG9SS	0.015	(0.39)	0.030	(0.76)
RG-12-SS	0.015	(0.39)	0.030	(0.76)
RSST-3	0.012	(0.31)	0.030	(0.76)
RSST-4	0.012	(0.31)	0.030	(0.76)
RSST-5N7V	0.008	(0.21)	0.024	(0.61)
RSS9	0.015	(0.38)	0.030	(0.76)
SBSH14ATC30ZA1501			0.010	(0.25)
SBS16ATC50ZA1460	0.006	(0.16)	0.030	(0.76)
SBS24ATC46ZA1501			0.010	(0.25)
SJT194-13-S5	△5			
SJ-7154-SX-1TU-9D-1	△1			
SPS4-10A1-501	0.012	(0.31)	0.030	(0.76)
S-4	0.004	(0.11)		
TGA104N			0.015	(0.39)
TGA-14F	0.006	(0.16)	0.030	(0.76)
TGA-14G	0.006	(0.16)	0.030	(0.76)
T6A-12G	None	None	0.015	(0.39)
VTB02220	0.005	(0.13)	0.012	(0.31)
VTBO2310	0.005	(0.13)	0.012	(0.31)
WBS10FTF-29	0.012	(0.31)	0.030	(0.76)
WHT9	0.005	(0.13)	0.010	(0.25)
WSBS10FTF-29Z	0.012	(0.31)	0.030	(0.76)
WSBS12ATC29	0.008	(0.21)	0.024	(0.61)

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
W202PP	0.005	(0.13)	0.030	(0.76)
YD241A	None	None	0.020	(0.51)
YS-1125	0.005	(0.13)	0.030	(0.76)
YTA-178	0.005	(0.13)	0.030	(0.76)
YTA190B	0.012	(0.31)	0.030	(0.76)
YTA227-11	0.005	(0.13)	0.030	(0.76)
YTA-354			0.015	(0.39)
YTA373			0.015	(0.39)
YTA-384			0.030	(0.76)
YTA-385			0.020	(0.51)
12-2000-12	0.015	(0.39)	0.030	(0.76)
174PH	0.005	(0.13)	0.030	(0.76)
176260	0.012	(0.31)	0.030	(0.76)
177182	0.012	(0.31)	0.030	(0.76)
177183	0.012	(0.31)	0.030	(0.76)
177184	0.012	(0.31)	0.030	(0.76)
177293	0.012	(0.31)	0.030	(0.76)
47-140-252-3	0.012	(0.31)	0.030	(0.76)
204-001-058-003	0.005	(0.13)	0.030	(0.76)
204-001-064-001	0.012	(0.31)	0.030	(0.76)
204-001-064-003	0.012	(0.31)	0.030	(0.76)
204-011-118-001	None	None	0.020	(0.51)
204-011-418-001	△1			
204-011-451-001	None	None	0.020	(0.51)
204-011-769-001			None	None
204-061-717-001	0.005	(0.13)	0.008	(0.21)
204-061-717-003	0.012	(0.31)	0.030	(0.76)
204-076-428-001	0.012	(0.31)	0.030	(0.76)
205-001-047-001	△3 0.003	(0.08)	0.030	(0.76)

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
205-001-048-001	0.012	(0.31)	0.030	(0.76)
205-012-710-001			0.015	(0.39)
206-001-005-001	0.012	(0.31)	0.030	(0.76)
206-001-052-001	0.012	(0.31)	0.030	(0.76)
206-001-053-001	0.012	(0.31)	0.030	(0.76)
206-001-053-003	0.012	(0.31)	0.030	(0.76)
206-001-053-005	0.012	(0.31)	0.030	(0.76)
206-001-054-001	0.012	(0.31)	0.030	(0.76)
206-001-055-001	0.012	(0.31)	0.030	(0.76)
206-001-057-001	0.012	(0.31)	0.030	(0.76)
206-001-057-003	0.012	(0.31)	0.030	(0.76)
206-001-063	0.012	(0.31)	0.030	(0.76)
206-001-095-001	0.012	(0.31)	0.030	(0.76)
206-001-159	0.003	(0.08)	0.010	(0.25)
206-001-201-001	0.005	(0.13)	0.010	(0.25)
206-001-202-001	0.005	(0.13)	0.010	(0.25)
206-001-204-101	0.005	(0.13)	0.010	(0.25)
206-001-556	0.005	(0.13)	0.030	(0.76)
206-001-701-001	0.003	(0.08)	0.010	(0.25)
206-001-708-001		△4		
206-010-469-001	0.010	(0.25)	0.010	(0.25)
206-010-470-101	0.010	(0.25)	0.010	(0.25)
206-010-710-3	0.010	(0.25)	0.010	(0.25)
206-010-765-001			0.015	(0.39)
206-010-792-107			0.020	(0.51)
206-010-793-101	0.010	(0.25)	0.010	(0.25)
206-011-105-001	0.000	(0.00)	0.020	(0.51)
206-031-590-003			0.010	(0.25)
206-031-594-003			0.010	(0.25)

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
206-063-719	0.005	(0.13)	0.030	(0.76)
206-064-103-001	0.000	(0.00)	0.006	(0.156)
206-301-051-101	0.005	(0.13)	0.010	(0.25)
206-310-105-101			0.015	(0.39)
209-001-051-001	0.012	(0.31)	0.030	(0.76)
209-001-052-001	0.012	(0.31)	0.030	(0.76)
209-001-053-001	0.005	(0.13)	0.030	(0.76)
209-001-055-001	0.005	(0.13)	0.030	(0.76)
209-010-444	△5			
209-010-459-001			0.015	(0.39)
209-031-351-001	0.015	(0.39)	0.030	(0.76)
209-062-105-001	0.005	(0.13)	0.010	(0.25)
209-062-109-001	0.005	(0.13)	0.030	(0.76)
212-001-066-001	0.005	(0.13)	0.030	(0.76)
212-010-730-001	0.007	(0.18)	0.015	(0.39)
212-010-783-101	0.007	(0.18)	0.015	(0.39)
212-010-731-001	None	None	0.015	(0.39)
212-010-762-001	△1		0.020	(0.51)
212-010-768-001			0.015	(0.39)
212-010-782-101			0.015	(0.39)
212-010-783-101	0.007	(0.18)	0.015	(0.39)
212-061-117-001	0.005	(0.13)	0.030	(0.76)
214-001-049-001	0.012	(0.31)	0.030	(0.76)
214-001-082-001	0.006	(0.16)	0.015	(0.39)
214-001-083-001	0.006	(0.16)	0.030	(0.76)
214-001-083-003	0.006	(0.16)	0.030	(0.76)
214-001-093	0.005	(0.13)	0.030	(0.76)
214-001-424	0.006	(0.16)	0.030	(0.76)
214-010-434-001			0.015	(0.39)

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
214-010-435-003			0.015	(0.39)
214-010-437			0.030	(0.76)
214-010-487-001	0.020	(0.50)	0.030	(0.76)
214-010-489-101	0.020	(0.50)	0.030	(0.76)
214-010-711-001			0.015	(0.39)
214-010-712-001			0.015	(0.39)
214-010-714-001	△2			
214-010-733-001			0.015	(0.39)
214-010-736-001	△2			
214-010-744-001	△2			
214-010-777-101			0.015	(0.39)
214-010-815-101			0.015	(0.39)
214-010-850-101			0.015	(0.39)
214-010-851-103			0.015	(0.39)
214-010-856-103	△1 △2			
214-011-811-103			0.015	(0.39)
214-011-819-101			0.015	(0.39)
214-030-146-101	0.005	(0.13)	0.015	(0.39)
214-030-216-001	0.004	(0.11)		
214-030-633-001	0.008	(0.21)	0.024	(0.61)
222-301-011-101	0.012	(0.31)	0.030	(0.76)
222-301-012-101	0.012	(0.31)	0.030	(0.76)
222-301-013-101	0.012	(0.31)	0.030	(0.76)
222-310-119-101	△1			
222-310-401-101			0.015	(0.39)
222-310-460-103			0.015	(0.39)
222-310-461-001			0.015	(0.39)
222-310-473-001	△1			
222-310-473-103	△1			

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
222-310-475-001			0.020	(0.51)
222-310-475-103			0.020	(0.51)
222-310-478-101			0.020	(0.51)
222-310-479-101	△1			
222-312-718-001	△1			
222-312-719-001	△1			
222-312-751-001			0.015	(0.39)
222-312-752-001			0.015	(0.39)
222-312-753-101			0.015	(0.39)
222-312-754-101			0.020	(0.51)
222-312-755-101			0.020	(0.15)
222-312-760-001	△1			
230-360-101-103	0.005	(0.13)	0.012	(0.31)
406-310-403-101	0.005	(0.13)	0.012	(0.31)
406-310-405-101	None	None	0.015	(0.39)
406-310-405-103	None	None	0.015	(0.39)
409-360-706-001	0.005	(0.13)	0.015	(0.39)
412-010-427-101			0.015	(0.39)
412-320-400-107				
4708			None	None
47-140-252-5	0.012	(0.31)	0.030	(0.76)
47-729-155-3	0.012	(0.31)	0.030	(0.76)
50294	0.005	(0.13)	0.010	(0.25)
5103-J2-1	△1		0.020	(0.51)
540-011-414-1	0.005	(0.13)	0.030	(0.76)
542ZZ	0.005	(0.13)	0.030	(0.76)
59100W01-2-MBR-A1835				
60-BAA-4802	△1			
604-14-34-01			0.030	(0.76)

Table 9-2. Bearing Wear Limits (Cont)

BEARING PART NUMBER	BEARING WEAR LIMITS MAXIMUM PLAY			
	RADIAL		AXIAL	
	INCH	(MM)	INCH	(MM)
7203-D4F	△2			
76546	0.005	(0.13)	0.030	(0.76)
76549	0.012	(0.31)	0.030	(0.76)
76569	0.012	(0.31)	0.030	(0.76)
76585	0.012	(0.31)	0.030	(0.76)
76684	0.005	(0.13)	0.010	(0.25)
9101PP	0.005	(0.13)	0.030	(0.76)
9103PP	0.005	(0.13)	0.030	(0.76)
9104NPP	0.005	(0.13)	0.015	(0.39)
9104PP	0.005	(0.13)	0.015	(0.39)
9104VPP	0.005	(0.13)	0.030	(0.76)

NOTES:

△1 Inspect for smoothness during manual rotation, replace if rough.

△2 Bearing Condition: Smooth during rotation while loading axially and radially.

△3 Bearing has built in radial clearance of 0.0012 to 0.002 inch (0.0305 to 0.0508 mm) between ball and outer race.

△4 Oilite bearing used as friction surface.

△5 Check for roughness or binding.

9-4. BEARINGS — REPLACEMENT

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
T101886-1 or RST2020	Roll Staking Tool
T102095	Anvil Staking Tool Set
RST1016	Roll Staking Tool
Workaid Item (Figure 9-1)	Bearing/Sleeve Removal and Installation Tool Set

The following instructions contain information on bearings that may be removed, installed, and retained through staking. Table 9-5 provides the dimensions, type of bearing staking, tool number, bearing part number, sleeve part number, and other applicable data for various parts and assemblies. Bellcranks, levers, etc. are listed in numerical order in the table.

Unless otherwise specified in Table 9-5, the following general fits and clearances are provided to ensure proper installation of bearings:

- Bearings must have a 0.0002 to 0.0012 inch (0.0051 to 0.0305 mm) tight fit in sleeves or housings.

NOTE

Sleeve may need to be ream to the dimension provided in Table 9-5 located under the bearing P/N and hole (bore) size for bearing column.

- Sleeves must have a 0.0002 to 0.0022 inch (0.0051 to 0.0559 mm) tight fit in housings.
- Bearings installed with an anaerobic sealing compound must have a 0.0005 to 0.0010 inch (0.0127 to 0.0254 mm) clearance between the bearing and the housing.

9-5. Bearing Removal

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-309	MEK
C-407	Abrasive Pad
C-486	Cheesecloth

1. Remove an unserviceable sleeve and/or bearing from the part with the bearing/sleeve removal and installation tool set as follows (refer to Figure 9-1 for construction of workaids):

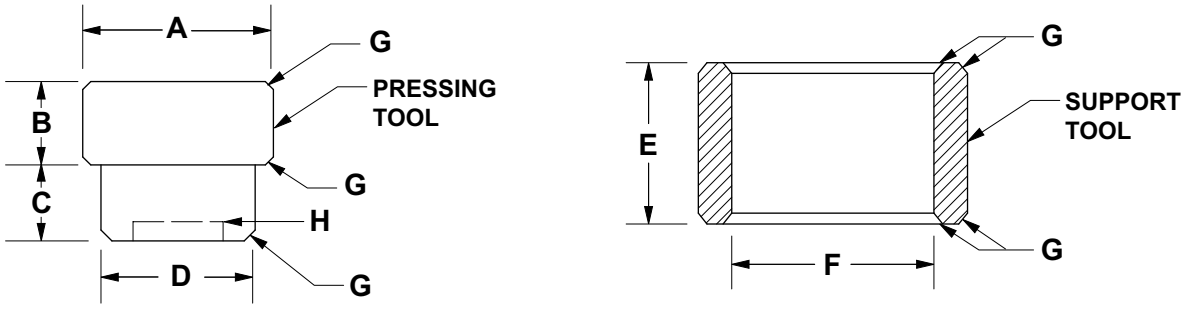
CAUTION

BEFORE PRESSING OUT A PREGROOVED BEARING WITH A STEEL OUTER RACE, CAREFULLY CUT AWAY AND REMOVE ROLL STAKED LIP ON ONE SIDE OF BEARING USING A FLY CUTTER. DO NOT CUT INTO PART.

a. Put the part in a press with the unserviceable bearing over the fabricated support tool.

b. Press out the bearing with the small end of the fabricated pressing tool. Press out the sleeve with the large end of the fabricated pressing tool.

c. Thoroughly clean the bore of the part with MEK (C-309) and an abrasive pad (C-407). Wipe dry with clean cheesecloth (C-486) before the MEK (C-309) evaporates.



MATERIAL: ANY ROUND ALLOY STOCK

NO.	REF LTR	DIMENSIONS
1	A	Slightly smaller than sleeve outside diameter.
2	B	Two times the bearing length.
3	C	Two times the bearing width.
4	D	Slightly smaller than bearing inside diameter.
5	E	Slightly longer than bearing or sleeve height/length.
6	F	Slightly larger than bearing or sleeve O.D.
7	G	Chamfer 0.025 inch (0.635 mm) by 45°.
8	H	Undercut 0.4 inch (10.16 mm) to provide clearance for shoulder diameter bearing inner ring.

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Figure 9-1. Bearing/Sleeve Removal and Installation Workaids

9-6. Bearing Installation — Ring Staking Method

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent
C-486	Cheesecloth

Ring staking is used on steel and aluminum sleeves. Ring stake is centered on the sleeve and lays over a portion of the sleeve to the part and a portion of the sleeve to the bearing, as shown in Figure 9-2. Refer to Table 9-3 for the applicable tools.

1. Ring stake as follows:

CAUTION

EXTREME CARE MUST BE EXERCISED TO AVOID ANY CONTAMINATION OF BEARING DURING ALL PHASES OF HANDLING AND INSTALLATION.

a. Measure the bore of the part, new bearing, and new bearing sleeve to make sure dimensions will provide the interference fit given in Table 9-5.

b. Apply the coating, as specified in Table 9-5, to the outside diameter of the new sleeve and to the mating bore in the part.

c. While the coating is wet, press the sleeve into the part with the bearing/sleeve removal and installation tool set (Figure 9-1). The sleeve must be equally centered from each side of the part.

d. Apply the coating, as specified in Table 9-5, to the outside diameter of a new bearing and to the inside diameter of the previously installed sleeve. Avoid excessive application of coating and do not apply to the bearing seals or shields.

Table 9-3. Staking Tool Set Application

TOOL PART NO.	SLEEVE PART NO.	MANUFACTURER'S BEARING PART NO.	MILITARY STANDARD BEARING PART NO.
T101873-3	120-012-4 120-015-4K	KP4A DW4K	MS27641-4 MS27647-4
T101873-5	120-011-3 120-013-3 120-014-3	KP3 and KS3 DSP3 and DSRP3 DPP3	MS27640-3 MS27643-3 MS67644-3
T101873-7	120-012-5	KP5A	MS27641-5
T101873-9	120-012-6	KP6A	MS27641-6
T101873-11	120-015-5	DW5	MS27647-5
T101873-13	120-011-4 120-013-4 120-014-4	KP4 and KS4 DSP4 and DSRP4 DPP4	MS27640-4 MS27643-4 MS27644-4
T101873-15	120-015-6	DW6	MS27647-6

Table 9-3. Staking Tool Set Application (Cont)

TOOL PART NO.	SLEEVE PART NO.	MANUFACTURER'S BEARING PART NO.	MILITARY STANDARD BEARING PART NO.
T101873-17	120-012-8	KP8A	MS27641-8
T101873-19	120-011-5 120-013-5 120-014-5	KP5 and KS5 DSP5 and DSRP5 DPP5	MS27640-5 MS27643-5 MS27644-5
T102095-1	None	209-001-005-1	N/A
T102095-3	None	209-011-051-1	N/A

NOTE:

The table is for the T102095 staking tool set and is primary for flight controls.

CAUTION

DURING BEARING INSTALLATION, MAKE SURE YOU APPLY PRESSURE ONLY TO THE OUTER RACE. DO NOT APPLY PRESSURE TO THE INNER RACE AND SPHERICAL BALL OF THE BEARING OR DAMAGE MAY OCCUR.

e. While the coating is wet, press the new bearing into the sleeve with the bearing/sleeve removal and installation tool set (Figure 9-1). The bearing must be equally centered from each side of the part.

f. Select the applicable ring staking tool given in Table 9-5. Ring stake to obtain the required dimensions on both sides of the sleeve (Figure 9-2).

g. Clean any excess coating with clean cheesecloth (C-486) moistened with drycleaning solvent (C-304).

h. Make sure there is no movement or looseness of the bearing outer race in the bore of the part.

i. Proof load the bearing if required (Table 9-5).

j. Examine the bearing for smooth rotation and breakout (misalignment), breakaway, or rotational (roll) torque (Table 9-5).

9-7. Pregrooved Bearing Installation — Roll Staking Method

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent
C-486	Cheesecloth

Roll staking is used for the staking of pregrooved spherical bearings to the part by rolling over the pregrooved lip of the bearing onto the chamfer of the hole in the part, as shown in Figure 9-3.

1. Roll stake as follows:

CAUTION

EXTREME CARE MUST BE EXERCISED TO AVOID ANY CONTAMINATION OF BEARING DURING ALL PHASES OF HANDLING AND INSTALLATION.

a. Measure the bore of the part and the outside diameter of a new bearing to make sure the dimensions will provide the proper fit given in Table 9-5.

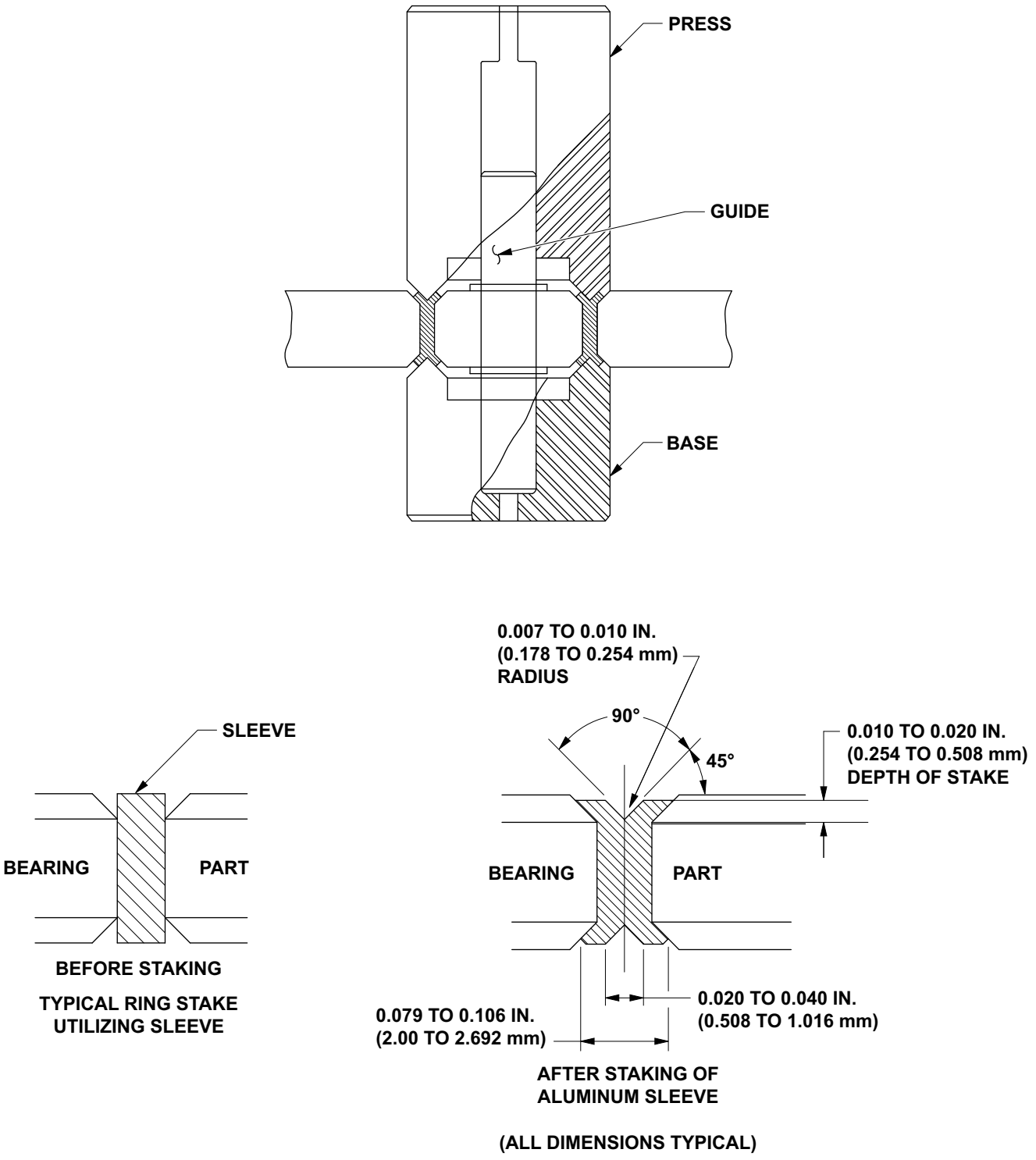

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Figure 9-2. Ring Staking

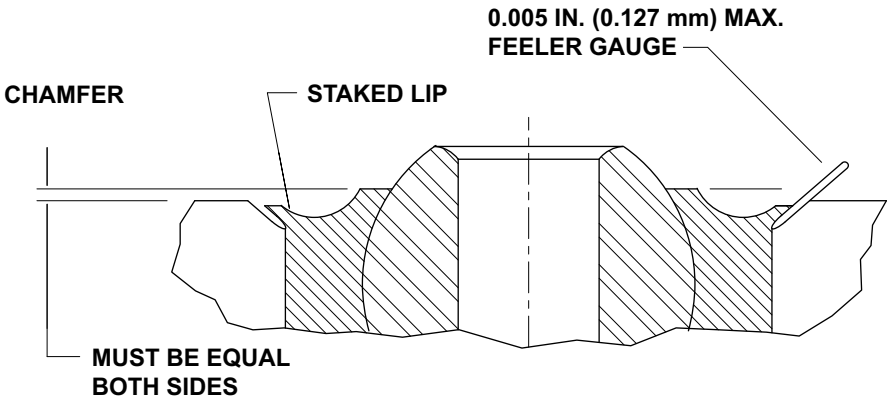

Figure 9-3. Roll or Anvil Staking Pregrooved Bearings

b. Apply coating, as specified in Table 9-5, to the outside diameter of the new bearing and to the mating bore in the part.

CAUTION

DURING BEARING INSTALLATION, MAKE SURE YOU APPLY PRESSURE ONLY TO THE OUTER RACE. DO NOT APPLY PRESSURE TO THE INNER RACE AND SPHERICAL BALL OF THE BEARING OR DAMAGE MAY OCCUR.

c. While the coating is wet, press the bearing into the part with the bearing/sleeve removal and installation tool set (Figure 9-1). The bearing must be equally centered from each side of the part.

d. Select the applicable roll staking tool given in Table 9-5.

NOTE

The base (or backstop) receives the inner race of the bearing and supports the outer race during staking.

The roller fixture (or spinning tool) has a pilot on the lower end that goes into the inner race, roller wheels that contact the groove in the outer race, and a shank that mounts in a drill press.

e. Install the roll staking tool in a hand-fed drill press. Set the spindle to a speed of 200 to 350 RPM.

CAUTION

DO NOT LET THE BEARING OVERHEAT DURING STAKING (SPINNING). IF IT BECOMES UNCOMFORTABLE TO HOLD THE BEARING WITH BARE HANDS, THE BEARING IS DAMAGED AND MUST BE REPLACED.

NOTE

Undue forcing of the roll staking tool into the outer lip of the pregrooved bearing will cause excessive stress and binding of the staked bearing.

f. After you start the drill press, roll stake both sides of the bearing as follows:

(1) Carefully apply a small quantity of oil to the area of staking and to the staking rollers immediately prior to staking.

NOTE

The bearing must be centered in the part and staked the same amount on both sides. To meet this requirement, it may be necessary to partially stake one side, stake the opposite side, then reverse bearing back to first side and finish staking.

(2) Apply a steady pressure to the lever of the drill press in 10-second intervals. This allows the rollers to move the outer race lip of the bearing onto the chamfer of the part.

(3) Repeat staking on the other side of the bearing in the same way.

(4) After staking, remove oil completely with clean cheesecloth (C-486) moistened with drycleaning solvent (C-304).

g. Examine the bearing for correct installation as follows:

(1) Make sure the gap between the chamfer of the part and the staked (rolled) lip of the bearing outer race is no more than 0.005 inch (0.127 mm), as shown in Figure 9-3. As required, stake the bearing again.

(2) Make sure there is no movement or looseness of the bearing outer race in the bore of the part.

(3) Make sure the bearing is centered in the part.

h. Examine the bearing for smooth rotation.

i. Proof load the bearing if required (Table 9-5).

j. If applicable, do a check of the breakout (misalignment), breakaway, or rotational (roll) torque

of the bearing as follows (refer to Table 9-5 for specific requirements):

(1) Secure a bolt to the bearing inner race with nuts and washers and rotate the race with a torque wrench, or use a spring scale attached to the bolt (Figure 9-4).

9-8. Bearing Installation — Roll Staking Method

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent
C-486	Cheesecloth

Roll staking is used for aluminum sleeves. The sleeve is placed between the bearing and the enlarged bore of the housing. Swaging the extended part of the sleeve provides both axial retention and radial tightness, as shown in Figure 9-5.

1. Roll stake as follows:

CAUTION

EXTREME CARE MUST BE EXERCISED TO AVOID ANY CONTAMINATION OF BEARING DURING ALL PHASES OF HANDLING AND INSTALLATION.

a. Measure the bore of the part, new bearing, and new bearing sleeve to make sure the dimensions will provide the correct fit given in Table 9-5.

b. Apply coating, as specified in Table 9-5, to the outside diameter of the new sleeve and to the mating bore in the part.

c. While the coating is wet, press the sleeve into the part with the bearing/sleeve removal and installation tool set (Figure 9-1). The sleeve must be equally centered from each side of the part.

d. Make sure the inside diameter of the sleeve meets the hole size for the bearing, as specified in Table 9-5. Ream the sleeve to the required diameter if necessary.

e. Apply coating, as specified in Table 9-5, to the outside diameter of the bearing and to the inside diameter of the previously installed sleeve. Avoid excessive application of coating and do not apply to the bearing seals or shields.

CAUTION

DURING BEARING INSTALLATION, MAKE SURE YOU APPLY PRESSURE ONLY TO THE OUTER RACE. DO NOT APPLY PRESSURE TO THE INNER RACE AND SPHERICAL BALL OF THE BEARING OR DAMAGE MAY OCCUR.

f. While the coating is wet, press the new bearing into the sleeve with the bearing/sleeve removal and installation tool set (Figure 9-1). The bearing must be equally centered from each side of the part.

g. Select the applicable roll staking tool given in Table 9-5.

h. Install the roll staking tool in a hand-fed drill press. Set the spindle to a speed of 200 to 350 RPM.

i. After you start the drill press, roll stake both sides of the sleeve as follows (Figure 9-5):

NOTE

The bearing must be centered in the part and staked the same amount on both sides. To meet this requirement, it may be necessary to partially stake one side, stake the opposite side, then reverse bearing back to first side and finish staking.

(1) Apply a steady pressure to the lever of the drill press in 10-second intervals. This will allow rollers to flow the metal out.

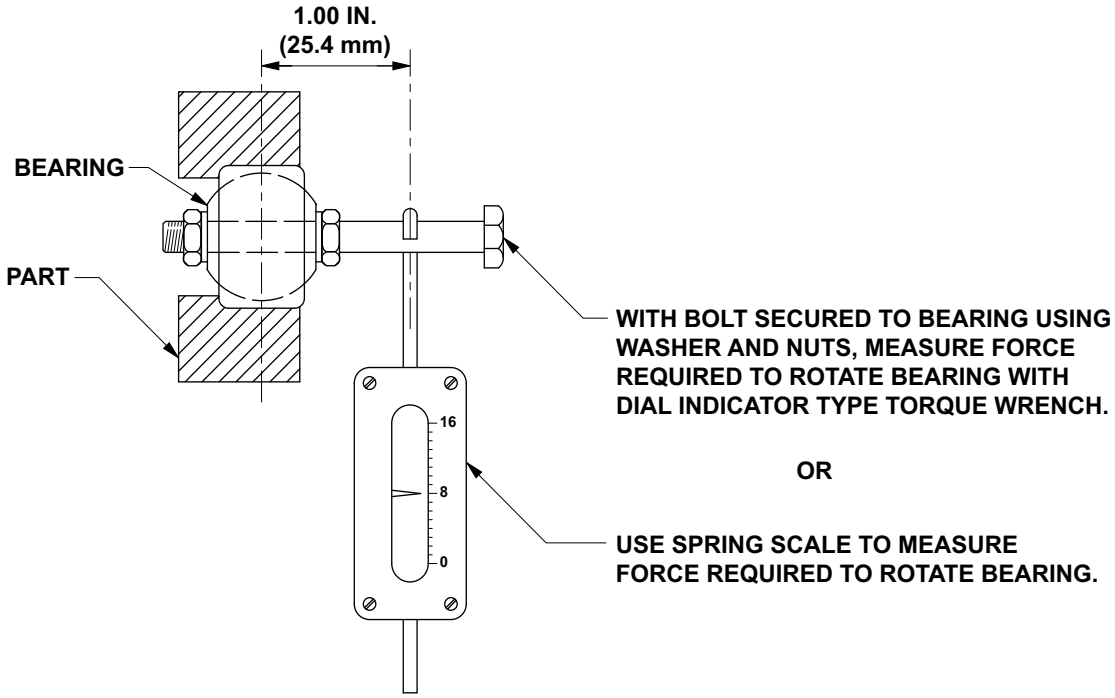

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Figure 9-4. Bearing Rotational Torque Check

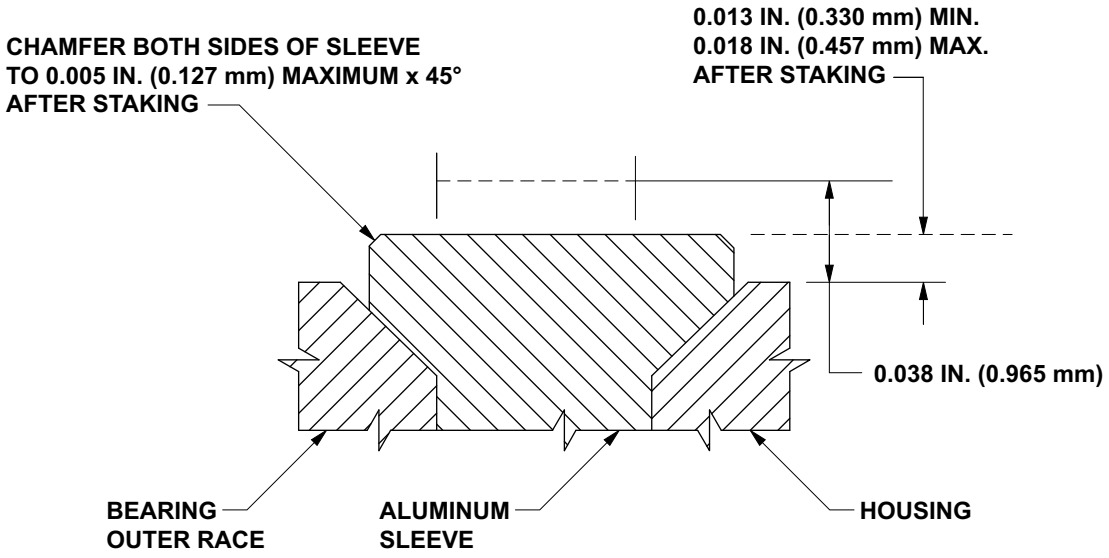

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Figure 9-5. Roll Staking Sleeves or Bushings

(2) Repeat staking on the other side of the sleeve in the same way.

j. Clean any excess coating with clean cheesecloth (C-486) moistened with drycleaning solvent (C-304).

k. Chamfer both sides of the sleeve to 0.005 inch (0.127 mm) maximum by 45°.

l. Make sure there is no movement or looseness of the bearing outer race in the bore of the part.

m. Proof load the bearing if required (Table 9-5).

n. Examine the bearing for smooth rotation and, if applicable, do a check of the breakout (misalignment), breakaway, or rotational (roll) torque (Table 9-5).

9-9. Bearing Installation — Segment Staking Method

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent
C-486	Cheesecloth

NOTE

As segment staking uses the parent metal of the housing to retain the bearing, subsequent bearing replacement using the same housing is not authorized.

Segment staking is used on steel housings and trunnions/axles. Segment staking retains the outer bearing race by staking parent metal of the housing, as shown in Figure 9-6.

1. Segment stake as follows:

CAUTION

EXTREME CARE MUST BE EXERCISED TO AVOID ANY CONTAMINATION OF BEARING DURING ALL PHASES OF HANDLING AND INSTALLATION.

a. Measure the bore of the part and the outside diameter of a new bearing to make sure the dimensions will provide the interference fit given in Table 9-5.

b. Apply coating, as specified in Table 9-5, to the outside diameter of the new bearing and to the mating bore in the part.

CAUTION

DURING BEARING INSTALLATION, MAKE SURE YOU APPLY PRESSURE ONLY TO THE OUTER RACE. DO NOT APPLY PRESSURE TO THE INNER RACE AND SPHERICAL BALL OF THE BEARING OR DAMAGE MAY OCCUR.

c. While the coating is wet, press the bearing into the part with the bearing/sleeve removal and installation tool set (Figure 9-1). The bearing must be equally centered from each side of the part.

d. Select the applicable segment staking tool given in Table 9-5. Segment stake to obtain the required dimensions on both sides of the part (Figure 9-6).

e. Clean any excess coating with clean cheesecloth (C-486) moistened with drycleaning solvent (C-304).

f. Examine the bearing for smooth rotation.

g. If applicable, do a check of the breakout (misalignment), breakaway, or rotational (roll) torque of the bearing as follows (refer to Table 9-5 for specific requirements):

(1) Secure a bolt to the bearing inner race with nuts and washers and rotate the race with a torque wrench, or use a spring scale attached to the bolt (Figure 9-4).

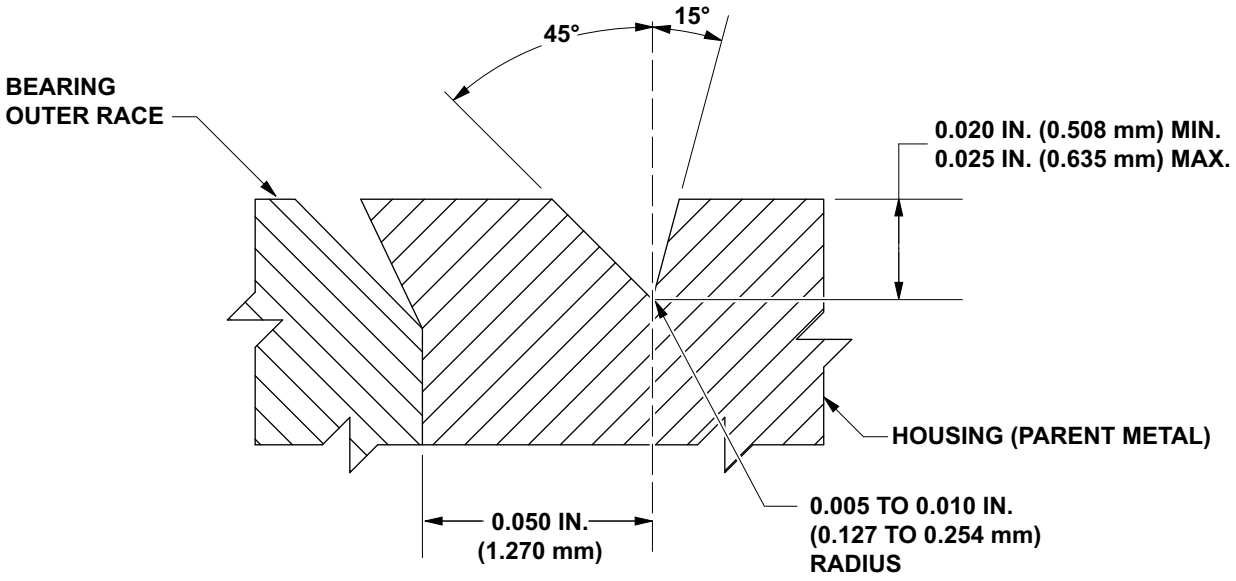

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Figure 9-6. Segment Staking

9-10. Pregrooved Bearing Installation — Anvil Staking Method

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent
C-486	Cheesecloth

Anvil staking is used for the staking of pregrooved bearings to the part by laying over the pregrooved outer lip of the bearing onto the chamfer of the part, as shown in Figure 9-3.

Anvil type staking is used in applications where a roll staking tool cannot be used (refer to Table 9-5 for applicable tools).

1. Anvil stake as follows:

CAUTION

EXTREME CARE MUST BE EXERCISED TO AVOID ANY CONTAMINATION OF BEARING DURING ALL PHASES OF HANDLING AND INSTALLATION.

a. Measure the bore of the part and the outer diameter of a new bearing to make sure the dimensions will provide the proper fit given in Table 9-5.

b. Apply coating, as specified in Table 9-5, to the outer diameter of the bearing and to the mating bore in the part.

c. While the coating is wet, press the bearing into the part with the bearing/sleeve removal and installation tool set (Figure 9-1). The bearing must be equally centered from each side of the part.

NOTE

Undue forcing of the anvil staking tool into the outer lip of the pregrooved bearing will cause excessive stress and binding of the staked bearing.

The bearing must be centered in the part and staked the same amount on both sides. To meet this requirement, it may be necessary to partially stake one side, stake the opposite side, then reverse bearing back to first side and finish staking.

d. Select the applicable anvil staking tool given in Table 9-5 and anvil stake both sides of the bearing.

e. Examine the bearing for correct installation as follows:

(1) Make sure the gap between the chamfer of the part and the staked lip of the bearing outer race is not more than 0.005 inch (0.127 mm), as shown in Figure 9-3. As required, stake the bearing again.

(2) Make sure there is no movement or looseness of the bearing outer race in the bore of the part.

(3) Make sure the bearing is centered in the part.

f. Clean any excess coating with clean cheesecloth (C-486) moistened with drycleaning solvent (C-304).

g. Examine the bearing for smooth rotation.

h. Proof load the bearing if required (Table 9-5).

i. If applicable, do a check of the breakout (misalignment), breakaway, or rotational (roll) torque of the bearing as follows (refer to Table 9-5 for specific requirements):

(1) Secure a bolt to the bearing inner race with nuts and washers and rotate the race with a torque wrench, or use a spring scale attached to the bolt (Figure 9-4).

9-11. PROTECTION OF STAKED BEARINGS DURING INSPECTION

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-217	Peelable Coating
C-304	Drycleaning Solvent
C-486	Cheesecloth

Prior to the fluorescent penetrant inspection or magnetic particle inspection of parts with staked bearings installed, the bearings must be protected with a peelable coating (C-217).

1. Clean the exposed surface of the bearing with clean cheesecloth (C-486) moistened with drycleaning solvent (C-304).

NOTE

Where possible, the peelable coating (C-217) should overlap the bearing outer diameter 0.125 to 0.250 inch (3.18 to 6.35 mm).

2. Apply a peelable coating (C-217) to the exposed surface of the bearing.

3. After the inspection and final cleaning of the part, remove the peelable coating (C-217) from the bearing.

4. Examine the bearing for cleanliness and smooth rotation.

9-12. BUSHINGS

9-13. BUSHINGS — REPLACEMENT

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
Workaid Item (Figure 9-7)	Bushing Removal and Installation Tool Set

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-201	Zinc Chromate Primer
C-309	MEK
C-317	Adhesive
C-407	Abrasive Pad
C-486	Cheesecloth

1. Press out an unserviceable bushing with the bushing removal and installation tool set (Figure 9-7) as follows:

a. Put the bushing over the fabricated support tool.

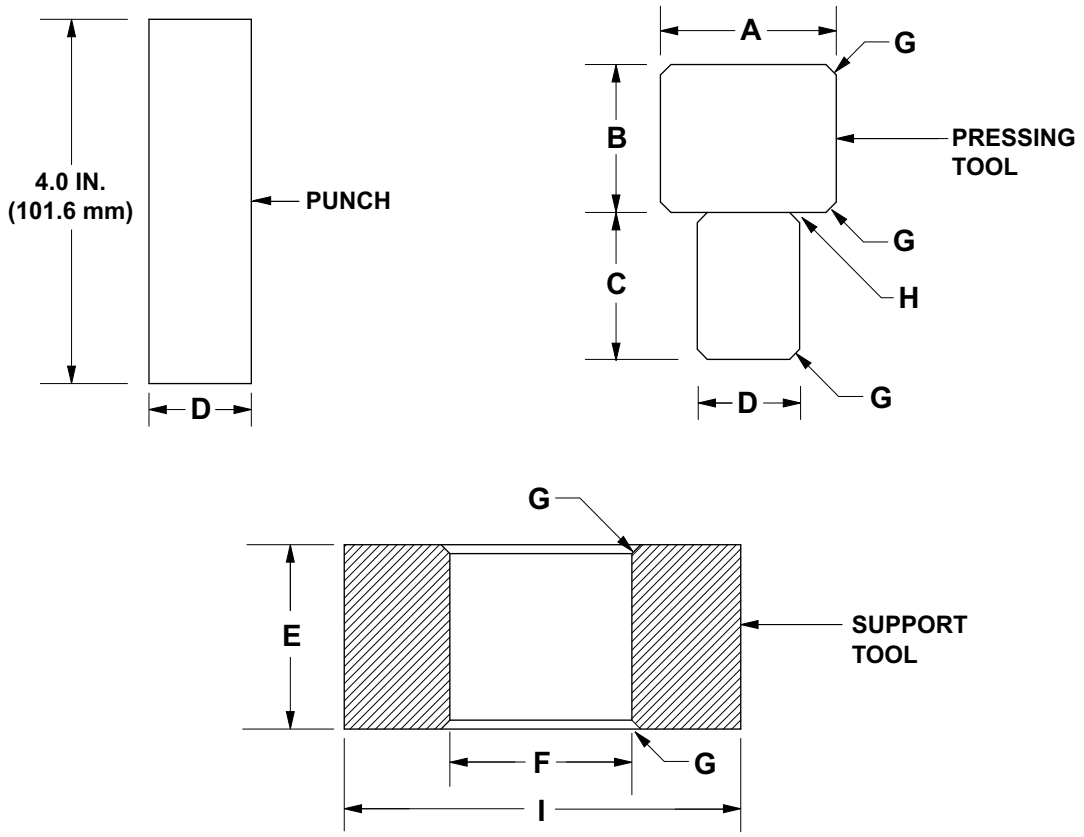
b. Press out the bushing with the fabricated pressing tool.

c. Thoroughly clean adhesive or primer from the bore of the part with MEK (C-309) and an abrasive pad (C-407).

NOTE

Damage must be removed without exceeding the limit of the maximum bore diameter (refer to the wear, damage, and repair limits of the applicable part).

d. Inspect the bore of the part for damage.



MATERIAL: ANY ALLOY STOCK

NO.	REF LTR	DIMENSIONS
1	A	Slightly smaller than bushing outside diameter.
2	B	Same as bushing length.
3	C	1/2 of bushing length.
4	D	Slightly smaller than bushing inside diameter.
5	E	Slightly longer than bushing length.
6	F	Slightly larger than bushing flange O.D.
7	G	Chamfer 0.025 inch (0.635 mm) by 45°.
8	H	Undercut 0.005 inch (0.127 mm) deep x 0.015 inch (0.381 mm) long.
9	I	Support tool should be large enough to extend ears on either side of lug part to press bushings in or out.

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Figure 9-7. Bushing Removal and Installation Workaids

2. Press a new bushing into the bore of the part with the bushing removal and installation tool set (Figure 9-7) as follows:

a. Clean the new bushing and the bore of the part with clean cheesecloth (C-486) moistened with MEK (C-309). Wipe dry with clean cheesecloth (C-486) before the MEK (C-309) evaporates.

b. As required, apply zinc chromate primer (C-201) or other specified primer, or adhesive (C-317) to the outside diameter of the bushing and the bore of the part.

c. Make sure to install the part on an appropriate support to prevent distortion or stress of the part during pressing.

NOTE

The bushing must have a 0.0005 to 0.0015 inch (0.0127 to 0.0381 mm) interference fit in the bore of the part.

d. Press the bushing into the bore of the part until flush with the part (flanged type bushings) or equally centered from each side (slip type bushings).

e. Clean any excess primer or adhesive with clean cheesecloth (C-486) moistened with MEK (C-309).

f. Allow the zinc chromate primer (C-201) or other specified primer, or the adhesive (C-317) to cure before you ream the bushings. Choose between the following normal and accelerated curing time of the adhesive (C-317):

- Curing time at room temperature: 24 hours at 70 to 90°F (21 to 32°C), or
- Curing time with a heat source: 60 minutes at 170 to 190°F (77 to 88°C).

NOTE

Bushing must be in line and have a surface finished of 63 RHR.

g. As required, ream and countersink the bushings.

9-14. ROD END BEARINGS, INSERTS, AND CLEVIS — REPLACEMENT

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-309	MEK
C-313	Adhesive
C-317	Adhesive

NOTE

The dimensions that you record must be maintained after repair of the control tube assemblies.

1. Record the existing distance between the centers of the bolt holes, in the rod end bearings or clevises, and the angle between the corresponding faces (Figure 9-8 and Table 9-4).

2. Heat the bonded area of the rod end bearing, clevis, or insert without exceeding the applicable temperature limit:

- Maximum of 212°F (100°C) for aluminum control tubes.
- Maximum of 300°F (149°C) for steel control tubes.

3. Clean the parts as follows:

a. Remove the remaining adhesive from the threaded bore of the control tube assembly with a bristle brush and MEK (C-309).

b. Clean the rod end bearing, clevis, and insert threads with a bristle brush and MEK (C-309).

c. Rinse the control tube assembly and replacement fitting with MEK (C-309) and allow to air dry.

NOTE

Unless otherwise specified in notes contained in Table 9-4, adhesive (C-313) is to be used to assemble the rod end bearings, clevises, and inserts on aluminum control tubes and adhesive (C-317) is to be used on steel control tubes.

4. Apply adhesive (C-313) or adhesive (C-317), as applicable, to the threads of the rod end bearing or clevis, to the insert, and internal threads of the control tube assembly.

5. Install the insert until fully seated in the control tube assembly. Torque the insert to a maximum of 100 inch-pounds (11.30 Nm).

6. Install the rod end bearing or clevis into the control tube assembly.

7. Keep the bead of adhesive in excess to provide for good bonding and sealing.

8. Adjust the distance between the centers of the bolt holes and the angle between corresponding faces. Refer to the recorded dimensions and information provided in Figure 9-8 and Table 9-4.

9. Do not touch the rod end bearing, clevis, or insert after you set the length and orientation of the control tube assembly.

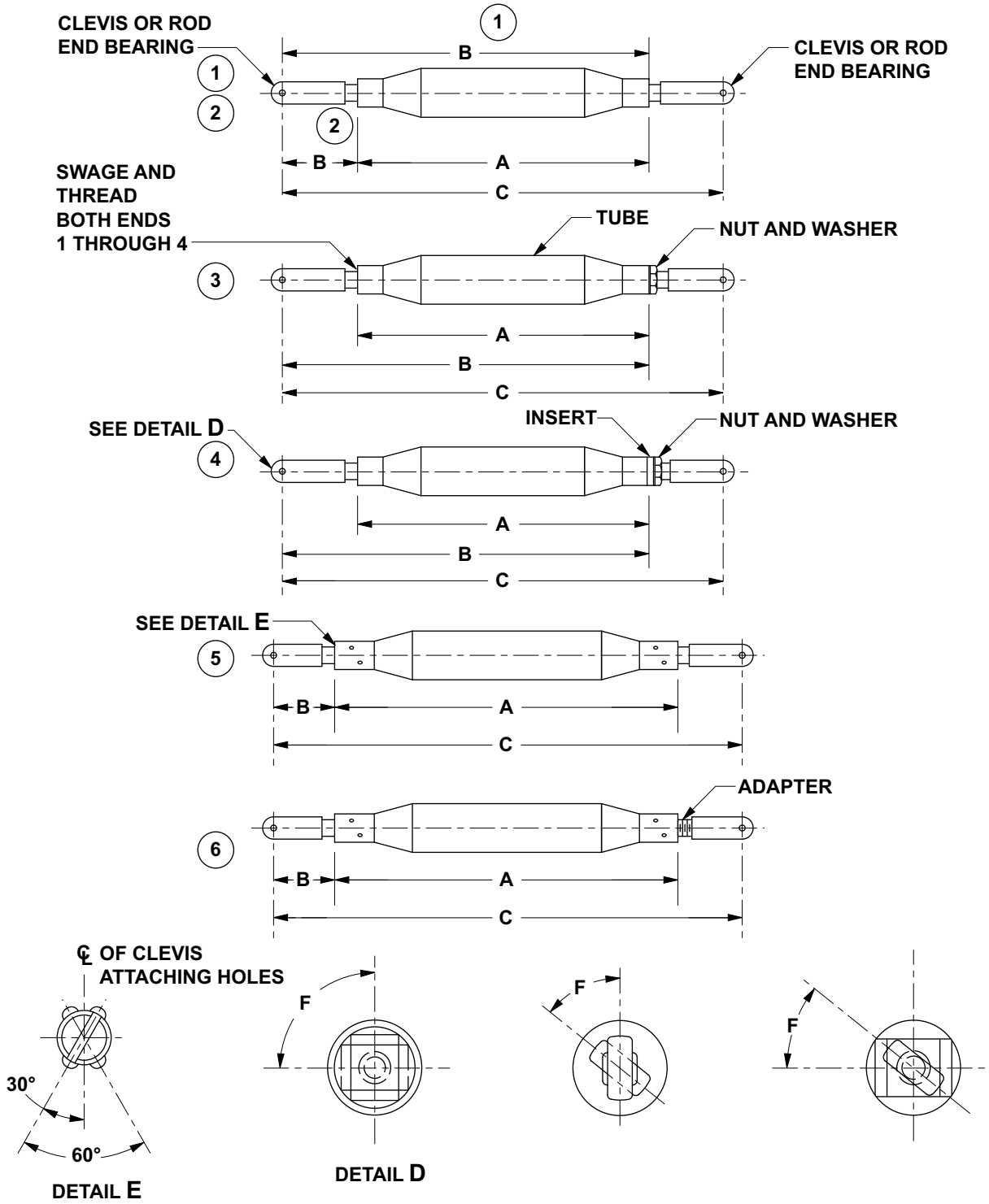
NOTE

Do not use heat to cure adhesive (C-313) or adhesive (C-317).

10. Allow adhesive (C-313) or adhesive (C-317) to cure for 24 hours at 75°F (24°C) (full curing time is 5 to 7 days).

11. Do a proof load test of the bonded rod end bearings, clevises, and inserts using the applicable load value:

- 40 inch-pounds (4.52 Nm) rotational, for 1/4-28 threads.
- 100 inch-pounds (11.30 Nm) rotational, for 3/8-24 threads.



NOTES

1. All dimensions are in Inches. Tolerance ±0.03 inch (±0.762 mm).
2. Refer to configuration numbers for assembly dimensions.

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Figure 9-8. Control Tube Assemblies with Bonded or Riveted Clevises, Inserts, or Rod End Bearings

Table 9-4. Control Tube Assemblies

TUBE ASSEMBLY PART NUMBER	DIMENSIONS (INCHES (CM))			ANGLE (°)	CONFIGURATION NUMBER	NOTES
	A	B	C	F		
204-001-011-013	8.93 (22.7)	12.24 (31.1)	15.55 (39.5)	0	5	△1 and Detail E
204-001-012-001 (BHT-212-SI-4)	35.79 (90.9)	3.31 (8.4)	44.00 (111.8)	–	6	△10 and Detail E
204-001-012-013 (BHT-214-SI-4)	7.34 (18.6)	3.31 (8.4)	15.55 (39.5)	–	6	△10 and Detail E
204-001-012-017	7.91 (20.1	3.31 (8.4)	16.12 (40.9)	–	6	△10 and Detail E
204-001-012-29 (BHT-212-SI-4)	18.46 (46.9)	3.31 (8.4)	26.67 (67.7)	–	6	△10 and Detail E
204-001-014-001	20.60 (52.3)	0.76 (1.9)	22.12 (56.2)	90	5	△9 and Detail E
204-001-014-007	20.60 (52.3)	0.76 (1.9)	22.12 (56.2)	90	5	△9 and Detail E
204-001-016-013	9.50 (24.1)	3.31 (8.4)	16.12 (40.9)	90	5	△1 and Detail E
204-001-027-005	49.70 (126.2)	3.31 (8.4)	56.32 (143.1)	178-182	5	△1 and Detail E
204-001-027-023	43.72 (111.0)	3.31 (8.4)	50.34 (127.9)	178-182	5	△1 and Detail E
204-001-047-001	–	–	7.92 (20.1)	–	–	△11 and Detail E
204-001-957-001	3.59 (9.1)	–	10.21 (25.9)	0	5	△1 and Detail E
204-010-925-009	14.02 (35.6)	14.70 (37.3)	17.18 (43.6)	–	–	△9 and Detail E
204-060-719-037	25.81 (65.6)	0.62 (1.6)	27.05 (68.7)	0	5	△24 and Detail E
204-060-719-039	16.46 (41.8)	0.62 (1.6)	17.70 (45.0)	0	5	△24 and Detail E
204-060-719-041	34.01 (86.4)	0.62 (1.6)	35.25 (90.0)	0	5	△24 and Detail E
204-060-719-043	16.70 (42.4)	0.62 (1.6)	7.94 (20.2)	0	5	△24 and Detail E
204-060-719-045	25.81 (65.6)	0.62 (1.6)	27.05 (68.7)	0	5	△24 and Detail E
204-060-719-047	18.60 (47.2)	0.62 (1.6)	19.92 (50.6)	0	5	△24 and Detail E

Table 9-4. Control Tube Assemblies (Cont)

TUBE ASSEMBLY PART NUMBER	DIMENSIONS (INCHES (CM))			ANGLE (°)	CONFIGURATION NUMBER	NOTES
	A	B	C	F		
204-060-753-025	20.19 (51.3)	0.62 (1.6)	22.09 (56.1)	0	5	25 and Detail E
204-060-753-027	31.12 (79.0)	0.62 (1.6)	33.37 (84.8)	0	5	25 and Detail E
204-060-792-009	–	1.81 (4.6)	11.40 (29.0)	–	6	26
204-061-716-001	23.89 (60.7)	24.48 (62.2)	25.73 (65.4)	–	3	27
204-061-716-007	19.57 (49.7)	20.16 (51.2)	21.41 (54.4)	–	3	27
205-001-011-001	56.27 (143.0)	3.31 (8.4)	62.89 (159.7)	0	5	1 and Detail E
205-001-011-005	47.31 (120.2)	3.31 (8.4)	53.93 (137.0)	65-69	5	1 and Detail E
205-001-011-009	51.41 (130.6)	3.31 (8.4)	53.03 (134.7	21-25	5	1 and Detail E
205-011-017-001	23.39 (59.4)	1.76 (4.5)	30.05 (76.3)	–	6	10 and Detail E
205-001-017-007	36.29 (92.2)	1.76 (4.5)	42.95 (109.1)	–	6	1 and Detail E
205-001-018-005	49.48 (125.7)	3.31 (8.4)	56.10 (142.5)	0	5	1 and Detail E
205-001-021-007	24.78 (62.9)	22.01 (55.9)	20.96 (53.2)	0		
205-001-033-001	5.25 (13.3)	3.31 (8.4)	9.94 (25.2)	0	5	25 and Detail E
205-001-053-007	22.30 (56.6)	19.85 (50.4)	19.10 (48.5)	0		
205-001-053-011	20.83 (52.9)	18.38 (46.7)	17.63 (44.8)	0		
205-001-054-001	30.05 (76.3)	27.45 (69.7)	25.75 (63.5)	0		
205-001-054-007	42.95 (109.1)	40.53 (102.9)	38.83 (98.6)	0		
205-001-055-001	20.83 (52.9)	18.30 (46.5)	17.55 (44.6)	0		
205-001-055-013	22.30 (56.6)	19.77 (50.2)	19.02 (48.3)	0		
205-060-107-001	17.61 (44.7)	0.75 (1.9)	19.07 (48.4)	0	5	9
205-060-702-001	35.16 (89.3)	1.28 (3.3)	37.68 (95.7)	0	5	25 and Detail E
205-060-712-001	–	1.81 (4.6)	20.47 (52.1)	–	6	26

Table 9-4. Control Tube Assemblies (Cont)

TUBE ASSEMBLY PART NUMBER	DIMENSIONS (INCHES (CM))			ANGLE (°)	CONFIGURATION NUMBER	NOTES
	A	B	C	F		
205-060-729-019	36.65 (93.1)	0.62 (1.6)	37.90 (96.3	0	5	24 and Detail E
205-060-729-021	23.91 (60.7)	0.62 (1.6)	25.16 (63.9	0	5	24 and Detail E
205-060-729-023	22.76 (57.8)	0.62 (1.6)	24.02 (61.0)	0	5	24 and Detail E
205-060-729-025	32.32 (82.1)	0.62 (1.6)	33.57 (85.3)	0	5	24 and Detail E
205-060-733-009	–	1.81 (4.6)	11.17 (28.4)	–	6	26
205-060-734-009	12.70 (32.3)	0.62 (1.6)	13.95 (35.4)	0	5	24 and Detail E
205-060-734-011	20.06 (51.1)	0.62 (1.6)	21.31 (54.1)	0	5	24 and Detail E
206-001-020-029	46.60 (118.4)	47.29 (120.1)	47.99 (121.9)	0	1	7
206-001-020-033	38.82 (98.6)	39.51 (100.4)	40.20 (102.1)	142	1	7
206-001-020-049	9.53 (24.2)	10.26 (26.1)	10.99 (27.9)	5	1	7
206-001-020-067 (Dual Controls Kit)	11.18 (28.4)	11.91 (30.3)	12.65 (32.1)	175	1	7
206-001-020-075	28.66 (72.8)	29.35 (74.5)	30.04 (76.3)	0	1	7
206-001-020-101	9.77 (24.8)	10.50 (26.7)	11.23 (28.5)	5	1	7
206-001-021-013	167.27 (424.9)	167.96 (426.6)	168.65 (428.4)	90	1	1
206-001-021-021	167.27 (424.9)	167.96 (426.6)	168.65 (428.4)	90	1	1
206-001-021-017	156.84 (398.4)	157.53 (400.1)	158.22 (401.9)	90	1	7
206-001-022-073	43.79 (111.2)	44.48 (113.1)	45.86 (116.5)	–	3	6
206-001-022-085	13.75 (34.9)	14.44 (36.7)	15.82 (40.2)	–	3	6
206-001-032-001	18.63 (47.3)	19.43 (49.4)	20.23 (51.4)	0	1	7
206-001-058-101	167.27 (424.9)	167.96 (426.6)	168.65 (428.4)	90	1	7
206-001-059-101	157.86 (401.1)	157.55 (400.2	158.22 (401.9)	90	1	7

Table 9-4. Control Tube Assemblies (Cont)

TUBE ASSEMBLY PART NUMBER	DIMENSIONS (INCHES (CM))			ANGLE (°)	CONFIGURATION NUMBER	NOTES
	A	B	C	F		
206-001-088-001	47.00 (119.4)	47.69 (121.1)	48.38 (122.9)	0	1	7
206-001-089-001	63.80 (162.1)	64.50 (163.8)	65.20 (165.6)	33	1	7
206-001-089-009	63.34 (160.9)	64.03 (162.6	64.72 (164.4)	11°40	1	7
206-001-096-001	46.03 (116.9)	46.72 (118.7)	48.04 (122.0)	–	4	18
206-001-096-007	41.90 (106.4)	42.59 (108.2)	43.91 (111.5)	–	4	18
206-001-096-013	30.51 (77.5)	31.20 (79.2)	32.52 (82.6)	–	4	18
206-001-096-031	52.75 (134.1)	53.44 (135.7)	54.90 (139.4)	–	4	18
206-001-096-037	46.03 (116.9)	46.72 (118.7)	48.04 (122.0)	–	4	18
206-001-096-043	41.90 (106.4)	42.59 (108.2)	43.91 (111.5)	–	4	18
206-001-096-113	–	29.82 (75.7)	31.14 (79.1)	–	4	18
206-001-097-007	51.21 (130.1)	51.96 (132.1)	53.45 (135.8)	–	4	18
206-001-097-101	50.12 (127.3)	50.87 (129.2)	52.36 (133.1)	–	4	18
206-001-098-001	14.60 (37.1)	16.32 (41.5)	17.82 (45.3)	–	4	20
206-001-099-001	9.08 (23.1)	11.17 (28.4)	14.10 (35.8	–	4	18
206-001-189-001	5.03 (12.8)	7.12 (18.1)	10.04 (25.5)	–	4	18
206-001-190-001	6.80 (17.3)	8.89 (22.6)	11.82 (30.0)	–	4	18
206-001-191-001	77.44 (196.7)	79.12 (201.1)	80.63 (204.8)	–	4	18
206-001-192-001	14.90 (97.8)	16.19 (41.1)	18.28 (46.4)	0	1	4
206-001-193-001	12.07 (30.7)	14.16 (36.1)	16.26 (41.3)	0	1	4
206-001-194-001	7.20 (18.3)	9.29 (23.6)	11.38 (28.9)	0	1	4
206-001-194-005	6.32 (16.1)	8.41 (21.4	10.50 (26.7	0	1	4
206-001-558-001	–	–	6.98 (17.7)	–	–	13

Table 9-4. Control Tube Assemblies (Cont)

TUBE ASSEMBLY PART NUMBER	DIMENSIONS (INCHES (CM))			ANGLE (°)	CONFIGURATION NUMBER	NOTES
	A	B	C	F		
206-001-558-003	–	–	6.98 (17.7)	–	–	13
206-001-558-101	–	–	6.98 (17.7)	–	–	13
206-001-558-103	–	–	6.98 (17.7)	–	–	13
206-011-725-001	–	5.15 (13.1)	6.06 (15.4)	90	3	20
206-061-745-061	7.90 (20.1)	–	10.85 (27.6)	–	6	22 and Detail
206-062-713-001	36.53 (92.8)	37.12 (94.3)	38.40 (97.5)	–	3	27 and Detail
206-063-703-001	8.19 (20.8)	–	11.14 (28.3)	–	6	22 and Detail
206-063-706-001	5.31 (13.5)	5.90 (15.1)	7.14 (18.1)	–	6	22 and Detail
206-064-702-001	8.62 (21.9)	–	11.70 (29.7)	–	6	16 22 and Detail
206-064-702-101	7.76 (19.7)	–	10.85 (27.6)	–	6	16 22 and Detail
212-001-051-001	17.27 (43.9)	18.02 (45.8	20.83 (52.9)	–	3	2
212-001-052-001	104.89 (266.4)	107.01 (271.8)	109.13 (277.2)	75	1	4
212-001-052-101	104.89 (266.4)	107.01 (271.8)	109.13 (377.2)	75	1	4
212-001-052-005	85.26 (216.6)	87.38 (221.9)	89.50 (227.3)	180	1	4
212-001-052-105	85.26 (216.6)	87.38 (221.9	89.50 (227.3	180	1	4
212-001-053-001	103.75 (263.5)	105.81 (268.8)	108.54 (275.7)	–	3	3
212-001-053-101	103.75 (263.5)	105.81 (268.8)	108.54 (275.7)	–	3	3
212-001-054-001	21.49 (54.6)	23.55 (59.8)	25.61 (65.0)	180	1	4
212-001-054-005	36.64 (93.1)	38.70 (98.3)	40.76 (103.5)	90	1	4
212-001-055-001	63.63 (161.6)	65.69 (166.9)	67.75 (172.1)	90	1	4
212-001-055-101	63.63 (161.69)	65.69 (166.9)	67.75 (172.1)	90	1	4
212-001-056-001	10.07 (25.6)	10.82 (27.5)	12.88 (32.7)	0	1	5

Table 9-4. Control Tube Assemblies (Cont)

TUBE ASSEMBLY PART NUMBER	DIMENSIONS (INCHES (CM))			ANGLE (°)	CONFIGURATION NUMBER	NOTES
	A	B	C	F		
212-001-057-001	26.28 (66.8)	28.34 (72.1)	31.15 (79.1)	–	3	3
212-001-060-001	21.07 (53.5)	21.82 (55.4)	23.20 (58.9)	–	3	6
212-001-061-001	35.08 (89.1)	2.15 (5.5)	38.11 (96.8)	0	2	5
212-001-062-001	20.23 (51.4)	20.83 (52.9)	21.48 (54.6)	50	1	7
212-001-062-003	21.75 (55.2)	22.35 (56.8)	23.00 (58.4)	130	1	7
212-001-063-001	17.74 (45.1)	18.40 (46.7)	20.71 (52.6)	130	3	2
212-001-063-003	16.23 (41.2)	16.89 (42.9)	18.60 (47.2)	50	3	2
212-001-252-001	20.99 (53.3)	21.74 (55.2)	23.20 (58.9)	–	4	18
212-001-270-001	34.42 (87.4)	35.27 (89.6)	38.11 (96.8)	–	4	18
212-001-322-001	17.19 (43.7)	17.94 (45.6)	20.83 (52.9)	–	4	18
212-001-755-001	59.97 (152.3)	60.80 (154.4)	62.89 (159.7)	0	1	5
212-060-724-003	7.51 (19.1)	8.10 (20.6)	9.34 (23.7)	–	3	6
212-060-724-007	38.42 (97.6)	39.01 (99.1)	40.25 (102.2)	–	3	6
212-060-724-011	22.54 (57.3)	23.13 (58.8)	23.72 (60.2)	0	1	7
212-060-724-013	10.88 (27.6)	11.63 (29.5)	12.22 (31.0)	0	1	7
212-060-724-015	36.41 (92.5)	37.00 (94.1)	37.59 (95.5)	0	1	7
212-060-724-017	35.31 (89.7)	35.90 (91.2)	36.49 (92.7)	0	1	7
212-060-724-019	31.01 (78.8)	31.60 (80.3)	32.19 (81.8)	0	1	7
212-060-724-021	23.85 (60.6)	24.44 (62.1)	25.68 (65.2)	90	3	6
212-060-724-025	25.11 (63.8)	25.70 (65.3)	26.94 (68.4)	90	3	6
212-060-724-029	41.47 (105.3)	42.06 (106.8)	42.65 (108.3)	0	1	7
212-060-724-031	41.53 (105.5)	42.12 (107.1)	42.71 (108.5)	0	1	7

Table 9-4. Control Tube Assemblies (Cont)

TUBE ASSEMBLY PART NUMBER	DIMENSIONS (INCHES (CM))			ANGLE (°)	CONFIGURATION NUMBER	NOTES
	A	B	C	F		
212-060-724-033	26.85 (68.2)	27.44 (69.7)	28.68 (72.8)	–	3	6
212-060-724-037	23.20 (58.9)	23.79 (60.4	25.03 (63.6)	–	3	6
212-060-724-041	16.16 (41.0)	16.75 (42.5)	17.34 (44.0)	0	1	7
212-060-724-043	37.92 (96.3)	38.51 (97.8)	39.75 (100.9)	–	3	6
212-060-724-101	40.87 (103.8)	41.46 (105.3)	42.05 (106.8)	0	1	7
212-060-724-105	38.29 (97.3)	38.88 (98.8)	40.12 (101.9)	–	3	18
212-060-724-109	38.29 (97.3)	39.01 (99.1)	40.25 (102.2)	–	3	18
212-076-151-001	26.66 (67.7)	28.02 (71.2)	31.00 (78.7)	–	4	3
212-076-151-003	21.09 (53.6)	22.39 (56.9)	25.43 (64.6)	0	4	4
212-076-151-007	26.48 (67.3)	28.02 (71.2)	31.00 (78.7)	–	4	3
212-076-151-009	20.91 (53.1)	22.39 (56.9)	25.43 (64.6)	–	4	3
212-076-151-101	–	23.14 (58.8)	26.18 (66.5)	90	3	3
214-001-020-001	39.25 (99.7)	41.31 (104.9)	44.00 (111.8)	–	4	18
214-001-020-013	21.92 (55.7)	23.98 (60.9)	26.67 (67.7)	–	4	18
214-001-020-101	21.80 (55.4)	23.89 (60.7)	26.67 (67.7)	–	4	18
214-001-020-107	11.25 (28.6)	13.34 (33.9)	16.12 (40.9)	–	4	18
214-001-020-113	39.13 (99.4)	41.22 (104.7)	44.00 (111.8)	–	4	18
214-001-020-119	17.67 (44.9)	19.76 (50.2)	22.54 (57.3)	–	4	18
214-001-020-125	35.77 (90.9)	37.86 (96.2)	40.64 (103.2)	–	4	18
214-001-022-001	27.98 (71.1)	29.72 (75.5)	32.45 (82.4)	90	4	18
214-001-022-101	27.58 (70.1)	29.32 (74.5)	31.93 (81.1)	90	4	18
214-001-023-001	27.32 (69.4)	28.25 (71.8)	30.98 (78.7)	–	4	18

Table 9-4. Control Tube Assemblies (Cont)

TUBE ASSEMBLY PART NUMBER	DIMENSIONS (INCHES (CM))			ANGLE (°)	CONFIGURATION NUMBER	NOTES
	A	B	C	F		
214-001-023-007	24.16 (61.4)	25.09 (63.7)	27.82 (70.7)	–	4	18
214-001-023-101	26.82 (68.1)	27.75 (70.5)	30.48 (77.4)	–	4	18
214-001-026-007	122.62 (311.5)	123.55 (313.8)	126.30 (320.8)	–	4	18
214-001-026-107	134.87 (342.6)	135.80 (344.9)	138.55 (351.9)	–	4	18
214-001-040-001	22.67 (57.6)	24.76 (62.9)	27.55 (70.1)	–	4	18
214-001-041-001	73.18 (185.9	75.27 (191.2)	78.06 (198.3)	–	4	18
214-001-042-001	38.68 (98.2)	40.38 (102.6)	41.03 (104.2)	0	1	5 16
214-001-046-001	41.71 (105.9)	43.41 (110.3)	45.51 (115.6)	90	1	4
214-001-088-001	24.28 (61.7)	26.34 (66.9)	28.40 (72.1)	0	1	4
214-001-088-005	39.15 (99.4)	41.21 (104.7)	43.27 (109.9)	90	1	4
214-001-088-009	8.89 (22.6)	10.95 (27.8)	13.01 (33.0)	90	1	4
214-001-088-013	17.08 (43.4)	19.14 (48.6)	21.20 (53.8	0	1	4
214-001-088-017	35.66 (90.6	37.72 (95.8)	39.78 (101.0)	0	1	4
214-001-088-021	37.33 (94.8)	39.39 (100.1)	41.45 (105.3	0	1	4
214-001-088-025	38.74 (98.4)	40.80 (103.6)	42.86 (108.9	90	1	4
214-001-088-101	41.01 (104.2)	43.07 (109.4)	45.13 (114.6)	90	1	4
214-001-088-105	27.74 (70.5)	29.80 (75.7)	31.86 (80.9)	0	1	4
214-001-088-109	38.73 (98.4)	40.79 (103.6)	42.85 (108.8)	90	1	4
214-001-088-113	39.81 (101.1)	41.87 (106.3)	43.93 (111.6)	0	1	4
214-001-088-117	37.89 (96.2)	39.95 (101.5)	42.01 (106.7	0	1	4
214-001-088-121	43.65 (110.9)	45.71 (116.1)	47.77 (121.3)	0	1	4
214-001-088-125	37.10 (94.2)	39.16 (99.5)	41.22 (104.7)	90	1	4

Table 9-4. Control Tube Assemblies (Cont)

TUBE ASSEMBLY PART NUMBER	DIMENSIONS (INCHES (CM))			ANGLE (°)	CONFIGURATION NUMBER	NOTES
	A	B	C	F		
214-001-088-129	32.47 (82.5)	34.53 (87.7)	36.59 (92.9)	0	1	4
214-001-089-001	21.87 (55.5)	23.56 (59.8)	25.26 (64.2	90	1	4
214-001-090-001	40.90 (103.9)	41.71 (105.9)	42.52 (108.0)	50 RH	1	7
214-001-090-002	40.90 (103.9)	41.71 (105.9)	42.52 (108.0)	50 LH	1	7
214-001-097-005	123.50 (313.7)	124.36 (315.9)	126.44 (321.2)	0	1	5
214-001-098-005	113.73 (288.9)	115.79 (294.1)	117.85 (299.3)	0	1	4
214-001-098-009	113.73 (288.9)	115.79 (294.1)	117.85 (299.3)	0	1	4
214-001-098-013	55.26 (140.4)	57.32 (145.6)	59.38 (150.8)	90	1	4
214-001-098-101	59.54 (151.2)	61.60 (156.5)	63.66 (161.7)	90	1	4
214-001-141-101	41.01 (104.2)	43.07 (109.4)	45.13 (114.6)	90	1	4
214-001-252-101	28.37 (72.1)	29.51 (75.1)	30.65 (77.9)	0	1	4
214-001-252-103	28.09 (71.3)	29.23 (74.2)	30.37 (77.1)	0	1	4
214-001-348-101	–	–	8.67 (22.0)	–	–	13
214-001-790-101	4.75 (12.1)	5.56 (14.1)	8.37 (21.3	–	3	2
214-060-726-001	21.80 (55.4)	22.39 (56.9)	23.64 (60.0)	–	3	6 16
214-060-726-005	10.11 (25.7)	10.70 (27.2)	11.29 (28.7)	0	1	7 16
214-060-726-007	36.82 (93.5)	37.41 (95.0)	38.00 (96.5)	0	1	7 16
214-060-726-009	25.89 (65.8)	26.48 (67.3)	27.07 (68.8)	0	1	7 16
214-060-726-011	23.87 (60.6)	24.46 (62.1	25.05 (63.6)	0	1	7 16
214-060-726-013	24.76 (62.9)	25.35 (64.4)	25.94 (65.9)	0	1	7 16
214-060-726-035	13.14 (33.4)	13.73 (34.9)	14.97 (38.0)	90	3	6 16
214-060-726-041	20.28 (51.5)	21.73 (55.2)	22.98 (58.4)	90	3	15 16

Table 9-4. Control Tube Assemblies (Cont)

TUBE ASSEMBLY PART NUMBER	DIMENSIONS (INCHES (CM))			ANGLE (°)	CONFIGURATION NUMBER	NOTES
	A	B	C	F		
214-060-726-045	14.86 (37.7)	15.45 (39.2)	16.04 (40.7)	0	1	7 16
214-060-726-083	17.61 (44.7)	18.20 (46.2)	18.79 (47.7)	0	1	7 16
214-060-726-093	11.16 (28.3)	12.00 (30.5)	13.25 (33.7)	14	3	6 16
222-001-006-101	141.97 (360.6)	144.06 (365.9)	146.15 (371.2)	0	1	4
222-001-006-103	141.97 (360.6)	144.06 (365.9)	146.15 (371.2)	0	1	4
222-001-007-001	4.54 (11.5)	6.63 (16.8)	9.36 (23.8)	90	4	18
222-001-007-025	9.62 (24.44 cm)	11.71 (29.7)	14.44 (36.7)	–	4	18
222-001-007-101	45.22 (114.9)	47.31 (120.2)	50.04 (127.1)	–	4	18
222-001-007-107	54.15 (137.5)	56.24 (142.8)	58.97 (149.8)	–	4	18
222-001-008-001	29.71 (75.5)	31.80 (80.8)	35.53 (90.2)	–	4	18
222-001-008-013	32.09 (81.5)	34.18 (86.8)	36.91 (93.8)	–	4	18
222-001-012-001	3.83 (9.7)	5.92 (15.0)	8.57 (21.8)	90	3	3
222-001-015-101	37.83 (96.1)	45.83 (116.4)	48.72 (123.7)	–	4	18
222-001-016-101	61.65 (156.6)	62.46 (158.6)	64.09 (162.8	–	4	18
222-001-016-107	18.27 (46.4)	19.08 (48.5)	20.71 (52.6)	–	4	18
222-001-016-113	49.61 (126.0)	50.42 (128.1)	52.05 (132.2)	–	4	18
222-001-017-101	50.74 (128.9)	2.09 (5.3)	53.64 (136.2)	4	2	5
222-001-017-105	5.50 (14.1)	2.09 (5.3)	8.40 (21.3)	90	2	5
222-001-017-109	5.32 (13.5)	2.09 (5.3)	8.22 (20.9)	0	2	5
222-001-017-113	38.73 (98.4)	2.09 (5.3)	41.63 (105.7)	90	2	5
222-001-017-117	2.05 (5.2)	2.09 (5.3)	22.95 (58.3)	0	2	5
222-001-017-121	56.75 (144.1)	2.09 (5.3)	59.65 (151.5)	90	2	5

Table 9-4. Control Tube Assemblies (Cont)

TUBE ASSEMBLY PART NUMBER	DIMENSIONS (INCHES (CM))			ANGLE (°)	CONFIGURATION NUMBER	NOTES
	A	B	C	F		
222-001-017-125	22.22 (56.4)	2.09 (5.3)	25.12 (63.8)	0	2	5
222-001-017-129	28.85 (73.3)	2.09 (5.3)	31.15 (79.1)	0	2	5
222-001-018-105	50.46 (128.2)	0.81 (2.1)	52.08 (132.3	90	2	7
222-001-018-109	14.98 (38.0)	0.81 (2.1	16.60 (42.2)	120	2	7
222-001-018-113	50.90 (129.3)	0.81 (2.1)	52.52 (133.4)	90	2	7
222-001-018-117	25.78 (65.5)	0.81 (2.1	27.40 (69.6)	120	2	7
222-001-019-101	34.94 (88.7)	2.10 (5.3)	39.04 (99.2)	0	2	4
222-001-020-101	11.03 (28.0)	0.81 (2.1)	13.94 (35.4)	90	2	5
222-001-021-101	9.87 (25.1)	10.74 (27.3)	13.62 (34.6)	–	4	18
222-001-021-107	15.32 (38.9)	16.19 (41.1)	19.07 (48.4)	–	4	18
222-001-021-125	10.81 (27.5)	11.68 (29.7)	14.56 (37.1)	–	4	18
222-001-088-101	158.34 (402.2)	2.095 (5.32)	162.53 (412.8)	0	2	4
222-001-088-107	158.34 (402.2)	2.095 (5.32)	162.53 (412.8)	0	2	4
222-001-088-109	158.34 (402.2)	2.095 (5.32)	162.53 (412.8)	0	2	4
222-001-088-111	158.34 (402.2)	2.095 (5.32)	162.53 (412.8)	0	2	4
222-001-511-101	23.50 (59.7)	24.35 (61.8)	25.98 (66.1)	–	4	18
222-060-236-101	11.10 (28.2)	0.65 (1.7)	16.34 (41.5)	–	6	18 and Detail
222-060-236-105	9.85 (25.0)	0.65 (1.7)	15.06 (38.3)	–	6	19 and Detail
222-060-733-003	13.15 (33.4)	13.80 (35.1)	15.02 (38.2)	–	3	6 16
222-060-733-101	11.53 (29.3)	12.18 (30.9)	13.40 (34.0)	–	3	6 16
222-060-760-005	22.69 (57.6)	23.34 (59.3)	24.56 (62.4)	–	3	6 16
230-060-030-101	6.88 (17.5)	7.61 (19.3)	8.92 (22.7)	–	3	6 16

Table 9-4. Control Tube Assemblies (Cont)

TUBE ASSEMBLY PART NUMBER	DIMENSIONS (INCHES (CM))			ANGLE (°)	CONFIGURATION NUMBER	NOTES
	A	B	C	F		
230-060-030-103	5.96 (15.1)	6.69 (17.1)	8.00 (20.3	–	3	6 16
230-060-718-109	10.57 (26.8)	0.65 (1.7)	15.80 (40.1)	–	6	19 and Detail
230-060-719-101	11.97 (30.4)	12.62 (32.1)	13.84 (35.2)	–	3	6 16
407-001-025-109	14.14 (35.9)	16.23 (41.2)	17.56 (44.6)	45	1	16 28
407-001-025-113	14.32 (36.4)	16.49 (41.9)	17.82 (45.3)	135	1	16 28
407-001-025-121	14.14 (35.9)	16.23 (41.2)	17.59 (44.7)	45	1	16 28
407-001-025-123	14.32 (36.4)	16.49 (41.9)	17.85 (45.3)	135	1	16 28
407-001-026-101	–	174.85 (444.1)	175.60 (446.0)	90	1	7 16
407-001-531-101	–	–	6.21 (15.8)	90	1	16 28
412-001-305-101	17.19 (43.7)	17.94 (45.6)	20.83 (52.9)	–	4	18
412-001-307-101	11.14 (28.3)	13.23 (33.6)	16.12 (40.9)	–	4	18

NOTES:

1. Riveted and bonded clevises both ends.
2. Bonded rod end bearing one end, adjustable clevis opposite end.
3. Bonded clevis one end, adjustable clevis opposite end.
4. Bonded clevises both ends.
5. Bonded rod end bearing one end, bonded clevis opposite end.
6. Bonded rod end bearing one end, adjustable rod end bearing opposite end.
7. Bonded rod end bearings both ends.
8. Riveted and bonded rod end bearing one end, riveted and bonded clevis opposite end.
9. Riveted and bonded rod end bearings both ends.
10. Riveted and bonded clevis one end, riveted and bonded adapter and adjustable clevis, opposite end.

Table 9-4. Control Tube Assemblies (Cont)

NOTES (CONT):

11 Riveted clevis on special adapter.

12 Riveted and bonded clevis one end, adjustable clevis opposite end.

13 Adjustable clevis one end, fixed clevis opposite end.

14 Bonded rod end is positioned 115° right of vertical center line when viewing from the bonded rod end.

15 Bonded clevis one end, adjustable rod end bearing opposite end.

16 Uses adhesive (C-317) for clevis/rod end bearing bond to tube assembly.

17 On adjustable control tubes this dimension is nominal. Refer to applicable helicopter rigging procedures.

18 Bonded or riveted rod end or clevis one end, adjustable rod end or clevis and bonded insert opposite end.

19 Bonded rod end one end, bonded and riveted adapter opposite end. Dimension C includes turnbuckle and both rod ends.

20 Rivet rod end one end, adjustable rod end, (and or bonded inset) opposite end.

21 Dimension C is measured from inboard hole on rod ends or clevis.

22 Riveted clevis one end, riveted adapter and adjustable rod end bearing opposite end.

23 Bonded rod end bearing one end, riveted clevis opposite end.

24 Riveted rod end both ends, install with zinc chromate primer (C-201).

25 Riveted rod end or clevis one end, special fitting opposite end.

26 Swaged adapters both ends, riveted rod end one end, adjustable rod end opposite end.

27 Bonded rod end one end, (one rivet required on some assemblies) adjustable rod end opposite end.

28 For tube assembly reindentification, refer to TB 407-03-42.

9-15. ELASTOMERIC BEARINGS

9-16. ELASTOMERIC BEARINGS — GENERAL

1. Elastomeric bearings are used in most transmission, engine, and pylon isolation mounting systems. They are subject to degradation from fatigue, overload, and oil or fluid contamination. Other forms of degradation occur from exposure to excessive heat or atmospheric ozone.

a. Fatigue occurs from normal oscillatory loading and usually causes small flex cracks and/or extrusions of small segments of elastomeric material.

b. Overloading results from excessively high loading of the isolation mounts. Excessive landing forces or other conditions that exceed the mounts limitations can cause overloading. Bearings weakened from fatigue or oil contamination will show signs of overloads during normal operating conditions. Overload signs include mechanical damage to housing, large cracks, or extrusion of elastomer.

c. Oil, fuel, solvent, and grease contamination is the most damaging to elastomeric bearings and usually is the cause of early isolation mount replacement. Bearings contaminated with these fluids become swollen, slick, and show signs of debonding and elastomer separating from metal support. Preventive maintenance is the best method to ensure a long life of elastomeric bearings.

d. Excessive heat exposure will cause the bearing elastomer to become brittle and separate at the bond lines between bearing and support.

e. Ozone cracks due to exposure to the atmosphere occurs along the surface of the elastomer, usually perpendicular to the load. These cracks are small and shallow and will not affect the mount or bearing performance.

f. Wax bloom. Some elastomers use wax to improve ozone protection. During cycling, the wax comes to the surface of the bearing, causing a dirty grayish appearance. This is a normal condition.

9-17. ELASTOMERIC BEARINGS — INSPECTION, MAINTENANCE, AND REPAIR

Refer to the applicable Maintenance Manual (MM) and Component Repair & Overhaul (CR&O) manual for inspection, maintenance, repair, and protection from oil contamination.

Table 9-5. Bearing and Sleeve Replacement Data

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
212 214B 214ST 412 205A-1	204-001-042-001 204-001-042-005	MS27643-4/ AN206DSP4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	△4
205A-1	204-001-148	AN206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	△1

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
205A-1	204-001-148	DW5/ MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A/ 23S6-5A 0.9990 to 1.0000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	1
		AN206DSP3/ MS27643-3 0.7769 to 0.7774 inch (19.7333 to 19.7460 mm)	120-013-3A/ 23S4-3A 0.9060 to 0.9065 inch (23.0124 to 23.0251 mm)	Ring Stake T101873-5	1
205A-1 214B	204-001-178	AN201KP4A/ MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A/ 23S3-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1
		AN201KP5A/ MS27641-5 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	120-012-5A/ 23S3-5A 0.9365 to 0.9375 inch (23.7871 to 23.8125 mm)	Ring Stake T101873-7	1
		AN201KP8A/ MS27641-8 1.1238 to 1.1243 inches (28.5445 to 28.5572 mm)	120-012-8A/ 23S3-8A 1.2495 to 1.2500 inches (31.7373 to 31.7500 mm)	Ring Stake T101873-17	1
205A-1 212 214B 412	204-001-185	MS27643-4/ AN206DSP4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.2239 to 26.1493 mm)	Ring Stake T101873-13	1
205A-1 214B	204-001-195	AN201KP4A/ MS27641-4 0.7488 to 0.7499 inch (19.0195 to 19.0475 mm)	120-012-4A/ 23S3-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
205A-1 214B	204-001-195	AN201KP5A/ MS27641-5 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	120-012-5A/ 23S3-5A 0.9365 to 0.9375 inch (23.7871 to 23.8125 mm)	Ring Stake T101873-7	1
		AN201KP8A/ MS27641-8 1.1238 to 1.1243 inches (28.5445 to 28.5572 mm)	120-012-8A/ 23S3-8A 1.2495 to 1.2500 inches (31.7373 to 31.7500 mm)	Ring Stake T101873-17	1
205A-1 212 412	204-001-332	AN206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1
212 214ST	204-001-333	MS27640-5 1.2490 to 1.2495 inches (31.7246 to 31.7373 mm)	204-001-345-001 1.3740 to 1.3745 inches (34.8996 to 34.9123 mm)	Not Staked	1
		None	204-001-346-001 3.2310 to 3.2315 inches (82.0674 to 82.0801 mm)	Not Staked	8
205A-1 212 214ST	204-001-351	AN206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1
205A-1 212 214ST	204-001-352	AN206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
205A-1 212 214ST	204-001-352	DW4K/ MS27647-4/ DW4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA/ 23S6-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1
205A-1 212 214B 214ST 412	204-001-353	AN200KP4/ MS27640-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-011-4A/ 23S2-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1
		AN201KP4A/ MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A/ 23S3-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	2
205A-1 212 214B 214ST 412	204-001-356	AN206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1
205A-1 212 214B 214ST 412	204-001-357-001 204-001-357-005	AN206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1
204B 205A-1 212	204-001-358 or 212-001-321	AN206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1
205A-1 212 214B 214ST 412	204-001-362-001	AN200KP5/ MS27640-5 1.2490 to 1.2495 inches (31.7246 to 31.7373 mm)	204-001-345-1 1.3740 to 1.3745 inches (34.8996 to 34.9123 mm)	None	1 2 (Hole for bushing)

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
205A-1 212 214B 412	204-001-514-001	MS27641-4/ AN201KP4A 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A/ 23S3-4 0.8660 to 0.8665 inch (21.9964 to 22.0091 mm)	Ring Stake T101873-3	1 2
		None 0.7501 to 0.7505 inch (19.0525 to 19.0627 mm)	120-012-4S/ 23S3-4S 0.8660 to 0.8665 inch (21.9964 to 22.0091 mm)	Ring Stake T101873-3	1
205A-1 212	204-001-559	AN206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1
205A-1 212 412	204-001-603	AN206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1
		MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A/ 23S6-5A 0.9990 to 1.0000 inch (25.3756 to 25.4000 mm)	Ring Stake T101873-11	1
205A-1 212 214B 214ST 412	204-001-700-001	DW6/ MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	120-015-6A/ 23S6-6A 1.1870 to 1.1875 inches (30.1498 to 30.1625 mm)	Ring Stake T101873-15	1
205A-1 212 214B 214ST 412	204-001-701-001	AN201KP6A/ MS27641-6 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-012-6A/ 23S3-6A 0.9990 to 1.0000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-9	1

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
212 214ST	204-001-760-001	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1
205A-1 212 214B 214ST 412	204-001-809	AN206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1
205A-1 212 412	204-001-855-001	AN206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	None	Roll Stake	4
		MS27647-4/ DW4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	Roll Stake	4
205A-1 212 412	204-001-855-101	AN206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	
		MS27647-4/ DW4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 23S6-4KA 0.8655 to 0.8665 inch (21.0285 to 21.1493 mm)	Ring Stake T101873-3	
205A-1 212	204-001-954	AN201KP5A/ MS27641-5 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	120-012-5A/ 23S3-5 0.9365 to 0.9375 inch (23.7871 to 23.8125 mm)	Ring Stake T101873-7	2 3

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
212	204-011-128	204-011-118-001 1.0615 to 1.0620 inches (26.9621 to 26.9748 mm)	None	Segment Stake Depth 0.015 to 0.020 inch (0.381 to 0.508 mm)	1
205A-1	204-011-246	BR5 1.2488 to 1.2493 inches (31.7195 to 31.7322 mm)	120-013-5A/ 23S5-5 1.3745 to 1.3750 inches 5 (34.9123 to 34.9250 mm)	Ring Stake T101873-19	
205A-1	204-011-301	AN201KP6A/ MS27641-6 0.8740 to 0.8745 inch (22.1996 to 22.2123 mm)	204-010-422-3 0.9995 to 1.0005 inches (25.3873 to 25.4127 mm)	None	1
		BR5R 1.2485 to 1.2490 inches (31.7119 to 31.7246 mm)	120-013-5A/ 23S5-5 1.3745 to 1.3750 inches (34.9123 to 34.9250 mm)	Ring Stake T101873-19	1
205A-1	204-011-438	AN201KP8A/ MS27641-8A 1.1240 to 1.1245 inches (28.5496 to 28.5623 mm)	204-010-422-13, -19 1.2495 to 1.2510 inches 5 (31.7373 to 31.7754 mm)	Ring Stake T101873-17	
205A-1	204-030-504	MS27645-3A MS27261KSP3L/ 0.6238 to 0.6243 inch (15.8445 to 15.8572 mm)	120-011-3LS 0.7495 to 0.7500 inch (19.0373 to 19.0500 mm)	Ring Stake T101873-95	1
205A-1	204-030-987	BSSN9003G/ RSS9 1.0932 to 1.0935 in. (27.7673 to 27.7749 mm)	204-030-909-011 1.2182 to 1.2187 in. (30.9423 to 30.9550 mm)	Ring Stake 30118 6	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
212	204-031-244-005	RSS-9 1.0932 to 1.0937 inches (27.7673 to 27.7800 mm)	204-030-909-011 1.2182 to 1.2187 inches (30.9423 to 30.9550 mm)	Ring Stake 30118 △6	△1
205A-1 212 412	204-031-920-003	LS-4/S-4/ KLS-4 214-030-216-001 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	Length as shown in text 120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	△1
205A-1	204-060-779	AN207DPP3/ MS27644-3 0.7762 to 0.7767 inch (19.7155 to 19.7282 mm)	23S5-3A 0.9060 to 0.9065 inch (23.0124 to 23.0251 mm)	Ring Stake T101873-5	△1
205A-1	205-001-307	DW5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	None	Anvil or Roll Stake	△1
		205-001-048-001 209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil or Roll Stake T102095-3	△1 △4
205A-1 214B	205-001-704	AN206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	△1
		DW5/ MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	23S6-5A/ 120-015-5A 0.9995 to 1.0000 inch (25.3873 to 25.4000 mm)	Ring Stake T101873-11	△1

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
205A-1	205-001-722	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil or Roll Stake T102095-3	1 4
		209-001-055-001 0.7488 to 0.7493 inch (19.019 to 19.0322 mm)	None	Anvil or Roll Stake T102095-1	1 4
205A-1	205-001-734	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil or Roll Stake T102095-3	1 4
		209-001-055-001 0.7488 to 0.7493 inch (19.019 to 19.0322 mm)	None	Anvil or Roll Stake T102095-1	1
205A-1	205-001-736	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil or Roll Stake T102095-3	1 4
		209-001-055-001 0.7488 to 0.7493 inch (19.019 to 19.0322 mm)	None	Anvil or Roll Stake T102095-1	1 4
205A-1	205-001-773	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil or Roll Stake T102095-3	4
		MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
205A-1	205-001-773	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	23S6-5A/ 120-015-5A 0.9995 to 1.0000 inch (25.3873 to 25.4000 mm)	Ring Stake T101873-11	4
205A-1	205-001-902	LHVA-5-26 RALT-5-4 76569 LHRA-5-26 ATSB5AA2 1.2500 to 1.2505 inches (31.7500 to 31.7627 mm)	120-013-5A 1.3740 to 1.3750 inches (34.8996 to 34.9250 mm)	Ring Stake T101873-19	4 14
212	205-001-905	AN206DSP4 MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 14
		AN206DSP5 MS27643-5 1.2488 to 1.2493 inches (31.7195 to 31.7322 mm)	120-013-5A/ 23S4-5A 1.3745 to 1.3750 inches (34.9123 to 34.9250 mm)	Ring Stake T101873-19	4 14
		DW5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	23S6-5A/ 120-015-5A 0.9995 to 1.0000 inch (25.3873 to 25.4000 mm)	Ring Stake T101873-11	4 14
205A-1	205-001-908-005	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil or Roll Stake T102095-3	1 4
		209-001-055-001 0.7488 to 0.7493 inch (19.019 to 19.0322 mm)	None	Anvil or Roll Stake T102095-1	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
205A-1 212 412	205-001-914-001 205-001-914-029 205-001-914-103	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 23S4-4A 1.0290 to 1.0295 inches (26.1366 to 26.1493 mm)	Ring Stake T101873-13	14
412	205-001-914-027 205-001-914-107	206-010-470-101 0.9375 to 0.9380 inch (23.8125 to 23.8252 mm)	None	Roll stake T101530-3 or RST2012 7	1 4
205A-1	205-001-916	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil or Roll Stake T102095-3	1 4
		209-001-055-001 0.7488 to 0.7493 inch (19.019 to 19.0322 mm)	None	Anvil or Roll Stake T102095-1	1 4
205A-1	205-001-917	MDW5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)			
		209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil or Roll Stake T102095-3	1 4
205A-1	205-001-919	MWD4 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)			
		209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil or Roll Stake T102095-3	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
205A-1	205-001-919	206-010-469-001/ 206-010-470-101 0.9375 to 0.9380 inch (23.8125 to 23.8252 mm)	None	Roll Stake T101530-3 RST2010 △7	△4
205A-1	205-001-921	209-001-055-001 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	Anvil or Roll Stake T102095-1	△1 △4
		209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil or Roll Stake T102095-3	△1 △4
205A-1	205-030-323	RG9SS/ 12-2-0-00-09/ MS14101-9 1.0932 to 1.0937 inches (27.7673 to 27.7800 mm)	None	Roll Stake RT-101-9 △6	△1 △4
205A-1	205-032-124	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil or Roll Stake T102095-3	△4
205A-1	205-060-717	MS20200KP4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-011-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	△4
205A-1	205-060-718	MS20200KP4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-011-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	△4
205A-1 214B	205-060-719	MS20200KP4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-011-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
205A-1	205-060-720	MS20200KP4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-011-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4
205A-1	205-076-381-005	RDW-5T-3V-1 0.8740 to 0.8745 inch (22.1996 to 22.2123 mm)	None	Roll Stake T101886-1 or RST2020 7	1 4 9
206L/ L1/L3	206-001-074	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil Stake T102095-3	1 4
206A/B 206L/ L1/L3/ L4	206-001-139	206-001-053-005 0.9062 to 0.9067 inch (23.0175 to 23.0302 mm)	None	Not Staked	1
206A/B 206L/ L1/L3/ L4	206-001-140	206-001-053-005 0.9062 to 0.9067 inch (23.0175 to 23.0302 mm)	None	Not Staked	1
206A/B	206-001-339-023 or 206-001-339-033	206-001-053-005 0.9062 to 0.9067 inch (23.0175 to 23.0302 mm)	None	Roll Stake T101530-3 or RST2012 7	1 2 4
		MS20200KP4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	None	Not Staked	12 31
206A/B 206L/ L1/L3	206-001-400-005 or 206-001-400-009	206-001-053-005/ 209-001-051-101 0.9062 to 0.9067 inch (23.0175 to 23.0302 mm)	None	Roll Stake T101530-3 or RST2012 7	1 4 29

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
206A/B 206L/ L1/L3/ L4	206-001-401	206-001-053-005/ 209-001-051-101 0.9062 to 0.9067 inch (23.0175 to 23.0302 mm)	None	Roll Stake T101530-3 or RST2012 △7	△1 △4 △29
206A/B	206-001-520	MS20201KP4A/ MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8660 to 0.8665 inch (21.9964 to 22.0091 mm)	Ring Stake T101873-3	△1 △4
		None	120-012-4S 0.8660 to 0.8665 inch (21.9964 to 22.0091 mm) 0.7501 to 0.7505 inch (I.D.) (19.0525 to 19.0627 mm)	Ring Stake T101873-3	△1 △4 △30
206A/B 206B3	206-001-526	206-010-469-001/ 206-010-470-101 0.9375 to 0.9380 inch (23.8125 to 23.8252 mm)	None	Roll Stake T101530-3 or RST2012 △7	△4 △21 △23
206A/B 206B3	206-001-538	206-001-053-005 0.9062 to 0.9067 inch (23.0175 to 23.0302 mm)	None	Roll Stake T101530-3 or RST2012 △7	△1 △4 △27
206L/ L1/L3/ L4	206-001-547-005 or 206-001-547-006	MS27641-4 0.7500 to 0.7505 inch (19.0500 to 19.0627 mm)	None	Not Staked	△31
206L/ L1/L3/ L4	206-001-549	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
206L/ L1/L3/ L4	206-001-550	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	1 4
		MS14103-3 0.6239 to 0.6244 inch (15.8471 to 15.8598 mm)	None	Roll Stake RST1001 7	1 4
206L/ L1/L3/ L4	206-001-551	MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	120-015-6A 1.1865 to 1.1875 inches (30.1371 to 30.1625 mm)	Ring Stake T101873-15	4 23
		206-010-469-001/ 206-010-470-101 0.9375 to 0.9380 inch (23.8125 to 23.8252 mm)	None	Roll Stake T101530-3 or RST2012 7	4 23 24
206L/ L1/L3/ L4	206-001-552	206-001-053-005 0.9062 to 0.9067 inch (23.0175 to 23.0302 mm)	None	Roll Stake T101530-3 or RST2012 7	1 4 27
206L/ L1/L3/ L4 407 427	206-001-556	MS27645-4A 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8660 to 0.8665 inch (21.9964 to 22.0091 mm)	Ring Stake T101873-3	1 4
206L/ L1	206-001-560	MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8660 to 0.8665 inch (21.9964 to 22.0091 mm)	Ring Stake T101873-3	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
206L/ L1	206-001-560	None	120-012-4S 0.8660 to 0.8665 inch (21.9964 to 22.0091 mm) 0.7501 to 0.7505 inch (I.D.) (19.0525 to 19.0627 mm)		1
		MS27641-5 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	120-012-5A 0.9365 to 0.9375 inch (23.7871 to 23.8125 mm)	Ring Stake T101873-7	1 4
		None	120-012-5S 0.9365 to 0.9375 inch (23.7871 to 23.8125 mm) 0.8126 to 0.8130 inch (I.D.) (20.6400 to 20.6502 mm)		
206L/ L1/L3/ L4	206-001-563-013	MS27641-5 0.8125 to 0.8130 inch (20.6375 to 20.6502 mm)	None	Not Staked	21 33
206A/B 206B3	206-001-567	MS27641-5 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	None	Not Staked	21 33
206A/B 206B3	206-001-568	MS14104-3 0.5615 to 0.5620 inch (14.2621 to 14.2748 mm)	120-015-12A 0.6978 to 0.6988 inch (17.7241 to 17.7495 mm)	Ring Stake	1 4
		MS27647-4/ 20-082-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
206A/B 206B3 206L/ L1/L3/ L4 407 427	206-001-702-009	MS27647-4/ 20-082-4/ DW4 0.7488 to 0.7493 in. (19.0195 to 19.0322 mm)	None	Roll Stake	
206L/ L1/L3/ L4	206-001-707-009	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	1 4
407	206-001-707-105 206-001-707-119 206-001-707-127	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	1 4
407	206-001-748	MS27647-5/ DW5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	None	Roll Stake	4
206A/B 206B3	206-001-756	MS27647-4/ 20-082-4 0.7488 to 0.7493 in. (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 in. (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
206L/ L1/L3/ L4	206-001-759	MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	120-015-6A 1.1865 to 1.1875 inches (30.1371 to 30.1625 mm)	Ring Stake T101873-15	1 4
206L/ L1/L3/ L4	206-001-763	MS27647-4/ 20-082-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
206L/ L1/L3/ L4	206-001-780	MS27641-5 0.8125 to 0.8130 inch (20.6375 to 20.6502 mm)	None	Not Staked	21 33
206L/ L1/L3/ L4	206-001-782	MS27641-5 0.8125 to 0.8130 inch (20.6375 to 20.6502 mm)	None	Not Staked	21 33
206L/ L1/L3/ L4	206-001-903	MS27647-5/ 20-082-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	1 4
206L/f L1/L3/ L4	206-001-904	MS27647-4/ 20-082-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
206L/ L1/L3/ L4	206-001-905	MS27647-4/ 20-082-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
206L/ L1/L3/ L4	206-001-906	MS27647-4/ 20-082-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
206A/B 206B3	206-010-336	206-010-469-001/ 206-010-470-101 0.9375 to 0.9380 inch (23.8125 to 23.8252 mm)	None	Roll Stake T101530-3 or RST2012 7	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
206A/B 206B3	206-010-451	206-010-469-001/ 206-010-470-101 0.9375 to 0.9380 inch (23.8125 to 23.8252 mm)	None	Roll Stake T101530-3 or RST2012 △7	△1 △4 △15
206A/B 206B3/ 206L/ L1/L3/ L4	206-010-453	206-010-469-001/ 206-010-470-101 0.9375 to 0.9380 inch (23.8125 to 23.8252 mm)	None	Roll Stake T101530-3 or RST2012 △7	△1 △4 △15
206A/B 206B3	206-010-467	206-010-469-001/ 206-010-470-101 0.9375 to 0.9380 inch (23.8125 to 23.8252 mm)	None	Roll Stake T101530-3 or RST2012 △7	△1 △4 △15
206A/B	206-011-139	MS27644-4 0.8999 to 0.9004 inch (22.8575 to 22.8702 mm)	None	Not Staked	△17
206A/B	206-011-721	MS20201KP4A/ MS27641-4 0.7488 to 0.7500 inch (19.0195 to 19.0500 mm)	None	Not Staked	△17
206A/B	206-011-722	MS20201KP5A 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	None	Not Staked	△1
206A/B	206-011-723	DW4/ MS27647-4/ 20-082-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	Segment Stake	△3 △4 △17
206A/B	206-016-201	206-010-765-001	206-010-733-003	Roll Stake T101529	△4 △21

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
206L/ L1/L3/ L4	206-023-101	209-001-051-1 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil Stake T102095-3	1 4
206A/B	206-030-539	MS14103-6 0.8123 to 0.8128 inch (20.633 to 20.645 mm)	None	Anvil Stake AT-6-435 6	4 21
206A/B	206-031-509	BSH-16-ATC32ZM 1.0010 to 1.0035 inches (25.4254 to 25.4889 mm)	206-031-513-101 1.1272 to 1.1292 inches (28.6309 to 28.6817 mm)	Segment Stake T101547	4 20 22 24 25
206A/B	206-031-589	206-031-590-003 1.4275 to 1.4380 inches (36.5125 to 36.5252 mm)	None	Roll Stake T101584	4 12 20 24
206A/B	206-031-592	206-031-594-003 0.9375 to 0.9380 inch (23.8125 to 23.8252 mm)	None	Roll Stake T101530-5	4 12 20
206A/B	206-031-593	206-031-594-003 0.9375 to 0.9380 inch (23.8125 to 23.8252 mm)	None	Roll Stake T101530-5	4 12
206L/ L1/L3	206-033-503	206-033-508-003 1.3750 to 1.3755 inches (34.9250 to 34.9377 mm)	None	Roll Stake 30125 6	4 12 22
		206-033-519-003 1.3750 to 1.3755 inches (34.9250 to 34.9377 mm)	None	Roll Stake 30125 6	4 22

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
206L/ L1/L3/ L4	206-033-506				91
206A/B	206-062-717	RSST-3/ LHSSR-3 0.5615 to 0.5620 inch (14.2621 to 14.2748 mm)	206-062-714-001 0.6779 to 0.6789 inch (17.2187 to 17.2441 mm)	Ring Stake	1 4
206A/B 206B3	206-062-723	DW4/ DW4K/ MS27647-4/ 20-082-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
206A/B	206-062-747	RSST-4/ LHSSV-4 0.6552 to 0.6557 inch (16.6421 to 16.6548 mm)	209-060-738-1 0.7701 to 0.7711 inch (19.5605 to 19.5859 mm)	Ring Stake	1 4 25 28
206L/ L1/L3/ L4	206-063-708	MS14102-6 (For -001 only) AW6SS (For -101 only) 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	120-012-51A 0.9365 to 0.9375 inch (23.7871 to 23.8125 mm)	Ring Stake T101873-7	4 18
206L/ L1/L3/ L4	206-063-709	MS14102-3 0.6238 to 0.6243 inch (15.8445 to 15.8572 mm)	120-012-31A 0.7490 to 0.7500 inch (19.0246 to 19.0500 mm)	Ring Stake	4 18
206L/ L1/L3/ L4	206-063-714	MS27647-4/ 20-082-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	4 18

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
206L/ L1/L3/ L4/407	206-063-719	MS27640-4			92
214ST	209-010-494	Refer to BHT-214ST-CR&O			
205A-1	209-030-357	RG9SS/ 12-2-0-00-09/ MS14101-9 1.0932 to 1.0937 inches (27.7673 to 27.7800 mm)	None	Roll Stake RT-101-9 6	1 4
212 412	212-001-188	DW4/ MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.90837 to 22.0091 mm)	Ring Stake T101873-3	1 4
212 412	212-001-210	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Ring Stake T102095-3	1 4
212 412	212-001-210	MS20206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		DW5/ MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.9995 to 1.0000 inch (25.3873 to 25.4000 mm)	Ring Stake T101873-11	1 4
212	212-001-253	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4 16

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
212	212-001-256	None 0.7501 to 0.7505 inch (19.0525 to 19.0627 mm)	120-012-4S 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake	1 4 16
212	212-001-257	MS27645-5 1.2488 to 1.2493 inches (31.7195 to 31.7322 mm)	120-011-5A 1.3740 to 1.3750 inches (34.8996 to 34.9250 mm)	Ring Stake T101873-19	1 4
212	212-001-312	MS20206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		DW5/ MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.9995 to 1.0000 inch (25.3873 to 25.4000 mm)	Ring Stake 4 T101873-11	1 or 16
212 412	212-001-313	MS27641-4 56 0.7501 to 0.7505 inch (19.0525 to 19.0627 mm)	N/A	Not Staked	12 54
212	212-001-317-001	MS20206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 16
		MS27647-5 (20-082-5) 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.9995 to 1.0000 inch (25.3873 to 25.4000 mm)	Ring Stake 4 T101873-11	1 or 16

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
212	212-001-321	AN206DPSP4 MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
212 412	214 212-001-501	MS20206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 16
205A-1 212 412	212-001-705	MS20206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 16
		DSRP-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 16
		MDW5/MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.9995 to 1.0000 inch (25.3873 to 25.4000 mm)	Ring Stake 4 T101873-11	1 or 16
212 412	212-001-708-001	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.9995 to 1.0000 inch (25.3873 to 25.4000 mm)	Ring Stake 4 T101873-11	1 or 16
		MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 16
212 412	212-001-710-001	212-001-066-001 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake 4 T101873-3	1 or 16

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
212 412	212-001-710-001	MS27643-4/ MS20206DSP4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 or 16
212	212-001-711	MS20206DSP4 MS27643-4/ 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 16
		DW4/ MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake 4 T101873-3	1 or 16
205A-1 212	212-001-712-101	DSRP-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 16
212 412	212-001-747-001	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.9990 to 1.0000 inch (23.3746 to 25.4000 mm)	Ring Stake 4 T101873-11	1 or 16
		MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 16
212	212-001-749	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 16
		DPP8W 1.6863 to 1.6868 inches (42.8320 to 42.8447 mm)	120-014-8A 1.8115 to 1.8125 inches (46.0121 to 46.0375 mm)	Ring Stake 4	1 or 16

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
212	212-001-750	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 18
212	212-001-751	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 18
212	212-001-753-002	MS27645-5 1.2493 to 1.2500 inches (31.7322 to 31.7500 mm)	120-011-5A 1.3740 to 1.3750 inches (34.8996 to 34.9250 mm)	Ring Stake 4 T101873-19	1 or 18
205A-1 212 412	212-001-758-105	DSRP-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 18
205A-1 212 412	212-001-759-101	DSRP-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 18
		MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.375 to 25.400 mm)	Ring Stake 4 T101873-11	1 or 18
212	212-001-900-001	MS20202DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake 4 T101873-13	1 or 16
		MDW5/ MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.400 mm)	Ring Stake 4 T101873-11	1 or 18

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
212	212-001-901	MS20206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake (4) T101873-13	(1) or (16)
		MDW5/ MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.375 to 25.400 mm)	Ring Stake (4) T101873-11	(1) or (16)
212	212-001-902	MS20206DSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake (4) T101873-13	(1) or (18)
		MS20206DSP5/ MS27643-5 1.2488 to 1.2493 inches (31.7195 to 31.7322 mm)	120-013-5A 1.374 to 1.375 inches (34.900 to 34.924 mm)	Ring Stake (4) T101873-19	(1) or (16)
		MDW4/ 212-001-066-001 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.855 to 0.8665 inch (21.9837 to 2.0091 mm)	Ring Stake (4)	(1) or (16)
205A-1 212	212-010-302	MS28913-5C (11) 1.2485 to 1.2490 inches (31.7119 to 31.7246 mm)	120-014-5A (5) 1.374 to 1.375 inches (34.900 to 34.925 mm)	Ring Stake T101873-19	(4) (5)
		MS20201KP10A/ MS27641-10 1.3740 to 1.3745 inches (34.8996 to 34.9123 mm)	204-010-422-021 1.500 to 1.501 inches (38.100 to 38.125 mm)	None	(1) or (16)

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
205A-1 212	212-010-403	MS20201KP8/ MS27641-8 1.1240 to 1.1245 inches (28.5946 to 28.5623 mm)	204-010-422-023 1.2495 to 1.2510 inches (31.7373 to 31.7754 mm)	Ring Stake T101873-17	4 5
205A-1 212	212-010-407	MS28913-5C 1.2488 to 1.2493 inches (31.7195 to 31.7322 mm)	120-013-5A/ 23S5-5 1.3745 to 1.3750 inches (34.9123 to 34.9250 mm)	Ring Stake T101873-19	4 5
205A-1 212	212-010-412		None		65
205A-1 212 412	212-030-104-101	209-031-351-001 1.4380 to 1.4383 inches (36.5252 to 36.5328 mm) After peening	None	Roll Stake RST1016 7	4 12
205A-1 212 412	212-030-104-5	MS14101-4 1.0932 to 1.0937 inches (27.7673 to 27.7800 mm) After peening	None	Roll Stake 4	1 or 18
212	212-060-210	MS20201KP3A 0.6238 to 0.6243 inch (15.8445 to 15.8572 mm)	120-012-3A 0.7490 to 0.7500 inch (19.0246 to 19.0500 mm)	Roll Stake T10873-3	
212	212-060-740-001	MS27647-4 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	120-015-4KA 0.7493 to 0.7488 inch (19.0322 to 19.0195 mm)	Ring Stake T101873-3	4 16
212	212-062-711-005	MS27644-3	120-14-3S	Ring Stake T101873-5	1
205A-1 205B 212 412	212-310-701-101	212-310-701-103 0.8330 to 0.885 inch (21.158 to 22.479 mm)	None	Roll Stake RST2854	4 72

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214B	214-001-021	WBS-8ATC21Z 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Not Staked	45
214B 214ST	214-001-051	Refer to BHT-214B-CR&O or BHT-214ST-CR&O			
214B	214-001-109	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27643-3 0.7762 to 0.7767 inch (19.7155 to 19.7282 mm)	120-013-3A 0.9055 to 0.9065 inch (22.9997 to 23.0251 mm)	Ring Stake T101873-5	1 4
214B 214ST	214-001-110	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil Stake T102095-3	1 47
214B 214ST	214-001-111	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil Stake T102095-3	1 47
	214-001-128	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil Stake T102095-3	1 47
214B	214-001-130	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214B	214-001-130	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.9990 to 1.0000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	1 4
			214-001-131-001 I.D. 1.8598 to 1.8606 inches (47.2389 to 47.2592 mm)		44
214ST	214-001-137	MS27643-3 0.7762 to 0.7767 inch (19.7155 to 19.7282 mm)	120-013-3A 0.9055 to 0.9065 inch (22.9997 to 23.0251 mm)	Ring Stake T101873-5	1 4
		MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214ST	214-001-163	MS27647-5/ 20-082-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.9990 to 1.0000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	1 4
		MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214ST	214-001-164	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27647-4 or 20-082-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4K 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214ST	214-001-169	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214ST	214-001-196	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214ST	214-001-202	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214B 214ST	214-001-309	MS20206DPSP4/ MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214B	214-001-313-101	MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 2 4
		None I.D. 0.7501 to 0.7505 inch (19.0525 to 19.0627 mm)	120-012-4S 0.8660 to 0.8665 inch (21.9964 to 22.0091 mm)	Ring Stake T101873-3	1 2 4
		MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	20-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214B	214-001-314	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214B	214-001-314	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.9990 to 1.0000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	1 4
214B	214-001-318	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil Stake T102095-3	1
			214-001-127-001 0.7498 to 0.7502 inch (19.0449 to 9.0551 mm)	Anvil Stake T102015-9	1 67
214B	214-001-319	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
	or				
214B	214-001-356	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.9990 to 1.0000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	1 4
214B	214-001-325	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214B	214-001-327	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214B	214-001-356	Refer to 214-001-319			

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214ST	214-001-371	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm) (2-places)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27641-5 0.8125 to 0.8130 inch (20.6375 to 20.6502 mm) (Lobe side)	None	Not Staked	31
		MS27641-5 0.8113 to 0.8118 inch (20.6100 to 20.6200 mm) (Flat side)	None	Not Staked	4
214ST	214-001-373	MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
		None 0.7501 to 0.7505 inch (19.0525 to 19.0627 mm) (Sleeve I.D.)	120-012-4S 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
214ST	214-001-376	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	Not Staked	31

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214ST	214-001-379	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214B	214-001-500	MS20206DSP4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		212-001-066-001 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
412	214-001-500-001	212-001-066-001 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
		MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214B	214-001-501-005	MS20206DSP4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
412	214-001-501-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214B	214-001-504	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214B	214-001-504	MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 2 4
		None 0.7501 to 0.7505 inch (19.0525 to 19.0627 mm)	120-012-4S 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
214B	214-001-505	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27647-4/ 20-082-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
214ST	214-001-542	MS27645-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-011-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27647-4 or 20-082-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
214ST	214-001-543	MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214ST	214-001-543	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214ST	214-001-553	MS27645-4A 0.7488 to 0.7493 inch (22.8651 to 22.8778 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9800 to 22.0100 mm)	Ring Stake T101873-3	1 4
214B	214-001-701	MS20206DSP4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		212-001-066-001 0.7488 to 0.7493 inch (22.8651 to 22.8778 mm)	120-015-4K4 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
214ST	214-001-708	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27647-4 0.7488 to 0.7493 inch (22.8651 to 22.8778 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
214B	214-001-710	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27641-4 0.7488 to 0.7493 inch (22.8651 to 22.8778 mm)	120-015-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 2 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214B	214-001-710	None I.D. 0.7501 to 0.7505 inch (19.0525 to 19.0627 mm)	120-012-4S 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 2 4
214B	214-001-714	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27647-4 0.7488 to 0.7493 inch (22.8651 to 22.8778 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
214B	214-001-716	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		214-001-093-007 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	206-001-708-001 I.D. 1.253 to 1.254 inches (31.826 to31.852 mm) O.D. 1.4995 to 1.500 inches (38.0873 to 38.100 mm)	Ring Stake T101873-3 (One side)	46
214B	214-001-721-001	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214B 214ST	214-001-723	214-001-093-9 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	None	Ring Stake T101873-3 (One side)	1 46
214B	214-001-724	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
214ST	214-001-769	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214ST	214-001-769	MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	Not Staked	31 33
214ST	214-001-779	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27641-5 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	None	Not Staked	33
214ST	214-001-783	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214ST	214-001-784	MS27640-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-011-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
214ST	214-001-788	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9800 to 22.0100 mm)	Ring Stake T101873-3	1 4
214ST	214-001-789	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.375 to 25.400 mm)	Ring Stake T101873-11	7 7
214ST	214-001-792	MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	120-015-6A 1.1865 to 1.1875 inches (30.1371 to 30.1625 mm)	Ring Stake T101873-15	1 4
		MS27645-4A 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
214ST	214-001-794	MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	Not Staked	31

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214B	214-001-909	Refer to BHT-214B-IPB and BHT- 214B-CR&O			
214B	214-001-912	209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Anvil Stake T102095-3	1 4
214B	214-001-914	MS27643-5 1.2488 to 1.2498 inches (31.7195 to 31.7449 mm)	120-013-5A 1.3740 to 1.3750 inches (34.9000 to (34.9300 mm)	Ring Stake T101873-19	1 4
		MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.375 to 25.400 mm)	Ring Stake T101873-11	1 4
214B	214-001-915	MS27643-5 1.2488 to 1.2493 inches (31.7195 to 31.7322 mm)	120-013-5A 1.3740 to 1.3750 inches (34.8996 to 34.9250 mm)	Ring Stake T101873-19	1 4
		214-001-093-003 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	None	Ring Stake T101873-3	1 4 48
		MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214B	214-001-916	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4
		MS27643-5 1.2488 to 1.2493 inches (31.7195 to 31.7322 mm)	120-013-5A 1.3740 to 1.3750 inches (34.8996 to 34.9250 mm)	Ring Stake T101873-19	1 4
		214-001-093-009	Replacement not authorized		
214ST 214B	214-001-918	209-010-459-001 1.8745 to 1.8750 inches (47.6123 to 47.6250 mm)	Sleeve bonded to bearing	Ring Stake T102015-5	1 4
214B	214-001-920	MS27643-5 1.2488 to 1.2493 inches (31.7195 to 31.7322 mm)	120-013-5A 1.3740 to 1.3750 inches (34.8996 to 34.9250 mm)	Ring Stake T101873-19	4 16
214B	214-001-931	209-001-051-001 0.6551 to 0.6556 inch (16.6395 to 16.6522 mm)	None	Anvil Stake T102095-3	1 4
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
214B	214-001-936	MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 2 4
214ST	214-001-971	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214ST	214-010-256	MS14103-8 0.9998 to 1.0003 inch (25.3949 to 25.4076 mm)	None	Roll Stake RST1010 △7	△4
214B	214-010-408	Refer to BHT-214B-CR&O			
214ST	214-010-494	Refer to BHT-214ST-CR&O			
214B	214-010-715	TGA104G or ALK4-86-1C1 0.6255 to 0.6260 inch (15.8877 to 15.9004 mm)	None	Roll Stake T101890 RST1002 △7	△1 △4 △51
214B 214ST	214-010-719	MS27647-6G	Replacement not authorized.		
			214-010-720-001 (Bushing) I.D. 0.3750 to 0.3755 inch (9.5250 to 9.5377 mm) O.D. 0.4995 to 0.5000 inch (12.7873 to 12.7000 mm)		△2 △49
214B 214ST	214-010-721	MS28913-4B	Replacement not authorized.		
		MS27647-6G	Replacement not authorized.		
		214-010-736-001 0.6860 to 0.6870 inch (17.4244 to 17.4498 mm)	None	Not Staked	△93 △94
214B	214-010-733	TGA108Y 1.0005 to 1.0010 inches (25.4127 to 25.4254 mm)	None	Roll Stake T101890 RST2017 △7	△1 △4 △50

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214ST	214-010-815	ALK4-128-101 0.6255 to 0.6260 inch (15.8877 to 15.9004 mm)	None	Roll Stake RST1002 △7	△1 △4
214B 214ST	214-010-850	AM2033-DHS 1.0005 to 1.0010 inches (25.4127 to 25.4254 mm)	None	Roll Stake RST2017 △7	△4
214B 214ST	214-010-851	AM2033-DHS 1.0005 to 1.0010 inches (25.4127 to 25.4254 mm)	None	Roll Stake RST2017 △7	△4
214B 214ST	214-011-802	214-011-819-101 1.4375 to 1.4380 inches (36.5125 to 36.5252 mm)	None	Roll Stake T101890 RST2015 △7	△1 △4
214ST	214-011-811	214-011-811-103 0.6255 to 0.6260 inch (15.8877 to 15.9004 mm)	None	Roll Stake T101890 RST1002 △7	△4 △52
214B	214-030-608	ADBY6V(L) 0.9049 to 0.9054 inch (22.9845 to 22.9972 mm)	None	Anvil Stake T101655-101	△4 △12
214B	214-030-609	214-030-633-001 0.9050 to 0.9055 inch (22.9870 to 22.9997 mm)	None	Anvil Stake T103301-101	△4 △12
214B	214-030-612	WSBS12ATC29-2Z 0.9062 to 0.9067 inch (23.0175 to 23.0302 mm)	None	Anvil Stake T101655-101	△4 △21 △52

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214ST 214B	214-031-608	WSBS12ATC29-Z 0.9049 to 0.9054 inch (22.9845 to 22.9972 mm)	None	Anvil Stake T101655-101	4 12
214ST	214-031-609	214-030-633-001 0.9050 to 0.9055 inch (22.9870 to 22.9997 mm)	None	Anvil Stake T103301-101	4 12
214ST 214B	214-031-612	WSBS12ATC29-2Z 0.9062 to 0.9067 inch (23.0175 to 23.0302 mm)	None	Anvil Stake T101655-101	4 21 53
214ST	214-031-613	WSBS12ATC29-2Z 0.9062 to 0.9067 inch (23.0175 to 23.0302 mm)	None	Anvil Stake T101655-101	4 21 53
214ST	214-031-986	MS14101-3 0.5625 to 0.5635 inch (14.2875 to 14.3129 mm)	None	Roll Stake RST1000 7	4
214ST	214-032-923	MS14101-3 0.5625 to 0.5635 inch (14.2875 to 14.3129 mm)	None	Roll Stake RST1000 7	1 4
214ST	214-032-954	MS14104-3 0.5616 to 0.5620 inch (14.2646 to 14.2748 mm)	None	Not Staked	56
214ST	214-032-955	MS14104-3 0.5616 to 0.5620 inch (14.2646 to 14.2748 mm)	None	Not Staked	56

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214ST	214-032-963	MS14104-3 0.5616 to 0.5620 inch (14.2646 to 14.2748 mm)	None	Not Staked	56
214ST	214-032-965	MS14104-3 0.5616 to 0.5620 inch (14.2646 to 14.2748 mm)	None	Not Staked	56
214ST	214-052-102	MS14103-14 1.6248 to 1.6253 inches (41.2700 to 41.2826 mm)	None	Roll Stake RST1018 7	4 54
		KPWD14P	None	Spanner KMT0140 60	8
214ST	214-052-148	MS14101-14 1.5623 to 1.5628 inches (39.6824 to 39.6951 mm)	None	Roll Stake RST1017 7	1 4
214ST	214-052-149	MS14101-14 1.5623 to 1.5628 inches (39.6824 to 39.6951 mm)	None	Roll Stake RST1017 7	1 4
214ST	214-052-161	MS14101-8 0.9998 to 1.0003 inches (25.4076 to 25.3949 mm)	None	Not Staked	67
206L/ L1/L3/ L4 214ST 427	214-052-174-101	MS14101-6 0.8128 to 0.8123 inch (20.6451 to 20.6324 mm)	None	Roll Stake RST1006 7	
206L/ L1/L3 L4 214ST 427	214-052-175-101	MS14101-6 0.8128 to 0.8123 inch (20.6451 to 20.6324 mm)	None	Roll Stake RST1006 7	

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214ST	214-052-175-105	MS14101-8 1.0003 to 0.9998 in. (25.4076 to 25.3949 mm)	None	Roll Stake RST1009 △7	
214B 214ST	214-052-200	MS14103-6 0.8125 to 0.8130 inch (20.6375 to 20.6502 mm)	None	Roll Stake RST1006 △7	
214ST	214-060-153	VTB03490 or P21320 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	None	Roll Stake RST1006 △7	△4
		VTB03500 or P21340 0.9985 to 0.9993 inch (25.3619 to 25.3822 mm)	None	Roll Stake RST1009 △7	△4
214ST	214-060-157	VTB03490 or P21320 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	None	Roll Stake RST1006 △7	△4
214ST	214-060-207	VTB03490 0.8115 to 0.8120 inch (20.6121 to 20.6248 mm)	None	Roll Stake RST1006 △7	△4
214ST	214-060-210	VTB03490 0.8115 to 0.8120 inch (20.6121 to 20.6248 mm)	None	Roll Stake RST1006 △7	△4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214ST	214-060-211	VTB03500 or P21340 0.9990 to 0.9995 inch (25.3746 to 25.3873 mm)	None	Roll Stake RST1009 △7	△4
214ST	214-060-217	VTB03490 0.8115 to 0.8120 inch (20.6121 to 20.6248 mm)	None	Roll Stake RST1006 △7	△4
214ST	214-060-303	MS27645-4A 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	△1 △4
214ST	214-060-304	MS27645-4A 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	△1 △4
214ST	214-060-334	MS27645-6A 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-012-6A 0.999 to 1.000 inch (25.375 to 25.400 mm)	Ring Stake T101873-9	△1 △4
214ST	214-060-335	MS27645-6A 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-012-6A 0.999 to 1.000 inch (25.375 to 25.400 mm)	Ring Stake T101873-9	△1 △4
214B	214-060-730	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	△1 △4
214B	214-060-731	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	△1 △4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214B	214-060-732	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
214B	214-060-733	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
214B	214-060-742	MS27647-4A 0.6238 to 0.6243 inch (15.8445 to 15.8572 mm)	120-015-4K2A 0.7480 to 0.7490 inch (19.0000 to 19.0200 mm)	Ring Stake T102095-1	1 4
214B	214-060-745	MS27645-10 1.9348 to 1.9358 inches (49.1439 to 49.1693 mm)	120-011-11A 2.0615 to 2.0625 inches (52.3621 to 52.3875 mm)	Ring Stake	1 4
214B	214-060-758	MS20201-KP3A 0.6238 to 0.6243 inch (15.8445 to 15.8572 mm)	None	Segment Stake	1 4 59
214B	214-060-770	Refer to BHT-214B-CR&O			
214B	214-060-781	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	1 4
214ST	214-061-878	MS14101-4 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Roll Stake RST1003 7	4
214ST	214-061-879	MS14101-4 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Roll Stake RST1003 7	4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
214ST	214-061-883	MS14103-3 0.6238 to 0.6243 inch (15.8445 to 15.8572 mm)	None	Roll Stake RST1001 △7	△4
214ST	214-061-884	MS14101-4 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Roll Stake RST1003 △7	△4
214ST	214-061-887	MS14103-3 0.6238 to 0.6243 inch (15.8445 to 15.8572 mm)	None	Roll Stake RST1001 △7	△4
214B 214ST	214-352-200	MS14103-6 0.8130 to 0.8125 inch (20.6502 to 20.6375 mm)	None	Roll Stake RST1006 △7	
222 230 430	222-001-141	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	△1 △4
222 230 430	222-001-252	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	△1 △4
222 230 430	222-001-256	MS14101-4 0.6556 inch (16.6522 mm) maximum diameter	None	Roll Stake RST1003 △7	△1 △4
222 230 430	222-001-283	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	△1 △4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
222 230 430	222-001-286	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
222 230 430	222-001-291	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
222 230	222-001-292	209-001-051-1 0.6567 inch (16.6802 mm) maximum diameter	None	Anvil Stake T102095-3 or RST2011 7	1 4
222 230 430	222-001-293	MS27646-41 1.501 inches (38.125 mm) maximum diameter	None	None	21
222 230 430	222-001-294	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 1.000 inch (25.400 mm) maximum diameter	Ring Stake T101873-11	1 4
222 230 430	222-001-294	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
		209-001-051-001 0.6567 inch (16.6802 mm) maximum diameter	None	Anvil Stake T102095-3 or RST2011 7	1 4
222 230 430	222-001-296	209-001-051-001 0.6567 inch (16.6802 mm) maximum diameter	None	Anvil Stake T102095-3 or RST2011 7	1 4
222	222-001-308	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
222 230 430	222-001-314	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	1 4
222 230 430	222-001-328	MS27641-8 1.1238 to 1.1243 inches (28.5445 to 28.5512 mm)	120-012-8A 1.250 inches (31.750 mm) maximum diameter	Ring Stake T101873-17	1 4
222 230 430	222-001-353	MS27640-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-011-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
222 230 430	222-001-355	MS27646-43 2.001 inches (50.825 mm) maximum diameter	None	None	21
222 230 430	222-001-358	MS27646-43 2.001 inches (50.825 mm) maximum diameter	None	None	21
222 230 430	222-001-360	MS27664-5/ DPP5W/FS464 1.2488 to 1.2493 inches (31.7195 to 31.7322 mm)	120-014-5A 1.3750 inches (34.9250 mm) maximum diameter	Ring Stake T101873-19	1 4
222 230 430	222-001-368	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
222 230 430	222-001-369	MS27646-41 1.501 inches (38.125 mm) maximum diameter	None	None	21
222	222-001-377	MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	1 4
		MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	None	1
222 230	222-001-382	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
		MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 1.000 inch (25.400 mm) maximum diameter	Ring Stake T101873-11	1 4
222 230	222-001-383	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
		MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 1.000 inch (25.400 mm) maximum diameter	Ring Stake T101873-11	1 4
222 230	222-001-402	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
222 230	222-001-402	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 1.000 inch (25.400 mm) maximum diameter	Ring Stake T101873-11	1 4
222 230 430	222-001-403	MS27641-4 0.7493 inch (19.0322 mm) maximum diameter	None	None	1
		MS27641-4 0.7505 inch (19.0627 mm) maximum diameter	None	None	35
		MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
222 230 430	222-001-407	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
222 230 430	222-001-434	MS27645-6A 0.8760 inch (22.2504 mm) maximum diameter	None	None	21
222 230 430	222-001-435	MS27645-6A 0.8760 inch (22.2504 mm) maximum diameter	None	None	21
222 230 430	222-001-504	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
222 230	222-001-513	209-001-051-001 0.6567 inch (16.6802 mm) maximum diameter	None	Anvil Stake T102095-3 or RST2011 △7	△1 △4
222 230 430	222-001-516	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	△1 △4
222 230 430	222-001-521	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	△1 △4
222 230 430	222-001-522	MS27646-41 1.501 inches (38.125 mm) max. dia.	None	None	△21
222	222-001-523	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	△1 △4
		MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 1.000 inch (25.400 mm) maximum diameter	Ring Stake T101873-11	△1 △4
222 230 430	222-001-524	209-001-051-001 0.6567 inch (16.6802 mm) maximum diameter	None	Anvil Stake T102095-3 or RST2011 △7	△1 △4
222 230 430	222-001-528	MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	△1 △4
222 230	222-001-530	MS27641-5 0.8130 inch (20.6502 mm) maximum diameter	None	None	△35

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
222 230 430	222-001-706	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	1 4
222 230 430	222-001-711	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
		MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	None	35
222 230 430	222-001-713	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
		MS27641-4 0.7505 inch (19.0322 mm) maximum diameter	None	None	35
		MS27641-4 0.7505 inch (19.0322 mm) maximum diameter	None	None	1
222 230 430	222-001-727	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
222 230 430	222-001-727	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
222 230 430	222-001-734	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	1 4
222 230 430	222-001-736	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	1 4
222 230 430	222-001-740	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 1.000 inch (25.400 mm) maximum diameter	Ring Stake T101873-11	1 4
222 230 430	222-001-741	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
		MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	120-015-6A 1.1875 inches (30.1625 mm) maximum diameter	Ring Stake T101873-15	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
222 230 430	222-001-748	MS27645-4A 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	1 4
		222-001-832-101 1.2500 inches (31.7500 mm) maximum diameter	None	None	35
222 230 430	222-001-768	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 1.000 inch (25.400 mm) maximum diameter	Ring Stake T101873-11	1 4
222	222-001-774	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
		MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	None	35
222	222-001-777	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
222 230 430	222-001-816	MS27641-4 0.7505 inch (19.0627 mm) maximum diameter	None	None	35
222	222-001-818	MS27647-4A 0.6238 to 0.6243 inch (15.8445 to 15.8572 mm)	120-015-4K2A 0.7500 inch (19.0500 mm) maximum diameter	Ring Stake T101873-3	1 4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
222	222-001-819	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	1 4
222 230	222-010-415	222-310-461-001 1.6863 to 1.6868 inches (42.8320 to 42.8447 mm)	222-010-474-001 1.8463 inches (46.8960 mm) maximum diameter	Roll Stake RST2071 7	1 4 36
222	222-010-419-101 222-010-419-106	205-012-710-001 1.4380 inches (36.5252 mm) maximum diameter	None	Roll Stake T101577	4 16
222 230	222-010-419-109 222-010-419-110	222-310-401-101 1.4380 inches (36.5252 mm) maximum diameter	None	Roll Stake T101577	4 16
222 230 430	222-012-711	222-312-751-001 0.6255 inch (15.8877 mm) maximum diameter	None	Roll Stake RST1002 7	1 4 32
222 230 430	222-012-715	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0295 inches (26.1493 mm) maximum diameter	Ring Stake T101873-13	1 4
		MS27641-4 0.7500 to 0.7505 inch (19.0500 to 19.0627 mm)	120-012-4A 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	1 4
222 230 430	222-012-715	222-312-759-001 0.8110 to 0.8120 inch (20.5994 to 20.6248 mm)	None	None	38
222	222-012-765	222-312-755 1.0000 to 1.0005 inches (25.4000 to 25.4127 mm)	None	Roll Stake RST2089 7	4 16 66

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
222	222-012-765	222-312-752 0.8130 to 0.8135 inch (20.6502 to 20.6629 mm)	None	Roll Stake RST2058 △7	△4 △16 △32
222 230 430	222-031-206	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	△1 △4
		MS27645-3A 0.6238 to 0.6243 inch (15.8445 to 15.8572 mm)	120-011-3LA 0.7500 inch (19.0500 mm) maximum diameter	Ring Stake	△4 △16
222 230 430	222-031-235	MS27646-43 2.0010 inches (50.8254 mm) max. dia.	None	None	△35
222 230	222-031-276	MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	120-015-6S 1.1875 inches (30.1625 mm) maximum diameter	Ring Stake T101873-15	△4 △12
222	222-031-619	222-330-625-001 or 222-330-619-101 0.9065 to 0.9070 inch (23.0251 to 23.0378 mm)	None	Roll Stake RST1034 △7	△4 △32
222	222-031-620	222-030-625-001 or 222-330-619-101 0.9065 to 0.9070 inch (23.0251 to 23.0378 mm)	None	Roll Stake RST1034 △7	△4 △21 △32
222 230	222-031-642	MS14101-7 0.9070 inch (23.0378 mm) maximum diameter	None	Roll Stake RST1007 △7	△4 △21 △62

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
222 230	222-031-662-105	LB6-1078-8-1 2.330 to 2.332 inches (59.182 to 59.233 mm)	None	Roll Stake 30155 △6	△4 △16
222 230	222-031-662-107	LB6-1078-9-1 1.994 to 1.942 inches (49.378 to 49.327 mm)	None	Roll Stake 30155 △6	△4 △16
222 230	222-060-204	MS27641-4 0.7505 inch (19.0627 mm) maximum diameter	None	None	△35
222	222-060-226	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	△1 △4
222	222-060-239	MS27641-4 0.7505 inch (19.0627 mm) maximum diameter	None	None	△31
222 230	222-060-706	MS27641-4 0.7505 inch (19.0627 mm) maximum diameter	None	None	△35
222	222-060-717	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	△1 △4
222	222-060-726	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	△1 △4
222 230	222-060-790	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8665 inch (22.0091 mm) maximum diameter	Ring Stake T101873-3	△1 △4

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
222 230	222-331-617	222-330-625-001 or 222-330-619-101 0.9060 to 0.9065 inch (23.0124 to 23.0251 mm)	None	Roll Stake RST1034 △7	△4 △21 △64
222 230	222-331-618	222-330-625-001 or 222-330-619-101 0.9060 to 0.9065 inch (23.0124 to 23.0251 mm)	None	Roll Stake RST1034 △7	△4 △21 △64
222 230 430	222-336-001	MS14101-4 0.6560 to 0.6565 inch (16.6624 to 16.6751 mm)	None	Roll Stake T2682507-7 △42 or RST1003 △7	△1 △4 △7
		MS14101-5 0.7498 to 0.7503 inch (19.0449 to 19.0567 mm)	None	Roll Stake T2681903-1 △42 or RST1005 △7	△1 △4
		MS14103-8 0.9998 to 1.0003 inches (25.3949 to 25.4076 mm)	None	Roll Stake T1231908-1 △42 or RST1010 △7	△1 △4
		MS14103-10 1.1873 to 1.1878 inches (30.1574 to 30.1701 mm)	None	Roll Stake T675616-1 △42 or RST1014 △7	△1 △4 △64
222 230 430	222-382-001	212-010-782-101 1.1870 to 1.1885 inches (30.1498 to 30.1879 mm)	None	Roll Stake T101577	△4 △21 △40
222 230 430	230-030-535-101 230-030-535-103	230-330-509-101 1.1248 to 1.1253 inches (28.5699 to 28.5826 mm)	None	Roll Stake RST2417 △7	△1 △4 △16 △66

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
230 430	230-061-808-101 230-061-808-102	MS14101-3 0.5625 to 0.5635 inch (14.2875 to 14.3129 mm)	None	Roll Stake RST1000 △7	△1 △4
230 430	230-061-809-101 230-061-809-102	MS14101-3 0.5625 to 0.5635 inch (14.2875 to 14.3129 mm)	None	Roll Stake RST1000 △7	△1 △4
222 230 430	230-312-001-101	230-312-001-103 0.8123 to 0.8128 inch (20.6324 to 20.6451 mm)	None	Roll Stake RST2058 △7	△4 △15 △16
		230-312-001-105 0.9373 to 0.9378 inch (23.8074 to 23.8201 mm)	None	Roll Stake RST2059 △7	△4 △15 △16
407	406-001-126	MS27646-40 1.3125 to 1.3135 inch (33.3375 to 33.3629 mm)	None	Not Staked	△73
407	406-001-704-101	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	△4 △16
407	406-010-417-101	Refer to BHT-407-CR&O			
427	406-010-417-109	Refer to BHT-427-CR&O			
407 427	406-010-432-101	Refer to BHT-407-CR&O and BHT-427-CR&O			
407 427	406-012-102-109	Refer to BHT-407-CR&O and BHT-427-CR&O			

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
407 427	407-001-050-101	MS14103-4 0.6245 to 0.6250 inch (15.8623 to 15.8750 mm)	None	Roll Stake	74 75 76
407	407-001-110-103	206-001-053-003 or 206-001-053-005 0.9062 to 0.9072 inch (23.0175 to 23.0429 mm)	None	Not Staked	16
407	407-001-112-101	206-001-053-003 or 206-001-053-005 0.9062 to 0.9072 inch (23.0175 to 23.0429 mm)	None	Not Staked	16
407 427	407-001-320-101	MKP4 0.9015 to 0.9019 inch (22.8981 to 22.9082 mm)	None	Not Staked	74
		MKP4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	None	Roll Stake	16 77
407 427	407-001-320-105 407-001-320-109	MKP4 0.9015 to 0.9019 inch (22.8981 to 22.9082 mm)	None	Not Staked	74
		MKP4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	None	Roll Stake	16 77

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
407 427	407-001-320-105 407-001-320-109	206-301-051-101 0.9062 to 0.9067 inch (23.0175 to 23.0302 mm)	None	Anvil Stake	4 16 75 78
407	407-001-323-102	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16
407 427	407-001-323-102	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16
427	407-001-323-102	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16
407	407-001-324-105	MDW5/ MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16
407	407-001-325-101	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16
		MS27645-4A 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	4 16
407	407-001-326-101	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
407 427	407-001-520-101	209-001-051-001 0.6551 to 0.6556 inch (16.6395 to 16.6522 mm)	None	Roll Stake T102095-3	16 79
		MS27641-5 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	None	Not Staked	52
		MS27641-5 0.8125 to 0.8130 inch (20.6375 to 20.6502 mm)	None	Not Staked	80
407	407-001-521-101	209-001-051-001 0.6551 to 0.6556 inch (16.6395 to 16.6522 mm)	None	Roll Stake T102095-3	16 79
		MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	Not Staked	52
		MS27641-4 0.7500 to 0.7505 inch (19.0500 to 19.0627 mm)	None	Not Staked	80
407	407-001-522-101	209-001-051-001 0.6551 to 0.6556 inch (16.6395 to 16.6522 mm)	None	Roll Stake T102095-3	16 79
		MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	Not Staked	52

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
407	407-001-522-101	MS27641-4 0.7500 to 0.7505 inch (19.0500 to 19.0627 mm)	None	Not Staked	80
427	407-001-522-105	209-001-051-001 0.6551 to 0.6556 inch (16.6395 to 16.6522 mm)	None	Roll Stake T102095-3	16 79
		MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	Not Staked	52
		MS27641-4 0.7500 to 0.7505 inch (19.0500 to 19.0627 mm)	None	Not Staked	80
407	407-001-523-101	MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	Not Staked	52
		MS27641-4 0.7500 to 0.7505 inch (19.0500 to 19.0627 mm)	None	Not Staked	80
407	407-001-524-105	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16
		206-010-470-101 0.9375 to 0.9385 inch (23.8125 to 23.8379 mm)	None	Roll Stake T101530-3 RST2010 7	4 20 81

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
407	407-001-526-105	MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	120-015-6A 1.1865 to 1.1875 inches (30.1371 to 30.1625 mm)	Ring Stake T101873-15	4 16
		206-010-470-101 0.9375 to 0.9385 inch (23.8125 to 23.8379 mm)	None	Roll Stake T101530-3 RST2010 7	4 20 81
407	407-001-528-101	MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	120-015-6A 1.1865 to 1.1875 inches (30.1371 to 30.1625 mm)	Ring Stake T101873-15	4 16
		206-010-470-101 0.9375 to 0.9385 inch (23.8125 to 23.8379 mm)	None	Roll Stake T101530-3 RST2010 7	4 20 81
407	407-001-711-101	MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	4 52
		MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	Not Staked	82
407	407-001-720-101	MS27647-4 or 20-082-4 0.7483 to 0.7493 inch (19.0068 to 19.0322 mm)	None	Roll Stake	4 16
407	407-001-723-101	MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	120-015-6A 1.1865 to 1.1875 inch (30.1371 to 30.1625 mm)	Ring Stake T101873-15	4 16

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
407	407-001-724-101 407-001-724-105	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16
407	407-001-725-101	MS27647-4 0.7488 to 0.7493 inch (22.8651 to 22.8778 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	4 16
407 427	407-001-731-101	MS27645-4A 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	4 16
407	407-001-732-101	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16
427	407-001-732-107 407-001-732-109	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16
412	412-001-300-105	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.9990 to 1.0000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16
		MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16
412	412-001-301-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
412	412-001-306-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 18
412	412-001-900-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16
412	412-010-405-101 412-010-405-107 412-010-405-109 412-010-405-111	412-010-427-101 1.3748 to 1.3753 inches (34.9200 to 34.9300 mm)	None	Roll Stake RST2128 7	4
412	412-010-448-101	412-010-427-101 1.3748 to 1.3753 inches (34.9200 to 34.9300 mm)	None	Roll Stake RST2128 7	4 12
205A-1 212 412	412-076-620	MS27647-5 0.8740 to 0.8745 inch (22.1996 to 22.2123 mm)	None	None	12 61
412	412-310-400-101 412-310-400-103 412-310-400-105	412-310-400-107 1.3750 to 1.3755 inches (34.9300 to 34.9400 mm)	None	Roll Stake RST2345 7	1 4 63
427	427-001-021-101	406-310-403-101 1.029 to 1.030 inches (26.1366 to 26.1620 mm)	None	Roll Stake	4 20 78
427	427-001-022-101	406-310-403-101 1.029 to 1.030 inches (26.1366 to 26.1620 mm)	None	Roll Stake	4 20 78

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
427	427-001-120-101	MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	None	Ring Stake	4 16 83
427	427-001-138-115	MS27641-4 0.7490 to 0.7495 inch (19.0246 to 19.0373 mm)	None	Not Staked	44
427	427-001-148-101	MS27641-4 0.7500 to 0.7505 inch (19.0500 to 19.0627 mm)	None	Not Staked	
427	427-001-168-101	MS27647-4A 0.6240 to 0.6245 inch (15.8496 to 15.8623 mm)	None	Ring Stake (One side)	16 83
427	427-001-169-101	MS27647-4A 0.6240 to 0.6245 inch (15.8496 to 15.8623 mm)	None	Ring Stake (One side)	16 83
427	427-001-323-101	MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	120-015-6A 1.1865 to 1.1875 inches (30.1371 to 30.1625 mm)	Ring Stake T101873-15	4 16
		209-001-051-001 0.6562 to 0.6567 inch (16.6675 to 16.6802 mm)	None	Roll Stake T102095-3	4 20
427	427-001-520	MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	120-015-6A 1.1865 to 1.1875 inches (30.1371 to 30.1625 mm)	Ring Stake T101873-15	4 52 84

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
427	427-001-520	206-010-470-101 0.9375 to 0.9385 inch (23.8125 to 23.8379 mm)	None	Roll Stake T101530-3 RST2010 △7	△4 △20 △81 △84
427	427-001-521	MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	120-015-6A 1.1865 to 1.1875 inches (30.1371 to 30.1625 mm)	Ring Stake T101873-15	△4 △52 △81
		206-010-470-101 0.9375 to 0.9385 inch (23.8125 to 23.8379 mm)	None	Roll Stake T101530-3 RST2010 △7	△4 △20 △81 △84
427	427-001-522	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	△4 △16
		206-010-470-101 0.9375 to 0.9385 inch (23.8125 to 23.8379 mm)	None	Roll Stake T101530-3 RST2010 △7	△4 △20 △81
427	427-001-535-101	MS27641-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	None	Not Staked	△52
		MS27641-4 0.7500 to 0.7505 inch (19.0500 to 19.0627 mm)	None	Not Staked	△80
427	427-001-550-135	MS27645-4A 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	△4 △16

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
427	427-001-720-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8652 to 0.8662 inch (21.9761 to 22.0015 mm)	Ring Stake T101873-3	4 16
427	427-001-721-105	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	None	Roll Stake	4 16
427	427-001-722-103	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16
427	427-001-723-101	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	4 16
427	427-001-725-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16
427	427-001-726-101	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	None	Roll Stake	4 16
427	427-001-740-101	MS27646-41 1.5000 to 1.5010 inches (38.1000 to 38.1254 mm)	None	Not Staked	20

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
427	427-010-208-101	430-310-205-103 1.3748 to 1.3753 inches (34.9200 to 34.9300 mm)	None	Roll Stake RST2936 △7 △72	△4 △16 △62
427	427-010-210-101	430-310-205-103 1.3748 to 1.3753 inches (34.9200 to 34.9300 mm)	None	Roll Stake RST2936 △7 △72	△4 △16 △62
429	427-010-210-105 427-010-210-109	430-310-205-105 1.3748 to 1.3759 inches (34.920 to 34.932 mm)	None	Roll Stake RST2936 △7 △72	△4 △16 △62
427	427-030-689-101	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	△4 △16
429	429-001-721-101	MS14103-4 0.6248 to 0.6253 inch (15.8699 to 15.8826 mm)	None	Roll Stake	△4 △16 △84 △85
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	△4 △16 △84 △86
		MS14101-5A 0.7498 to 0.7503 inch (19.0449 to 19.0567 mm)	None	Roll Stake	△4 △16 △34 △84
429	429-001-030-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	△4 △16 △86

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
429	429-001-031-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-121-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
		MS27641-5 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	None	Not Staked	87
		MS27641-5 0.8125 to 0.8130 inch (20.6375 to 20.6502 mm)	None	Not Staked	87
429	429-001-122-101	MS27647-6 1.0613 to 1.0618 inches (26.9570 to 26.9697 mm)	120-015-6A 1.1865 to 1.1875 inches (30.1371 to 30.1625 mm)	Ring Stake T101873-15	4 16
		MS27645-4A 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	4 16
429	429-001-124-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16
		MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
429	429-001-124-101	MS27645-4A 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	4 16
429	429-001-315-105	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16
		MS27645-4A 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-012-4A 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	4 16
429	429-001-317-101	MS27641-5 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	None	Not Staked	88
429	429-001-320-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16
		MS27641-5 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	None	Not Staked	87
		MS27641-5 0.8125 to 0.8130 inch (20.6375 to 20.6502 mm)	None	Not Staked	87
429	429-001-321-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
429	429-001-321-101	MS27641-5 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	None	Not Staked	87
		MS27641-5 0.8125 to 0.8130 inch (20.6375 to 20.6502 mm)	None	Not Staked	87
429	429-001-323-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
		MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16 86
		MS27645-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-011-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-324-101 429-001-324-102	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
		MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16 86
429	429-001-327-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
429	429-001-327-101	MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16 86
		MS27645-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-011-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-328-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
		MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16 86
		MS27645-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-011-4A 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-353-101	MS27641-5 0.8113 to 0.8118 inch (20.6070 to 20.6197 mm)	None	Not Staked	
429	429-001-520-101	MS27647-8 1.4363 to 1.4368 inches (36.4820 to 36.4947 mm)	120-015-8A 1.5625 to 1.5635 inches (39.6875 to 39.7129 mm)	Ring Stake	4 20 84
		MS14101-6 0.8123 to 0.8128 inch (20.6324 to 20.6451 mm)	None	Roll Stake RST1006 7	4 20 84 89

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
429	429-001-520-101	206-010-470-101 0.9375 to 0.9385 inch (23.8125 to 23.8379 mm)	None	Roll Stake T101530-3 RST2010 7	4 20 84 89
429	429-001-521-101	MS27647-8 1.4363 to 1.4368 inches (36.4820 to 36.4947 mm)	120-015-8A 1.5625 to 1.5635 inches (39.6875 to 39.7129 mm)	Ring Stake	4 20 84
		MS14101-6 0.8123 to 0.8128 inch (20.6324 to 20.6451 mm)	None	Roll Stake RST1006 7	4 20 84 89
429	429-001-522-101	MS27647-8 1.4363 to 1.4368 inches (36.4820 to 36.4947 mm)	120-015-8A 1.5625 to 1.5635 inches (39.6875 to 39.7129 mm)	Ring Stake	4 20 84
		MS14101-6 0.8123 to 0.8128 inch (20.6324 to 20.6451 mm)	None	Roll Stake RST1006 7	4 20 84 89
		206-010-470-101 0.9375 to 0.9385 inch (23.8125 to 23.8379 mm)	None	Roll Stake T101530-3 RST2010 7	4 20 84 89
429	429-001-523-101 429-001-523-103	MS27646-41 1.5000 to 1.5010 inches (38.1000 to 38.1254 mm)	None	Not Staked	20
429	429-001-523-107	429-301-010-101 1.5000 to 1.5010 inches (38.1000 to 38.1254 mm)	None	Not Staked	20

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
429	429-001-525-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-525-105 429-001-525-107	429-301-012-101 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-526-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-526-105	429-301-012-101 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-527-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-527-105 429-001-527-107	429-301-012-101 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-528-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-528-105	429-301-012-101 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
429	429-001-530-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-530-105 429-001-530-107	429-301-012-101 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-531-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-531-105	429-301-012-101 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
429	429-001-532-101 429-001-532-103	MS27646-41 1.5000 to 1.5010 inches (38.1000 to 38.1254 mm)	None	Not Staked	20
429	429-001-532-107	429-301-010-101 1.5000 to 1.5010 inches (38.1000 to 38.1254 mm)	None	Not Staked	20
429	429-001-702-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16
		MS27647-5 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	120-015-5A 0.999 to 1.000 inch (25.3746 to 25.4000 mm)	Ring Stake T101873-11	4 16

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
429	429-001-702-101	MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	4 16
429	429-001-711-101	MS27646-38 1.0610 to 1.0615 inches (26.9494 to 26.9621 mm)	None	Not Staked	
429	429-001-714-101	MS27646-38 1.0625 to 1.0630 inches (26.9875 to 27.0002 mm)	None	Not Staked	
429	429-001-720-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16 86
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	4 16 86
429	429-001-721-101	MS14101-5A 0.7498 to 0.7503 inch (19.0449 to 19.0567 mm)	None	Roll Stake T2681903-1 42 or RST1005 7	4 16 34
		MS14103-4 0.6248 to 0.6253 inch (15.8699 to 15.8826 mm)	None	Roll Stake RST1002 7	4 16 84 90
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	4 16 84 86

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
429	429-001-722-101	MS14103-4 0.6248 to 0.6253 inch (15.8699 to 15.8826 mm)	None	Roll Stake	4 16 84
		MS27641-6 0.8750 to 0.8755 inch (22.2250 to 22.2377 mm)	None	Not Staked	87
		MS27641-6 0.8738 to 0.8743 inch (22.1945 to 22.2072 mm)	None	Not Staked	87
429	429-001-727-101	MS27643-4 0.9002 to 0.9007 inch (22.8651 to 22.8778 mm)	120-013-4A/ 1.0285 to 1.0295 inches (26.1239 to 26.1493 mm)	Ring Stake T101873-13	4 16
		MS27647-4 0.7488 to 0.7493 inch (19.0195 to 19.0322 mm)	120-015-4KA 0.8655 to 0.8665 inch (21.9837 to 22.0091 mm)	Ring Stake T101873-3	4 16
429	429-012-105-101	Refer to the BHT-429-CMM, Chapter 64			
429	429-012-112-101	429-312-107-103	None	Roll Stake	4 15 52 96 97
429	429-012-112-103	0.8123 to 0.8128 inch (20.632 to 20.645 mm)	AST 429-312-107-101DP		95
430	430-010-204-101 430-010-204-103	430-310-201-101 1.9425 to 1.9430 inches (49.3395 to 49.3522 mm)	None	Roll Stake RST2940 7 72	4 16 70

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

MODEL	COMPONENT	BEARING P/N AND HOLE (BORE) SIZE FOR BEARING	SLEEVE P/N AND HOLE (BORE) SIZE FOR SLEEVE	TYPE STAKE AND TOOL NUMBER	NOTES
430	430-010-208-101 430-010-208-105	430-310-205-103 1.3748 to 1.3753 inches (34.9200 to 34.9300 mm)	None	Roll Stake RST2936 7 72	4 16 68
430	430-010-209-101 430-010-209-103	430-310-207-101 0.9061 to 0.9066 inch (23.0149 to 23.0276 mm)	None	Roll Stake RST2941 7 72	4 16 71
430	430-010-211-101 430-010-211-105	430-310-205-101 1.3748 to 1.3753 inches (34.9200 to 34.9300 mm)	None	Roll Stake RST2936 7 72	4 16 62
430	430-010-212-101 430-010-212-103	430-310-206-101 1.0935 to 1.0940 inches (27.7749 to 27.7876 mm)	None	Roll Stake RST2938 7 72	4 16 62
430	430-010-412-105 430-010-412-106	430-310-456-101 1.248 to 1.253 inches (31.6992 to 31.8262 mm)	None	Roll Stake RST2939 7 72	4 15 16 69
430	430-010-433-101	430-310-456-101 1.248 to 1.253 inches (31.6992 to 31.8262 mm)	None	Roll Stake RST2939 7 72	4 15 16 69
429 430	430-010-449-101	430-310-456-101 1.248 to 1.253 inches (31.6992 to 31.8262 mm)	None	Roll Stake RST2939 7 72	4 15 16 69

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

NOTES:

CAUTION

DO NOT USE WATERBORNE EPOXY PRIMER COATING (C-246) FOR WET INSTALLATIONS.

1. On fixed control part, install bearing/bearing sleeve with unreduced zinc chromate primer (C-201) on faying surfaces, except on bearings that run in oil. If bearing runs in oil, do not use primer. Use type of oil in which the bearing operates.
2. Line ream through both sleeves/bushings.
3. Retain sleeves and bearings with corrosion preventive compound (C-101) on faying surfaces. Use anaerobic primer grade CV (Blue).
4. Stake on both sides of bearing or sleeve, as applicable.
5. Use corrosion preventive compound (C-101) on faying surfaces.
6. Tool may be purchased from Cabco Industries (www.cabcoindustries.com).
7. Tool may be purchased from Rexnord Corp. (www.rexnord.com).
8. Apply sealant (C-356) on faying surfaces. Use grade T (Yellow) sealant (C-356).
9. Rotational torque of bearing, after staking, is 1 to 6 inch-pounds (0.11 to 0.68 Nm).
10. Deleted.
11. Proof load outer race of bearing, each direction 500 to 800 pounds (2224 to 3559 N).
12. Apply anaerobic retaining compound (C-352) to faying surfaces. Do not cure above 200°F (93°C).
13. Retain sleeves and bearings with sealant (C-320).
14. Retain sleeves and bearings with sealant (C-320) as follows:

    (a) Clean mating surfaces of bearing, sleeve, and housing with solvent MEK (C-309).

    (b) Apply anaerobic primer, grade N (Green), sealant (C-320) with cotton swab and allow to dry 2 to 3 minutes.

    (c) Position bearing and sleeve in housing. Apply small amounts of sealant, grade CV, color blue, MIL-S-22473 sealant (C-320) to joints between housing and sleeve and between sleeve and bearing. Sealant will flow into joints by capillary action. Repeat application of sealant until a ring of sealant remains just outside joint. Wait a few minutes and remove excess sealant with a clean cloth.

CAUTION

IF ALUMINUM PARTS OR LUBRICATED BEARINGS ARE INVOLVED, DO NOT EXCEED 200°F (93°C) DURING ACCELERATED CURE.

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

NOTES: (CONT)

(d) Allow seal to cure at room temperature for 60 to 90 minutes. If accelerated cure is required, cure at 200°F (93°C) (maximum) for 15 minutes.

15 Maximum breakout or misalignment torque of bearing, after installation, must be 10 inch-pounds (1.13 Nm).

CAUTION

DO NOT USE WATERBORNE EPOXY PRIMER COATING (C-246) FOR WET INSTALLATIONS.

16 On fixed control part, install bearing/bearing sleeve with unreduced epoxy polyamide primer (C-204) on faying surfaces, except on bearings that run in oil. If bearing runs in oil, do not use primer. Use type of oil in which bearing operates.

17 Do not paint or prime bearing or bushing bores.

18 Fluorescent Penetrant Inspection (FPI).

19 Refer to the BHT-206A/B-CR&O manual for detailed instructions.

20 Apply MIL-S-22473, Grade N, sealant (C-320) before you apply sealant (C-356) to faying surfaces. Do not cure above 200°F (93°C).

21 Apply sealant (C-356) to faying surfaces. Do not cure above 200°F (93°C).

22 Breakout or misalignment torque of bearing, after installation, must be 1 to 6 inch-pounds (0.11 to 0.68 Nm).

23 No load breakaway torque of bearing, after installation, must be 1 to 55 inch-pounds (0.11 to 6.21 Nm).

24 Stake depth to be 0.014 to 0.018 inch (0.36 to 0.46 mm).

25 Maximum breakout or misalignment torque of bearing, after installation, must be 1 inch-pound (0.11 Nm).

26 Maximum breakout or misalignment torque of bearing, after installation, must be 6 inch-pounds (0.68 Nm).

27 Maximum breakout or misalignment torque of bearing, after installation, must be 0.25 to 1.5 inch-pounds (0.03 to 0.17 Nm).

28 Install bearings flush to 0.003 inch (0.01 mm) below surface.

29 Install spacer P/N 206-001-339-009 with adhesive. Remove all squeeze-out. Apply anaerobic retaining compound (C-352) and install bearings flush to adjacent surfaces within 0.003 inch (0.08 mm).

30 Breakout or misalignment torque of bearing, after installation, must be 1 to 7 inch-pounds (0.11 to 0.79 Nm).

31 Apply anaerobic retaining compound sealant (C-356) to faying surfaces. Use 1/4-28UNF bolt, nut, and washers to align bearings and spacer during curing cycle. Torque bolt 25 to 35 inch-pounds (2.82 to 3.95 Nm) before curing.

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

NOTES: (CONT)

32 Breakout or misalignment torque of bearing, after installation, must be 1 to 5 inch-pounds (0.11 to 0.56 Nm).

33 Use anaerobic retaining compound sealant (C-356), omit staking.

34 Maximum breakaway torque, after staking, is 0.5 inch-pounds (0.06 Nm).

35 Apply anaerobic retaining compound sealant (C-356), omit staking. Use 1/4-28UNF bolt to align bearings and spacer during cure cycle. Torque bolt 25 to 35 inch-pounds (2.82 to 3.95 Nm) before curing.

36 Extension of staking sleeve on each side of lug, before staking, to be equal within 0.005 inch (0.13 mm).

37 After staking and prior to priming and painting, apply grease (C-001) to staked areas of sleeve.

38 Install flush to 0.010 inch (0.254 mm) below surface (with seals outward). Handpack bearings and cavity with grease (C-001).

39 Rotational preload for bearing, after installation, to be 1 to 7 inch-pounds (0.11 to 0.79 Nm) at 70 ±10°F (21 ±5.5°C).

40 Maximum breakaway torque, after staking, is 50 inch-pounds (5.65 Nm).

41 Refer to the BHT-222-CR&O manual for detailed instructions.

42 Tool may be purchased from Ozone Industries, Inc., Ozone Park, New York, 11416.

43 Remove old retaining compound with 400 grit abrasive cloth or paper (C-423). Apply retaining compound sealant (C-356).

44 Apply adhesive (C-313) to faying surfaces.

45 0.0025 inch (0.0127 mm) over listed dimension is permitted.

46 Press flange against shoulder on one side. Stake opposite side as noted.

47 Stake depth to be 0.005 to 0.009 inch (0.13 to 0.23 mm).

48 Refer to the BHT-214B-MM for detailed instructions.

49 Thermal fit. Stress relief not required.

50 Roll torque of bearing must not exceed 5 inch-pounds (0.56 Nm) at 72°F (22°C).

51 Roll torque of bearing must not exceed 3 inch-pounds (0.34 Nm) at 72°F (22°C).

CAUTION

DO NOT USE WATERBORNE EPOXY PRIMER COATING (C-246) FOR WET INSTALLATIONS.

52 Install with wet epoxy polyamide primer (C-204).

53 Maximum breakout torque of bearing, after installation, must be 12 inch-pounds (1.36 Nm).

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

NOTES: (CONT)

54 Use 1/4-28UNF bolt, nut, and washers to align bearings and spacer P/N 214-001-064-001 during curing cycle. Torque nut 25 to 35 12 inch-pounds (2.82 to 3.95 Nm) prior to curing.

55 Ball in bearing can be replaced without replacing race.

56 Install with sealant (C-320).

57 Stake depth to be 0.017 to 0.020 inch (0.43 to 0.51 mm).

58 Assemble lever P/N 214-060-769 in lever P/N 214-060-768 and press sleeve into levers. After bearing is ring staked, check for free movement of lever P/N 214-060-769 in lever P/N 214-060-768. Install rivet MS20470AD-3 through levers.

59 Each bearing will be subjected to a side load of 200 pounds (889.600 N) and shall have no evidence of permanent deformation, looseness, or damage.

60 Tool may be purchased from Kahr Bearing (www.sargentcontrols.com). Torque retainer to 148 inch-pounds (16.16 Nm).

61 Stake depth to be 0.005 to 0.009 inch (0.13 to 0.23 mm).

62 No load rotational breakaway torque after staking to be 15 inch-pounds (1.70 Nm) maximum.

63 Stake depth to be 0.025 to 0.040 inch (0.6350 to 1.0160 mm).

64 Bearing no load rotational breakaway torque not to exceed 25 inch-pounds (2.82 Nm).

65 Bearing not replaceable.

66 Bearing no load misalignment breakout torque must not exceed 5 inch-pounds (0.56 Nm).

67 Apply Grade N, sealant (C-320) to faying surfaces followed by application of retaining compound (C-352). Do not cure above 200°F (93°C). Do not stake bearing.

68 No load rotational breakaway torque after staking to be 12 inch-pounds (1.36 Nm) maximum.

69 Proof load test bearing installation to 1125 pounds (5004 N).

70 No load rotational breakaway torque after staking to be 1.0 to 18.0 inch-pounds (0.11 to 2.03 Nm).

71 No load rotational breakaway torque after staking to be 20.0 inch-pounds (2.26 Nm) maximum.

72 Tool may be obtained from Dixie Aerospace (www.dixieaerospace.com).

73 Apply MIL-S-22473, Grade N, sealant (C-320) before you apply sealant (C-356) to faying surfaces. Do not stake bearings. Do not cure above 200°F (93°C). Align bearings and spacer during cure cycle so that a 0.8743 inch (22.2072 mm) diameter shaft will pass through both bearings.

74 Apply MIL-S-22473, Grade N, sealant (C-320) before you apply ASTM D5363, Group 04, Class 1, Grade 1, retaining compound (C-352) to faying surfaces.

75 Proof load outer race of bearing to 650 pounds (2891 N), axially.

76 Breakout or misalignment torque of bearing, after installation, must be 0.125 to 5 inch-pounds (0.015 to 0.56 Nm).

77 Proof load inner race of bearing to 360 pounds (1601 N), axially.

Table 9-5. Bearing and Sleeve Replacement Data (Cont)

NOTES: (CONT)

78 Breakout or misalignment torque of bearing, after installation, must be 0.125 to 3 inch-pounds (0.015 to 0.34 Nm).

79 Breakout or misalignment torque of bearing, after installation, must be 1.5 inch-pounds (0.17 Nm) maximum.

80 Apply MIL-S-22473, Grade N, sealant (C-320) before you apply sealant (C-356) to faying surfaces. Do not stake bearings. Do not cure above 200°F (93°C). Use 1/4-28 UNF bolt, nut, and washers to align bearings and spacer during cure cycle. Torque bolt 25 to 35 inch-pounds (2.82 to 3.95 Nm) before curing.

81 Breakout or misalignment torque of bearing, after installation, must be 0.1 to 6 inch-pounds (0.011 to 0.67 Nm).

82 Apply MIL-S-22473, Grade N, sealant (C-320) before you apply ASTM D5363, Group 01, Class 1, Grade 1, sealant (C-320) to faying surfaces. Do not stake bearings. Do not cure above 200°F (93°C). Use bolt, nut, and washers to align bearings during cure cycle.

83 Stake depth to be 0.012 to 0.016 inch (0.30 to 0.41 mm).

84 Proof load bearing to 100 pounds (445 N).

85 Breakaway torque, after staking, must be less than 5 inch-pounds (0.56 Nm).

86 Breakaway torque, after staking, must be less than 0.0625 inch-pounds (0.007 Nm).

87 Apply MIL-S-22473, Grade N, sealant (C-320) before you apply sealant (C-356) to faying surfaces. Do not stake bearings. Do not cure above 200°F (93°C). Use 5/16-24 UNF bolt, nut, and washers to align bearings and spacer during cure cycle. Torque bolt 25 to 35 inch-pounds (2.82 to 3.95 Nm) before curing.

88 Breakaway torque, after staking, must be less than 0.0937 inch-pounds (0.0106 Nm).

89 Breakaway torque, after staking, must be less than 1 inch-pounds (0.11 Nm).

90 Breakaway torque, after staking, must be less than 0.3125 inch-pounds (0.0353 Nm).

91 Return the part to Bell Helicopter Textron (BHT) for evaluation and possible installation of replacement bearing. Refer to General Information Letter (IL) GEN-04-98 for the applicable shipping information and to obtain a Return Material Authorization (RMA) number.

92 Refer to TB 206L-96-189.

93 Use corrosion preventive compound (C-104) on faying surfaces.

94 Install flush to 0.005 inch (0.13 mm) below surface by pressing against stamped end of bearing.

95 Tool may be purchased from Aero Staking Inc.

96 Proof load test bearing installation to 365 pounds (1623 N) on both sides.

97 Breakaway torque, after staking, must be less than 10.0 inch-pounds (1.13 Nm).

CHAPTER 10 — STORAGE

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TABLES

STORAGE

10-1. GENERAL

This section provides preparation procedures to place the helicopter in storage for a period of 6 months or less, and depreservation procedures to activate the helicopter after storage. The procedure is divided into five categories of storage: flyable storage, short term storage, intermediate storage, long term storage, and individual component storage.

The storage of the helicopter includes corrosion control (Chapter 3 or CSSD-PSE-87-001), which consists primarily of preventing moisture from contacting exposed material surfaces by the use of preservatives.

Always refer to the applicable Flight Manual for approved fuel, oil, and hydraulic fluid specifications. Refer to the applicable Maintenance Manual for servicing instructions.

10-2. ENVIRONMENTAL CONDITIONS

Existing environmental conditions and available facilities must be considered when a helicopter is to be placed in storage. A choice of storage procedures is permitted for short periods of storage. For example, a choice must be made between flyable storage and short term storage for any period of time up to 45 days. The decision will be based on such on-site conditions as availability of people and materials, equipment necessary to perform ground runups, or motoring of engine(s), defueling and purging of fuel cell(s), and other similar elements. Wet weather conditions promote corrosion, rot, mildew, and mold. To prevent these deteriorating effects, do inspections regularly and take proper preventive maintenance action. The following practices should be used as a guide during exceptionally wet weather conditions:

1. Prevent rot, mildew, and mold from forming on non-metallic materials by keeping them clean and as dry as possible. Keep fabric material in the helicopter clean.

2. Treat for visible corrosion in accordance with Chapter 3 or the CSSD-PSE-87-001.

3. Keep the fuel cell(s) full to reduce condensation in the cell(s).

4. Store the helicopter in a dry, heated, and well ventilated hangar or shed, if space permits.

10-3. FLYABLE STORAGE

Flyable storage (no time limit) is the prescribed procedure to maintain a stored helicopter in an operable condition. If daily use is impossible or impractical, this procedure will keep the helicopter in the best possible condition. It requires periodic attention. The date and type of storage must be recorded in the helicopter records.

10-4. FLYABLE STORAGE — GENERAL PROCEDURES

1. Preservation should be done in an uninterrupted series of operations. When periods of interruption are necessary, temporary protection shall be provided by partially processed items, as required, to avoid contamination.

2. The prevention of corrosion depends on the control of moisture. One method is ventilation. On days when the relative humidity is 55% or higher, windows and other openings can be temporarily opened to allow a circulation of dry air through the helicopter. Use fans or blowers when available.

3. Make sure the water drain holes are free from obstruction and are kept open for the duration of the storage period.

4. Lubricate the helicopter prior to placing it in storage in accordance with the lubrication chart in the appropriate Maintenance Manual.

10-5. FLYABLE STORAGE — PREPARATION

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-002	Hydraulic Fluid
C-072	Hydraulic Fluid
C-410	Tape
C-427	Barrier Material

1. Power train.

a. Check and service the power train system as described in the appropriate Maintenance Manual.

2. Engine.

a. Exercise every precaution to keep the engine and accessories clean. Keep the air intake duct, plenum chamber, and compressor inlet screens clean and free of foreign materials. Clean and preserve engine(s).

b. Start engine(s). Refer to the appropriate Flight Manual.

NOTE

This engine run procedure may be omitted if helicopter was recently operated and is known to be dry.

c. After the warmup period, operate engine(s) for approximately 10 minutes at 100% N_P/N_R. Check all instruments for normal operation and make sure the engine temperature has stabilized. Shut down the engine(s). Refer to the appropriate Flight Manual.

d. Install the engine(s) inlet plug assemblies and exhaust cover(s). If the engine covers are not available, seal the air inlet and the exhaust openings with barrier material (C-427) and secure with tape (C-410).

e. Cover any additional engine cowling openings in a similar manner as outlined in the preceding step d.

f. Record the date engine(s) was placed in flyable storage in the helicopter records.

3. Hydraulic system(s).

a. Check the hydraulic reservoir(s).

NOTE

Refer to the applicable Flight Manual for approved hydraulic fluid specification.

b. Service as necessary with hydraulic fluid (C-002) or hydraulic fluid (C-072).

4. Fuel system.

a. Drain water from the fuel cells.

NOTE

Fuel cells filled to normal full capacity will reduce fuel contamination by condensation.

b. Service the fuel cells to normal full capacity after each engine preservation run.

5. Airframe.

a. Install the pitot tube cover(s), or if the cover is not available, wrap the pitot tube(s) with barrier material (C-427) and secure with tape (C-410).

b. Install the helicopter all-weather covers, if available.

c. Open (pull) all the circuit breakers.

d. Close the doors.

e. Install the static ground wire.

10-6. FLYABLE STORAGE — MAINTENANCE

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-410	Tape
C-427	Barrier Material

1. Do a preventive maintenance storage inspection at least once every 14 days (more frequently if required by local environmental conditions).

CAUTION

MAKE SURE IGNITION CIRCUIT BREAKERS ARE OPEN (PULLED) AND FUEL SHUTOFF VALVES ARE CLOSED.

2. To establish an inspection program outlined in the Maintenance Manual for storage of helicopters, Chapter 4 and Chapter 5 or other applicable Sections, Chapters, or documents may be used for areas to be covered and frequency of inspection. The inspection program shall include the following:

a. When the helicopter protective covers are not available, areas concerned will be protected with barrier material (C-427) secured with tape (C-410). Barrier material should be installed to prevent the accumulation of water on the surface. Provide drains if necessary. Replace damaged or deteriorated barrier materials or protective covers.

b. Determine the maximum helicopter interior temperatures during hot weather conditions. Temperature information can be obtained from standard thermometers temporarily installed in the helicopter. Record interior temperatures at regular intervals during the hottest part of the day. Ventilate the helicopter if the interior temperature exceeds 135°F (57°C). Provide forced air ventilation if normal ventilation procedures are not adequate to prevent mildew and corrosion.

c. Inspect and treat the helicopter for corrosion (Chapter 3 or CSSD-PSE-87-001).

d. Inspect the static ground wires, rotor tie-down straps, and mooring devices (ropes, cables, rods, or eyes) at regular intervals. Inspect the tie-down devices immediately after the helicopter has been subjected to winds exceeding 35 knots. Replace the ground wires, mooring devices, or tie-down straps that are deformed or deteriorated.

e. If possible, the helicopter should be stored in a hangar or under a protective cover. Otherwise, it should be parked and moored.

f. Enter the type of storage and the date the helicopter was placed in storage in the helicopter records.

10-7. FLYABLE STORAGE — DEPRESERVATION AND ACTIVATION

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-304	Drycleaning Solvent

1. Remove the protective covers and stow in a designated location.

2. Remove all barrier material and tape. Remove tape residue with drycleaning solvent (C-304).

3. Clean the helicopter as necessary.

4. Open all the doors and ventilate the helicopter.

5. Remove the main rotor and tail rotor tie-downs, if applicable.

6. Do the appropriate post storage inspections in accordance with the procedures in the Maintenance Manual.

7. Record the date the helicopter was prepared for service in the helicopter records.

8. Remove the static ground wire installed for storage.

10-8. SHORT TERM STORAGE

Short term storage (1 to 45 days) is used to store a helicopter up to 45 days with very little attention during storage period.

10-9. SHORT TERM STORAGE — GENERAL PREPARATION

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound

1. Make sure all the removed components are preserved and stowed in suitable containers.

2. Make sure a record of all the removed or disconnected parts is provided in the helicopter records.

3. Check the fuel, oil, and hydraulic lines and hoses for leakage.

4. Lubricate the helicopter.

5. Make sure the bolts, washers, nuts, etc. that are removed during disassembly are coated with a light coat of corrosion preventive compound (C-101) and reinstalled as removed from the component, unless otherwise specified.

6. Record the date and type of storage in the helicopter records.

10-10. SHORT TERM STORAGE — PRESERVATION

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
T-102102	Dehydrator
T-102103	Dehydrator

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-002	Hydraulic Fluid
C-011	Lubricating Oil
C-030	Lubricating Oil
C-072	Hydraulic Fluid
C-101	Corrosion Preventive Compound
C-105	Corrosion Preventive Compound
C-124	Corrosion Preventive Compound
C-125	Preservative Oil
C-304	Drycleaning Solvent
C-410	Tape
C-427	Barrier Material

1. Engine(s) and power train system.

NOTE

If the engine(s) is/are operable, complete preservation per step a and step b. If the engine(s) is/are inoperable, proceed to step f.

NOTE

The use of corrosion preventive compound (C-124) in oil MIL-PRF-7808 is not recommended.

a. Prior to engine runup:

(1) For components serviced with MIL-PRF-23699 lubricating oil (C-011), add corrosion preventive compound (C-124) to the transmission and tail rotor gearbox in the proportion of 5 ounces of concentrate to 1 U.S. quart (15% concentration) of the

oil system capacity. Refer to the appropriate Maintenance Manual.

(2) For components serviced with DOD-PRF-85734 lubricating oil (C-030), add corrosion preventive compound (C-124) to the transmission and tail rotor gearbox in the proportion of 1.5 ounces of concentrate to 1 U.S. quart (5% concentration) of the oil system capacity. Refer to the appropriate Maintenance Manual.

b. Preserve the engine(s). Refer to the appropriate engine Maintenance Manual for preservation and depreservation.

c. Clean the exposed metal surfaces of the power train system with a clean cloth dampened with drycleaning solvent (C-304).

d. Check the power train lubrication system including the sight gauges. Service the power train lubrication system. Refer to the Maintenance Manual.

e. Coat the exposed metal surfaces with corrosion preventive compound (C-101).

NOTE

If the engine(s) is/are inoperable, complete preservation of power train system in accordance with following step f.

f. Remove the transmission oil filler cap and tail rotor gearbox filler cap assembly. Install the dehydrator (T102102) on the transmission and the dehydrator (T102103) on the tail rotor gearbox. Cover the breather holes in the transmission and gearbox with barrier material (C-427) and secure with tape (C-410).

g. Install the engine protective inlet plug assemblies and engine protective exhaust cover, or seal openings with barrier material (C-427) and tape (C-410).

h. If the engine(s) cannot be motored, preserve the power train as follows:

(1) Preserve the engine fuel system.

(2) Remove the main rotor. Refer to the appropriate Maintenance Manual.

(3) Remove the mast assembly. Refer to the appropriate Maintenance Manual.

NOTE

The use of corrosion preventive compound (C-124) in oil MIL-PRF-7808 is not recommended.

(4) Spray the inside of the transmission, through the top opening, with approximately 1 gallon of applicable lubricating oil mixed with corrosion preventive compound (C-124). Use 5 ounces of corrosion preventive compound (C-124) per 1 U.S. quart of lubricating oil (C-011) MIL-PRF-23699 (15% concentration) or 1.5 ounces of corrosion preventive compound (C-124) per 1 U.S. quart of lubricating oil (C-030) MIL-PRF-85734 (5% concentration). Refer to the appropriate Maintenance Manual. While spraying, manually rotate the internal gears and bearings with the input drive quill. Spray the lower end of the mast and into the mast bearing.

(5) Install the mast assembly. Refer to the appropriate Maintenance Manual. Apply corrosion preventive compound (C-105) to all unpainted surfaces of the mast assembly. Wipe the mast dry with a clean lint-free cloth. Apply corrosion preventive compound (C-101) to all unpainted surfaces.

(6) Install the main rotor. Refer to the appropriate Maintenance Manual.

(7) Make sure the tail rotor gearbox has been filled with the applicable lubricating oil and corrosion preventive compound (C-124) to the proper level. Use 5 ounces of corrosion preventive compound (C-124) per 1 U.S. quart of lubricating oil (C-011) MIL-PRF-23699 (15% concentration) or 1.5 ounces of corrosion preventive compound (C-124) per 1 U.S. quart of lubricating oil (C-030) MIL-PRF-85734 (5% concentration).

(8) The transmission may have become overfilled during step (4). If so, drain down to the proper level. Refer to the appropriate Maintenance Manual.

i. Cover the cowling openings and breather holes in the transmission and gearboxes with barrier material (C-427) and secure with tape (C-410).

2. Fuel system.

a. Drain any water from the fuel cell(s). Maintain the fuel cell(s) at the full level for the duration of the storage period. Full fuel cells help reduce fuel contamination by condensation.

3. Hydraulic system(s).

NOTE

Refer to the applicable Flight Manual for approved hydraulic fluid specification.

a. Fill the hydraulic reservoir(s) with hydraulic fluid (C-002) or hydraulic fluid (C-072).

b. Wipe the exposed portions of the hydraulic boost cylinder actuator pistons with a lint-free cloth moistened with hydraulic fluid (C-002) or hydraulic fluid (C-072).

4. Rotor and controls.

a. Lubricate the rotor system. Refer to the applicable Maintenance Manual.

b. Apply corrosion preventive compound (C-105) to all unpainted metal surfaces. Remove any residue of the fingerprint remover with drycleaning solvent (C-304).

c. Wipe all parts dry with a clean, lint-free cloth, and apply corrosion preventive compound (C-101) on all unpainted metal surfaces not in contact with the bearings.

d. Clean the main rotor blades.

e. Apply a light, even coat of oil spray preservative oil (C-125) to the entire painted area of the rotor blades.

f. Purge lubricate all the exposed control bearings that require lubrication in accordance with the applicable Maintenance Manual.

5. Battery.

a. Disconnect the battery and allow to remain in the helicopter.

b. Wrap the battery quick-disconnects with barrier material (C-427) and secure with tape (C-410).

6. Instruments.

a. Install the cover on the pitot tube.

b. Apply electrical tape over the static ports, as applicable.

7. Avionics equipment.

a. Remove and store the headsets-microphones to an inside storage area.

b. Leave all the avionics equipment installed in the helicopter.

8. Landing gear.

a. Place the blocks or shoring under the skid tubes to provide free air passage.

b. Clean the crosstubes and skid tubes, and treat for corrosion (Chapter 3 or CSSD-PSE-87-001).

c. Repaint any exposed metal surfaces. If the paint system cannot be touched up, coat the bare metal surfaces with corrosion preventive compound (C-101).

9. Airframe.

a. Park and moor the helicopter with the main and tail rotor tie-downs installed.

b. Close the compartment doors.

c. Close and secure all the cowlings, inspection panels, and covers.

d. Close all openings not already covered with barrier material (C-427) and secure with tape (C-410).

e. Open (pull out) all the circuit breakers.

f. Install the static ground wire.

10-11. SHORT TERM STORAGE — MAINTENANCE

NOTE

The desiccant material in the dehydrators can be reactivated in accordance with the plug MS27215-2 manufacturers instructions.

1. Do the applicable portions of the storage inspection at least once every 30 days. Visually inspect the dehydrators for approximation of the degree of saturation of desiccant. If the dehydrator assembly is a dark blue color, this is acceptable. If the dehydrator assembly is a light beige or pink color, replace the dehydrator with serviceable unit.

2. If conditions change so a helicopter prepared for a short term storage must remain in storage for a longer period of time, represerve the helicopter in accordance with paragraph 10-14. Do not renew short term storage.

3. Engine(s).

a. Refer to the appropriate engine Maintenance Manual for preservation and depreservation.

10-12. SHORT TERM STORAGE — INSPECTION

1. Do the inspection procedures as required to ensure the helicopter is maintained in an acceptable storage condition.

2. Do a preflight inspection.

10-13. SHORT TERM STORAGE — DEPRESERVATION AND ACTIVATION

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-002	Hydraulic Fluid
C-072	Hydraulic Fluid
C-304	Drycleaning Solvent

1. Airframe.

a. Remove the protective covers and stow in a designated location.

b. Remove all the barrier material and tape. Remove tape residue with drycleaning solvent (C-304).

c. Open the compartment doors and ventilate the helicopter.

d. Remove the main and tail rotor tie-downs.

2. Landing gear.

a. Remove the blocks from under the skid gear.

3. Avionics.

a. Remove the headset-microphones from the storage area and install in the helicopter.

4. Instruments.

a. Remove the pitot tube covers and electrical tape from the static ports. Remove tape residue with drycleaning solvent (C-304).

5. Battery.

a. Remove the barrier material and tape from the quick-disconnect plugs.

b. Service and connect the battery (BHT-ELEC-SPM).

6. Rotor and controls.

a. Clean the main and tail rotor assemblies with drycleaning solvent (C-304). Wipe dry with a lint-free cloth.

b. Lubricate in accordance with the lubrication chart of the appropriate Maintenance Manual.

7. Power train assembly.

a. Remove the dehydrator assemblies (T102102 and T102103) from the transmission and tail rotor gearbox. Drain and fill the transmission and tail rotor gearbox with new lubricating oil (specification per applicable Flight Manual) in accordance with the

appropriate Maintenance Manual. Install the oil filler caps in the transmission and in the tail rotor gearbox.

b. Replace the transmission oil filter.

c. Clean the driveshafts as necessary with drycleaning solvent (C-304).

8. Fuel system(s).

a. Check the fuel cells for the presence of water and drain the water as necessary.

b. Fill the fuel cells, as necessary, with approved fuel.

9. Hydraulic system(s).

NOTE

Refer to the applicable Flight Manual for approved hydraulic fluid specification.

a. Clean the exposed portion of all the hydraulic boost cylinder actuator pistons with a clean cloth dampened with hydraulic fluid (C-002) or hydraulic fluid (C-072) and service the reservoirs to full level.

b. Coat the hydraulic pistons with a light coat of hydraulic fluid (C-002) or hydraulic fluid (C-072).

10. Engine(s).

a. For preservation and depreservation of the engine(s), refer to the applicable engine Maintenance Manual.

11. Miscellaneous.

a. Clean the helicopter as necessary.

b. Make sure all the removed components have been reinstalled on the helicopter. Check the helicopter records for components that have been removed or disconnected. Check for a subsequent installation or connection.

c. Make sure the systems have been properly depreserved and serviced before any system or component operational check is done. Do the necessary inspections and system operational checks as required.

d. Do the necessary inspections and system operational checks as required. Do a preflight inspection.

e. Remove the static ground wire installed for storage.

f. Record the date the helicopter was prepared for service in the helicopter records.

10-14. INTERMEDIATE STORAGE

Intermediate storage (46 to 180 days) is the type of storage to be used for helicopters that will be inactive for more than 45 days but not exceeding 180 days.

10-15. INTERMEDIATE STORAGE — GENERAL STORAGE PROCEDURES

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-011	Lubricating Oil
C-030	Lubricating Oil
C-124	Corrosion Preventive Compound

NOTE

The use of corrosion preventive compound (C-124) in oil MIL-PRF-7808 is not recommended.

1. Prior to engine runup, add corrosion preventive compound (C-124) to the transmission and gearbox oil systems as follows:

a. For components serviced with lubricating oil (C-011) MIL-PRF-23699, add corrosion preventive compound (C-124) to the transmission and tail rotor gearbox in the proportion of 5 ounces of concentrate to 1 U.S. quart (15% concentration) of the oil system capacity. Refer to the appropriate Maintenance Manual.

b. For components serviced with lubricating oil (C-030) DOD-PRF-85734, add corrosion preventive compound (C-124) to the transmission and tail rotor gearbox in the proportion of 1.5 ounces of concentrate

to 1 U.S. quart (5% concentration) of the oil system capacity. Refer to the appropriate Maintenance Manual.

10-16. INTERMEDIATE STORAGE — PREPRESERVATION GENERAL INSPECTION

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-104	Corrosion Preventive Compound

1. Inspect the helicopter in accordance with the applicable Maintenance Manual requirements and as follows:

a. Make sure all removed components are preserved and either stowed in the helicopter or at a designated location as prescribed in the respective paragraph.

b. Main rotor blades should be removed and placed in a metal shipping and storage container and stored under the cover.

c. Make sure a record of all removed or disconnected components is entered in the helicopter records.

d. Check the fuel, oil, and hydraulic lines and hoses for leakage.

e. Lubricate the helicopter in accordance with the information provided in the appropriate Maintenance Manual.

f. Make sure the bolts, washers, nuts, etc. that are removed during disassembly, are coated with a light coat of corrosion preventive compound (C-104) and reinstalled as removed from the component, unless otherwise specified.

10-17. INTERMEDIATE STORAGE — PRESERVATION

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
T102102	Dehydrator
T102103	Dehydrator

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-002	Hydraulic Fluid
C-072	Hydraulic Fluid
C-101	Corrosion Preventive Compound
C-105	Corrosion Preventive Compound
C-125	Preservative Oil
C-304	Drycleaning Solvent
C-410	Tape
C-427	Barrier Material

1. Preserve the engine and power train system (paragraph 10-10).

2. Preserve engine(s).

a. Refer to the applicable engine Maintenance Manual for preservation and depreservation.

3. Fuel system.

a. Drain and purge the fuel cells. Refer to fuel purging information in the applicable Maintenance Manual.

4. Hydraulic system(s).

NOTE

Refer to the applicable Flight Manual for approved hydraulic fluid specification.

a. Fill the hydraulic reservoir(s) with hydraulic fluid (C-002) or hydraulic fluid (C-072).

b. Wipe the exposed portions of the hydraulic boost cylinder actuator pistons with a lint-free cloth moistened with hydraulic fluid (C-002) or hydraulic fluid (C-072).

5. Main rotor and controls.

a. Lubricate the rotor system.

b. Apply corrosion preventive compound (C-105) to all unpainted metal surfaces. Remove any residue of the fingerprint remover with drycleaning solvent (C-304).

c. Wipe all parts dry with a clean, lint-free cloth, and apply corrosion preventive compound (C-101) on all unpainted metal surfaces not in contact with the bearings.

d. Remove and clean the main rotor blades. Refer to the applicable Maintenance Manual.

e. Apply a light, even coat of oil spray preservative oil (C-125) to the entire painted area of the rotor blades. Place the blades in a metal shipping and storage container and store under the cover.

f. Purge lubricate all exposed control bearings that require lubrication in accordance with the applicable Maintenance Manual.

6. Battery.

a. Remove the battery and store in an appropriate storage area.

b. Clean the battery compartment and accessories. Service and store the battery (Chapter 12).

c. Wrap the battery quick-disconnect plugs with barrier material (C-427) and secure with tape (C-410).

7. Instruments.

a. Install the cover on the pitot tube. Apply electrical tape over the static ports, as applicable.

8. Avionics equipment.

a. Remove and store the headsets-microphones to an inside storage area.

b. Leave all the avionics equipment installed in the helicopter.

9. Utility equipment.

a. Remove, apply a tag, and store inside in a secure storage area the first aid kit and other equipment subject to mildew or deterioration.

10. Landing gear.

a. Place the blocks or shoring under the skid tubes to provide free air passage.

b. Clean the crosstubes and skid tubes and treat for corrosion (Chapter 3 or CSSD-PSE-87-001).

c. Repaint any exposed metal surfaces. If the paint system cannot be touched up, coat the bare metal surfaces with corrosion preventive compound (C-101).

11. Airframe.

a. Park and moor the helicopter with the tail rotor tie-downs installed.

b. Close and secure all the cowlings, inspection panels, and covers.

c. Close all the openings in the fuselage not already covered with barrier material (C-427) and secure with tape (C-410).

d. Open (pull out) all the circuit breakers.

e. Install the static ground wire.

10-18. INTERMEDIATE STORAGE — MAINTENANCE

1. Helicopters in intermediate storage will be inspected in accordance with the applicable Maintenance Manual and the following instructions:

NOTE

The desiccant material in the dehydrators can be reactivated in accordance with the plug MS27215-2 manufacturers instructions.

2. Do the applicable portion of a storage inspection at least once every 30 days in accordance with the applicable Maintenance Manual. Visually inspect the dehydrator assembly for approximation of the degree of saturation of desiccant. If the dehydrator assembly is a dark blue color, this is acceptable. If the dehydrator assembly is a light beige or pink color, replace the dehydrator with a serviceable unit.

3. If conditions change so a helicopter prepared for intermediate storage must remain in storage for a longer period of time, refer to paragraph 10-21.

4. Engine(s).

a. Refer to the applicable engine Maintenance Manual.

10-19. INTERMEDIATE STORAGE — INSPECTION

1. Do the inspection procedures as required to ensure the helicopter is maintained in an acceptable storage condition.

2. Do a preflight inspection.

10-20. INTERMEDIATE STORAGE — DEPRESERVATION AND ACTIVATION

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-002	Hydraulic Fluid
C-072	Hydraulic Fluid
C-304	Drycleaning Solvent

1. Airframe.

a. Remove the protective covers and stow in a designated location.

b. Remove all the barrier material and remove tape residue with drycleaning solvent (C-304).

c. Open all the compartment doors and ventilate the helicopter.

d. Remove the tail and main rotor tie-downs.

2. Landing gear.

a. Remove the blocks from under the skid gear.

3. Avionics.

a. Remove the headset-microphones from storage and install in the helicopter.

4. Instruments.

a. Remove the pitot tube cover and store with the other protective covers.

b. Remove the barrier material and tape from the static vents in the airspeed system. Remove tape residue with drycleaning solvent (C-304).

5. Battery.

a. Remove the battery from storage. Service and verify the charge in accordance with the BHT-ELEC-SPM. Install in the helicopter.

b. Remove the barrier material and tape from the quick-disconnect plugs.

c. Connect the battery.

6. Rotor and controls.

a. Clean the main and tail rotor assemblies with drycleaning solvent (C-304). Wipe dry with a lint-free cloth.

b. Install the main rotor blades. Refer to the applicable Maintenance Manual.

c. Lubricate in accordance with the applicable Maintenance Manual instructions.

7. Utility equipment.

a. Remove the first aid kit(s) and other equipment from storage and install in the helicopter.

8. Hydraulic system(s).

NOTE

Refer to the applicable Flight Manual for approved hydraulic fluid specification.

a. Clean the exposed portion of the hydraulic boost cylinder actuator pistons with a clean cloth dampened with hydraulic fluid (C-002) or hydraulic fluid (C-072).

b. Coat the hydraulic pistons with a light coat of hydraulic fluid (C-002) or hydraulic fluid (C-072).

c. Service the hydraulic reservoir(s) with hydraulic fluid (C-002) or hydraulic fluid (C-072). Refer to the applicable Maintenance Manual.

9. Fuel system.

a. Drain any water from the fuel cells.

b. Fill the fuel cells, as required, with approved fuel. Refer to the applicable Flight Manual.

c. Prime the engine fuel system in accordance with the engine Maintenance Manual.

10. Power train assembly.

a. Remove the dehydrator assemblies (T102102 and T102103) from the transmission and tail rotor gearbox. Drain and fill the transmission and tail rotor gearbox with new lubricating oil (specification per the applicable Flight Manual) in accordance with the applicable Maintenance Manual. Install the oil filler cap in the transmission and tail rotor gearbox assembly.

b. Replace the transmission oil filter.

c. Clean the driveshafts, as necessary, with drycleaning solvent (C-304).

d. For Models 206L4 and 407 only, check the freewheel forward housing for internal corrosion flaking as follows:

(1) Cap the oil flow from the transmission oil line, which comes from the manifold on the deck to the freewheel to the tee with the restrictors installed.

(2) Remove the oil line from the freewheel forward housing and cap the oil flow. Drain the freewheel assembly.

(3) Remove the chip detector and base.

(4) With a bright light and or borescope look to see if there are particles floating or suspended in the oil or trapped in the return oil fitting, which is located just above the chip detector. If nothing is found, return the removed lines and reservice the system.

(5) If particles are found, remove the freewheel assembly and disassemble for further inspection. Refer to the BHT-407-CR&O or BHT-206A/B/L-Series-CR&O, housing (406-040-506) wear, damage, and repair limits.

11. Engine(s).

a. Refer to the applicable engine Maintenance Manual for preservation and depreservation.

12. Miscellaneous.

a. Clean the helicopter as necessary.

b. Make sure all removed components have been installed. Check the helicopter records for a record of components that have been removed or disconnected. Check for a subsequent installation or connection.

c. Make sure the systems have been properly depreserved and serviced before any system or component operational check is done.

d. Do the necessary inspections and system operational checks as required. Do a preflight inspection.

e. Remove the static ground wire installed for storage.

f. Record the date the helicopter was prepared for service in the helicopter records.

10-21. LONG TERM STORAGE

For storage beyond 180 days, renew the intermediate storage procedures in accordance with paragraph 10-14 through paragraph 10-19.

For Models 206L4 and 407 only, for long term storage depreservation and activation, refer to paragraph 10-20, step 10.

10-22. COMPONENT STORAGE — GENERAL

This portion of the chapter gives the preparation procedures to put the parts, sub-assemblies, and components in storage for different lengths of time. The instructions for depreservation are also given. The procedures are divided into four categories of storage: the parts and sub-assemblies temporary storage (1 to 14 days) (paragraph 10-24), the parts and sub-assemblies long term storage (15 to 180 days) (paragraph 10-25), component temporary storage (1 to 180 days) (paragraph 10-26), and component long term storage (180 to 365 days) (paragraph 10-33).

1. You must wear rubber or canvas gloves when you do the preservation steps for the parts.

2. Do not preserve the self-lubricating bearings (Teflon lined or oil impregnated).

3. Do not use newspaper, supermarket bags, tissue paper, or disposable wipers to wrap the parts or components.

4. Do not apply the preservative to the parts that have elastomeric rubber. When you store elastomeric material, you must keep it away from circulating air, sunlight, fuel, oil, water, dust, and ozone (generated by electric arc, fluorescent lamps, and other equivalent electrical equipment).

5. The parts and sub-assemblies that are in long term storage (15 to 180 days) and the components that are in temporary storage (1 to 180 days) or long term storage (180 to 365 days) must be examined every 30 days for condition.

NOTE

The desiccant material in the dehydrators can be reactivated in accordance with the plug MS27215-2 manufacturers instructions.

6. Desiccant material in the plug of dehydrators has a dark blue color. If the color changes to beige or pink, change the plug or the dehydrator desiccant material in the plug.

10-23. STORAGE — ENVIRONMENTAL CONDITIONS

The storage instructions are applicable if the parts, sub-assemblies, or components are stored in the controlled conditions that follow:

- Temperature: 40 to 80°F (4 to 27°C)
- Relative humidity: 50% maximum

10-24. PARTS AND SUB-ASSEMBLIES — TEMPORARY STORAGE (1 TO 14 DAYS)

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-105	Corrosion Preventive Compounds
C-304	Drycleaning Solvent
C-516	Clean Cloth

1. Clean the parts and sub-assemblies per Chapter 5 and/or special instructions given in the applicable cleaning section of the applicable manual.

NOTE

Only exposed metal is subject to the application of corrosion preventive compound (C-105) or preservative. Painted surfaces must be protected.

2. For parts or sub-assemblies that cannot be fully placed into preservative, do as follows:

a. As required, apply a layer of corrosion preventive compound (C-105) to the surfaces with a clean cloth (C-516).

b. Apply a layer of the applicable preservative (Table 10-1) to the surfaces with a clean cloth (C-516).

3. For parts or sub-assemblies that can be fully placed into preservative, do as follows:

a. Gently shake the part or sub-assembly in corrosion preventive compound (C-105) for 2 minutes.

b. Drain the corrosion preventive compound (C-105) from the part or sub-assembly.

c. Flush the part or sub-assembly in drycleaning solvent (C-304).

d. Dry the part or sub-assembly with filtered compressed air.

e. Apply a layer of the applicable preservative (Table 10-1) to the part or sub-assembly by dipping or by brush.

4. Put the part or sub-assembly in a controlled and dust-free environment.

5. If the 14-day storage needs to be extended, examine the corrosion protective coat and apply a coat of system lubricant to the part or sub-assembly, as required. If the conditions change and the part or sub-assembly must stay in storage, do the long term storage (15 to 180 days) procedure (paragraph 10-25).

CAUTION

MAKE SURE THAT ALL OF THE LUBRICATION PASSAGES ARE CLEAN AND FREE OF OBSTRUCTION.

6. If you have to use the part or sub-assembly, refer to Chapter 5 for instructions on how to clean the part or sub-assembly before you use it.

10-25. PARTS AND SUB-ASSEMBLIES — LONG TERM STORAGE (15 TO 180 DAYS)

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-105	Corrosion Preventive Compound
C-304	Drycleaning Solvent

MATERIALS REQUIRED (Cont)

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-410	Tape
C-427	Barrier Material
C-516	Clean Cloth
MIL-B-22191	Plastic Material

1. Clean the parts and sub-assemblies per Chapter 5 and/or the special instructions given in the applicable cleaning section of the applicable manual.

NOTE

Only exposed metal is subject to the application of corrosion preventive compound (C-105) or preservative. Painted surfaces must be protected.

2. For parts or sub-assemblies that cannot be fully placed into preservative, do as follows:

a. Apply a layer of corrosion preventive compound (C-105) to the necessary surfaces with a clean cloth (C-516).

b. Apply a layer of applicable preservative (Table 10-1) to the surfaces with a clean cloth (C-516).

3. For parts or sub-assemblies that can be fully placed into preservative, do as follows:

a. Gently shake the part or sub-assembly in corrosion preventive compound (C-105) for 2 minutes.

b. Drain the corrosion preventive compound (C-105) from the part or sub-assembly.

c. Flush the part or sub-assembly in drycleaning solvent (C-304).

d. Dry the part or sub-assembly with filtered compressed air.

e. Apply a layer of applicable preservative (Table 10-1) to the part or sub-assembly by dipping or by brush.

4. After the preservation is completed, individually wrap the part into barrier material (C-427) and safety with tape (C-410) or put the part in a bag made of plastic material (MIL-B-22191) and do a heat seal or safety with tape (C-410).

5. If the condition requires that the storage be extended, examine the corrosion protective coat and apply a new coat of corrosion protective preservative to the part or sub-assembly if necessary. You will extend the storage time for 180 days. Do this procedure each time the storage time needs to be extended.

CAUTION

MAKE SURE THAT ALL OF THE LUBRICATION PASSAGES ARE CLEAN AND FREE OF OBSTRUCTION.

6. If you have to use the part or sub-assembly, refer to Chapter 5 for instructions on how to clean the part or sub-assembly before you use it.

10-26. COMPONENTS — TEMPORARY STORAGE (1 TO 180 DAYS)

1. Refer to Chapter 5 for instructions on how to clean the exposed metal surfaces of a component.

2. If the conditions change and the component must stay in storage, apply a coat of preservative to the component as described in Table 10-1. For the transmission, intermediate, and the tail rotor gearbox, do the preservation in agreement with the long term storage (180 to 365 days) (paragraph 10-33).

3. If you have to use the component, refer to Chapter 5 for instructions on how to clean the part or sub-assembly before you use it. Always drain residual oil and fill with new oil in accordance with the applicable Maintenance Manual. Refer to the Flight Manual for approved oils. Make sure the transmission, intermediate, or the tail rotor gearbox are not overfilled.

10-27. Main Rotor Hub — Temporary Storage (1 to 180 days)

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-410	Tape
C-427	Barrier Material
MIL-B-22191	Plastic Material

1. Apply a protective coat to the main rotor hub as described in Table 10-1.

CAUTION

IF APPLICABLE, DO NOT APPLY THE PRESERVATIVE TO PARTS THAT HAVE ELASTOMERIC RUBBER.

2. Wrap the main rotor hub in barrier material (C-427) or plastic material (MIL-B-22191) and safety with tape (C-410).

3. If there are elastomeric rubber parts in the main rotor hub, put the main rotor hub away from circulating air, sunlight, fuel, oil, water, dust, and ozone (generated by electric arc, fluorescent lamps, and other equivalent equipment).

10-28. Swashplate — Temporary Storage (1 to 180 days)

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-410	Tape
C-427	Barrier Material
MIL-B-22191	Plastic Material

1. Apply a protective coat to the swashplate as described in Table 10-2.

2. Refer to the applicable Maintenance Manual and purge lubricate the swashplate.

3. Wrap the swashplate in barrier material (C-427) or plastic material (MIL-B-22191) and safety with tape (C-410).

10-29. Mast — Temporary Storage (1 to 180 days)

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-011	Lubricating Oil
C-030	Lubricating Oil
C-410	Tape
MIL-B-22191	Plastic Material

NOTE

Refer to the applicable Flight Manual for the specification of lubricating oil.

1. Spray lubricating oil (C-011) or lubricating oil (C-030) in the mast and mast bearing.

2. Apply a protective coat to the mast per Table 10-1.

3. Wrap the lower mast end (include the bearing and the support sub-assembly) in plastic material (MIL-B-22191) and safety with tape (C-410).

10-30. Freewheel — Temporary Storage (1 to 180 days)

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-011	Lubricating Oil

MATERIALS REQUIRED (Cont)

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-030	Lubricating Oil
C-410	Tape
C-427	Barrier Material
MIL-B-22191	Plastic Material

NOTE

Refer to the applicable Flight Manual for specification of lubricating oil.

1. Make sure the internal components of the freewheel have a coating of lubricating oil (C-011) or lubricating oil (C-030).

2. Apply a protective coat to the freewheel per Table 10-1.

3. Wrap the freewheel in barrier material (C-427) or plastic material (MIL-B-22191) and safety with tape (C-410).

4. For Models 206L4 and 407 only, for freewheel temporary storage depreservation and activation, inspect housing (406-040-506) for flaking condition. Refer to the BHT-407-CR&O or the BHT-206A/B/L-Series-CR&O, housing wear, damage, and repair limits.

10-31. Transmission — Temporary Storage (1 to 180 days)

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
△1	Transmission Cover and Lift Plate Assembly
T102102	Dehydrator

NOTE:

△1 Refer to the applicable Maintenance Manual (MM) for the part number.

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-011	Lubricating Oil
C-030	Lubricating Oil
C-410	Tape
C-427	Barrier material
MIL-B-22191	Plastic Material

NOTE

Refer to the applicable Flight Manual for the specification of lubricating oil.

1. Spray lubricating oil (C-011) or lubricating oil (C-030) in the transmission. Rotate and make sure all gears, bearings, and surfaces are coated. Drain the transmission.

2. Apply a protective coat to the transmission per Table 10-1.

3. Wrap the transmission in barrier material (C-427) or plastic material (MIL-B-22191) and safety with tape (C-410).

10-32. Intermediate/Tail Rotor Gearbox — Temporary Storage (1 to 180 days)

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
△1	Transmission Cover and Lift Plate Assembly
T102103	Dehydrator

NOTE:

△1 Refer to the applicable Maintenance Manual (MM) for the part number.

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-011	Lubricating Oil
C-030	Lubricating Oil
C-410	Tape
C-427	Barrier Material
MIL-B-22191	Plastic Material

NOTE

Refer to the applicable Flight Manual for the specification of lubricating oil.

1. Spray lubricating oil (C-011) or lubricating oil (C-030) in the tail rotor gearbox. Rotate and make sure all gears, bearings, and surfaces are coated. Drain the gearbox.

2. Apply a protective coat to the tail rotor gearbox per Table 10-1.

3. Wrap the tail rotor gearbox in barrier material (C-427) or plastic material (MIL-B-22191) and safety with tape (C-410).

10-33. COMPONENTS — LONG TERM STORAGE (180 TO 365 DAYS)

1. For long term storage (180 to 365 days) of the main rotor hub, swashplate, mast, and freewheel, do the procedure for temporary storage (1 to 180 days) every 180 days (paragraph 10-26).

2. If the conditions change and the transmission, intermediate, or the tail rotor gearbox must stay in storage, apply a coat of preservative to the component as described in Table 10-1. Drain the residual oil mixture from the component and do the spray procedure again. Refer to paragraph 10-34 and paragraph 10-35.

3. If you have to use the component, refer to Chapter 5 for instructions on how to clean a part or sub-assembly before you use it. Always drain the

residual oil mixture and fill with new oil in accordance with the applicable Maintenance Manual. Refer to the Flight Manual for approved oils.

10-34. Transmission — Long Term Storage (180 to 365 days)

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
△1	Transmission Cover and Lift Plate Assembly
T102102	Dehydrator

NOTE:

△1 Refer to the applicable Maintenance Manual (MM) for the part number.

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-011	Lubricating Oil
C-030	Lubricating Oil
C-124	Corrosion Preventive Compound
C-410	Tape
C-427	Barrier Material
MIL-B-22191	Plastic Material

NOTE

Refer to the applicable Flight Manual for the specification of lubricating oil.

NOTE

The use of corrosion preventive compound (C-124) in MIL-PRF-7808 oil is not recommended.

1. Spray inside the transmission, through the top opening, with approximately 1 gallon of the applicable lubricating oil mixed with corrosion preventive compound (C-124). Use 5 ounces of corrosion preventive compound (C-124) per 1 U.S. quart of MIL-PRF-23699 lubricating oil (C-011) (15% concentration) or 1.5 ounces of corrosion preventive compound (C-124) per 1 U.S. quart of MIL-PRF-85734 lubricating oil (C-030) (5% concentration). While spraying, manually rotate the internal gears and bearings with the input drive quill. Make sure all the gears, bearings, and surfaces are coated. Drain the transmission.

2. Apply a protective coat to the external areas described in Table 10-1.

3. Wrap the transmission in barrier material (C-427) or plastic material (MIL-B-22191) and safety with tape (C-410).

10-35. Intermediate/Tail Rotor Gearbox — Long Term Storage (180 to 365 days)

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
△1	Transmission Cover and Lift Plate Assembly
T102103	Dehydrator

NOTE:

△1 Refer to the applicable Maintenance Manual (MM) for the part number.

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-011	Lubricating Oil
C-030	Lubricating Oil
C-124	Corrosion Preventive Compound

MATERIALS REQUIRED (Cont)

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-410	Tape
C-427	Barrier Material
MIL-B-22191	Plastic Material

NOTE

Refer to the applicable Flight Manual for the specification of lubricating oil.

NOTE

The use of corrosion preventive compound (C-124) in MIL-PRF-7808 oil is not recommended.

1. Make sure the intermediate or tail rotor gearbox has been filled with the applicable lubricating oil and corrosion preventive compound (C-124) to the proper level. Use 5 ounces of corrosion preventive compound (C-124) per 1 U.S. quart of MIL-PRF-23699 lubricating oil (C-011) (15% concentration) or 1.5 ounces of corrosion preventive compound (C-124) per 1 U.S. quart of MIL-PRF-85734 lubricating oil (C-030) (5% concentration). To coat the internal component surfaces with oil, manually rotate the internal gears and bearings with the input drive. Make sure all the gears, bearings, and surfaces are coated. Drain the gearbox.

2. Apply a protective coat to the external areas described in Table 10-1.

3. Wrap the tail rotor gearbox in barrier material (C-427) or plastic material (MIL-B-22191) and safety with tape (C-410).

Table 10-1. Preservation Requirement

ITEM	MATERIAL AND/OR ITEM	PROCEDURE OF PRESERVATION	PRESERVATIVE ⚠1
1	**Aluminum alloy parts**		
	Bare, not fully anodized, not fully chemical film treated, or not fully painted.	Apply a coat of preservative to the bare surfaces.	PR-1 or PR-2
2	**Bearings**		
	1. Sealed or shielded – grease lubricated.	1. Purge the lubricant and apply a coat of preservative to the bare and external surfaces of the bearing.	1. PR-3
	2. Oil lubricated.	2. Apply a coat of preservative to the surfaces of the bearing.	2. PR-4
	3. Teflon lined.	3. Individually wrap in barrier material.	3. None
3	**Ferrous (steel) parts, or a ferrous part in an aluminum or magnesium sub-assembly (bearing liner)**		
	1. Bare, not fully painted or plated, or not fully coated with a solid film lubricant.	1. Apply a coat of preservative to the bare surface.	1. PR-1 or PR-2

Table 10-1. Preservation Requirement (Cont)

ITEM	MATERIAL AND/OR ITEM	PROCEDURE OF PRESERVATION	PRESERVATIVE ⚠1
	2. Black oxide coated parts.	2. Apply a coat of preservative to black oxide coated parts.	2. PR-5
4	**Magnesium parts** Bare or Dow 19 treated or not fully painted.	Apply a coat of preservative to the bare and Dow 19 treated surfaces.	PR-5

NOTE:

⚠1 Refer to Table 10-2 for the identification of the preservatives.

Table 10-2. Preservatives Identification

TYPE	DESCRIPTION	MATERIAL CODE OR SPECIFICATION
PR-1	Thin film preservative (soft film, cold application)	Corrosion preventive compound (C-104)
PR-2	Preservative oil	MIL-L-21260, Type I, Grade 10, 30, or 50 or Type II, Grade 10 or 30 (C-578)
PR-3	Grease	Grease (C-001), unless otherwise stated in applicable Maintenance Manual, Mobile 28 is preferred
PR-4	Low volatile preservative oil	Lubricating oil (C-020)
PR-5	Preservative oil	MIL-C-6085, Type II (C-579)

CHAPTER 11 — SOLVENTS

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TABLES

SOLVENTS

11-1. SOLVENTS — GENERAL

The correct use of solvents during maintenance and overhaul of parts and components is very important. Metallic and non-metallic materials, used in all Bell Helicopter models of helicopter, are sensitive to solvents. The solvent is a fluid that dissolves solids and liquids. Therefore, safety and non-safety related precautions must be followed to prevent injuries to persons and/or damage to these materials.

When these materials are in contact with specific solvents, damage from immediate destruction to a delayed deterioration can result. When delayed, the damage may not be readily apparent at the time of the solvent usage. For that reason, it is imperative to follow the guidelines and restrictions on the usage of solvents, provided in Table 11-1. Because solvents are commonly used as cleaning agents, refer to Chapter 5 for additional information on cleaning procedures.

11-2. SOLVENTS — PRECAUTIONS

WARNING

MAKE SURE YOU OBEY ALL OF THE SAFETY PRECAUTIONS WHEN YOU USE SOLVENTS. FAILURE TO DO SO MAY RESULT IN INJURIES TO PERSONS AND/OR DAMAGE TO COMPONENTS.

1. Do not ingest or inhale solvents. Ingestion of solvent may have the following chronic health effects:

- Solvents can be carcinogenic (Benzene, Chloroform, etc.)
- Solvents can cause damage to internal organs (liver, kidneys, etc.)

Refer to the Material Safety Data Sheet (MSDS) of the solvent or to the container label for additional safety information.

2. Each time you use solvent, make sure to follow all the safety precautions given hereafter:

- Avoid contact of the solvent with the skin. Absorption of solvent through the skin is possible, and can cause sores and wounds. Always wear gloves.
- If possible, prevent the solvent from making vapors (fume hood, etc.). Otherwise, make sure the work area has good ventilation, keep the solvent container tightly closed, and avoid the breathing of solvent vapors.
- Never use flammable solvents near open flame (refer to Table 11-2 for properties of solvents).

3. Some materials are extremely sensitive to solvents. Whenever you use solvent, make sure of the following:

- Always protect transparent areas (including coated glass windshields) from solvent splash, fumes, and overspray.
- Always protect parts made of elastomeric material (seals, boots, mounts, springs, etc.) from solvent splash, fumes, and overspray.
- Solvents may soften or dull materials. If you are not sure about the effects, test the solvent on an insignificant area of the material.

11-3. SOLVENTS — COMMON SOLVENTS FOR MAINTENANCE AND OVERHAUL

The following provides information on the solvents that are commonly used in maintenance and overhaul of parts and components. These are organic solvents, or solvents that contain carbon. Additional information on properties, applications, and nomenclatures is given in Table 11-2 in order to clarify the usage of the solvents.

11-4. CHLORINATED HYDROCARBONS

NOTE

1,1,1-Trichloroethane (Methyl chloroform, chlorothene, tri-ethane, solvent 111) and trichloroethylene (triclene, Tri, trilene) are no longer authorized for use on Bell Helicopter Parts. Use perchloroethylene (C-563) (tetrachloroethylene, perclene, perc) instead.

Chlorinated hydrocarbons are organic solvents that contain chlorine. Some of the most commonly used are:

1. Perchloroethylene (C-563) (tetrachloroethylene, perclene, Perc).

Perchloroethylene (C-563) is not flammable at room temperature and evaporates easily into air. It is widely used for dry cleaning and metal-degreasing. It is also currently in use at Bell Helicopter for vapor degreasing. The boiling point is 248 to 252°F (120 to 122°C).

2. Methylene chloride (methylene dichloride, dichloromethane) (ASTM D4079).

Occasionally specified for cleaning and degreasing. Used in some paint removers. The boiling point is 103 to 104°F (39.4 to 40°C). Not flammable.

11-5. FLUORINATED SOLVENTS

These are normally supplied under trade names such as:

- FREON — Dupont
- GENESOLV — Allied Chemical

A number of commercial “degreasers” are mixtures of fluorinated materials and other solvents such as alcohol, methylene chloride or ketones. The principal restriction on the use of fluorinated solvents is that it could lead to corrosion problems when used to clean hydraulic assemblies. However, care must be exercised to ensure that mixtures do not contain solvents which may damage the parts being cleaned. Many of the “cleaners” for electrical and electronic equipment contain fluorinated solvents.

These materials are not flammable but can break down when exposed to hot surfaces or flame.

11-6. PETROLEUM SOLVENTS

These are by far the most common solvents available.

1. Aliphatic naphtha (C-305).

Aliphatic naphtha (C-305) is the only naphtha considered to be safe for use on plastics and paints. The flash point is 20 to 50°F (–6.7 to 10.0°C) and it is extremely flammable. This solvent is normally used for removing grease and oil from painted surfaces and plastic parts.

2. Aromatic naphtha (C-388).

In some applications, aromatic naphtha (C-388) may be specified. Be careful not to substitute this solvent with aliphatic naphtha (C-305) because it will damage some plastics and painted parts. The flash point is usually about 100°F (37.8°C). This solvent is often specified for activation of rubber cements and for removal of grease from metal parts.

3. Stoddard solvent (C-389).

(Similar to dry cleaning solvent, white spirits, safety solvent, or high flash naphtha). The flash point is about 100 to 110°F (37.8 to 43.3°C). This solvent is often specified for degreasing metal parts and for cleaning assemblies. It may be used for wiping painted parts but should not be used on plastics.

4. Mineral spirits (petroleum distillate, heavy naphtha, turpentine substitute).

This solvent is usually used as a thinner for exterior house paints and for cleaning paint equipment. It should not be used on plastic or painted parts.

11-7. ALCOHOLS

NOTE

Alcohols are generally required for specific cleaning processes and the particular type required should be specified. Otherwise, any of those listed hereafter is suitable.

Methyl alcohol (C-302) (methanol, wood alcohol, wood spirit, carbinol) are no longer authorized for use on Bell Helicopter parts. Use ethyl alcohol (C-339) instead.

Alcohols are most often used for cleaning plastic surfaces or assemblies. There are two different alcohols which are specified for use during maintenance and overhaul operations. These are:

1. Ethyl alcohol (C-339) (ethanol, grain alcohol, spirits, denatured alcohol).

2. Isopropyl alcohol (C-385) (secondary propyl alcohol, isopropanol, Per-Spirit, petrohol). Common rubbing alcohol is a diluted isopropyl alcohol (C-385).

11-8. KETONES

The ketones are strong solvents that will dissolve many paints and plastics. The most common ketones used in aircraft maintenance are:

1. Acetone (C-316) (propanone, dimethyl ketone, 2-propanone).

Acetone (C-316) is a colorless and flammable solvent. It can be used to remove superglue and for thinning (dilution) and cleaning fiberglass resins and epoxies. Use acetone (C-316) only when specified in the procedure.

2. MEK (C-309) (methyl-ethyl-ketone, 2-butanone).

MEK (C-309) is a colorless and flammable solvent with a sharp and sweet odor. The solvent is widely used in paints and coatings because it evaporates quickly. It can dissolve many substances, therefore it should be used only when specified in the procedure.

11-9. AIRCRAFT PAINT AND PRIMER THINNERS

The newer paint materials (epoxy and urethane) use specific catalyst/thinner mixtures which are normally supplied as a “kit” with the base material, and these should not be used for any other purpose. However, there are a number of enamels and lacquers still in use which require dilution (thinning) prior to application.

1. Nitrate cellulose lacquer thinner (C-206).

Normally these are mixtures of solvents, such as toluene, alcohols and esters. In some cases, particular mixtures must be used with specific lacquer formulations or undesirable coatings may result. They should not be used for general cleaning of painted or plastic parts. They are flammable with a flash point around 50°F (10.0°C).

2. Toluene (C-306).

Normally used for thinning zinc chromate primers (alkyd type) and some other paints. This solvent should not be used for general cleaning of painted or plastic parts. The flash point is below 45°F (7.2°C).

Table 11-1. Solvents — Usage and Limitations

MATERIAL	SOLVENTS	TEMPERATURE	NOTES
Bare metal (except titanium) with no paint, adhesive, rubber, etc.	Aliphatic naphtha (C-305) Stoddard solvent (C-389) Mineral spirits Paint thinners Perchloroethylene (C-563)	Ambient Ambient Ambient Ambient 248 to 252°F (120 to 122°C)	Vapor degrease
Metal with paint.	Aliphatic naphtha (C-305) Stoddard solvent (C-389) Isopropyl alcohol (C-385) Mineral spirits	Ambient only Ambient only Ambient only Ambient only	△1 △2 △3
Metal with adhesive bonded joints.	Aliphatic Naphtha (C-305) Stoddard Solvent (C-389) Isopropyl Alcohol (C-385)	Ambient only Ambient only Ambient only	△1 △2
Metal with rubber (elastomeric bearings, grease and oil seals, boots, etc.).	Aliphatic naphtha (C-305) Stoddard solvent (C-389) Isopropyl alcohol (C-385)	Ambient Ambient Ambient	△2 △4 Use these solvents sparingly.

Table 11-1. Solvents — Usage and Limitations (Cont)

MATERIAL	SOLVENTS	TEMPERATURE	NOTES
Titanium metal (nodal beam retention bolts, etc.)	Isopropyl alcohol (C-385) Aliphatic naphtha (C-305) Mineral spirits Stoddard solvent (C-389) Toluene (C-306)	Ambient Ambient Ambient Ambient Ambient	2 5

NOTES:

1. Do not use ketones, lacquer thinner (C-206), and other strong solvents on painted surface.
2. Do not use alcohol to clean hydraulic components. A sticky acrylic resin will form and can prevent correct operation of equipment.
3. If paint needs to be removed, use solvents for bare metals.
4. Do not soak, vapor degrease, or clean with chlorinated solvents.
5. If paint or solid film lubricant needs to be removed, use MEK (C-309) or a non-chlorinated paint remover.

Table 11-2. Solvents — Characteristics

SOLVENTS AND SOLVENT TYPES	PROPERTIES	APPLICATIONS	COMMON, SYSTEMATIC, OR TRADE NAMES
CHLORINATED HYDROCARBONS			
Perchloroethylene (C-563)	Not flammable Boiling point 248 to 252°F (120 to 122°C) Melting point -2.2°F (-19°C)	Dry cleaning Vapor degreasing	Tetrachloroethylene Tetrachloroethene Perclene Perc
Methylene chloride	Not flammable Boiling point 103 to 104°F (39.4 to 40.0°C) Melting point -142°F (-96.7°C)	Cleaning Degreasing Used in some paint removers.	Methylene dichloride Dichloride methane Dichloromethane
FLUORINATED SOLVENTS			
Fluorinated solvents	Not flammable Sensitive to extreme heat	Normally combined in a mixture with other cleaning agents such as alcohol, methylene chloride, or MEK to impart degreasing properties.	Freon Genesolv

Table 11-2. Solvents — Characteristics (Cont)

SOLVENTS AND SOLVENT TYPES	PROPERTIES	APPLICATIONS	COMMON, SYSTEMATIC, OR TRADE NAMES
PETROLEUM SOLVENTS			
Aliphatic naphtha (C-305)	Extremely flammable Flash point 20 to 50°F (-6.7 to 10.0°C)	Removal of grease and/or oil from painted and plastic surfaces.	Naphtha Type II naphtha
Aromatic naphtha (C-388)	Flammable Flash point 100°F (37.8°C)	Specified for activation of rubber cements. Removal of grease from metal parts. Will damage plastic parts and painted surfaces. May not be substituted for aliphatic naphtha.	Type I naphtha
Drycleaning solvent (C-304)	Flammable Flash point 100 to 110°F (37.8 to 43.0°C)	Cleaning of metals Degreasing of metals Wiping of painted parts. Should not be used on plastics.	Dry cleaning solution White spirits High flash naphtha
Mineral spirits	Flammable	Paint thinner Cleaning of paint equipment. Should not be used on plastics.	Petroleum distillate Heavy naphtha Turpentine substitute White spirit (Europe) Petroleum spirit (Europe)
ALCOHOLS			
Ethyl alcohol (C-339)	Highly flammable	Cleaning of plastic surfaces. Removal of tack glues. Special cases as specified.	Ethanol Grain alcohol Denatured alcohol
Isopropyl alcohol (C-385)	Highly flammable	Cleaning of plastics or as specified.	Isopropanol Petrohol Rubbing alcohol (dilute)
KETONES			
Acetone (C-316)	Extremely flammable. Flash point –20 to 20°F (–28.9 to –6.6°C)	Use only as specified in procedures. Will dissolve most paints and plastics.	Propanone Dimethyl ketone 2-Propanone

Table 11-2. Solvents — Characteristics (Cont)

SOLVENTS AND SOLVENT TYPES	PROPERTIES	APPLICATIONS	COMMON, SYSTEMATIC, OR TRADE NAMES
KEYTONES (CONT)			
MEK (C-309)	Extremely flammable. Flash point –20 to 20°F (–28.9 to –6.6°C)	Use only as specified in procedures. Will dissolve most paints and plastics.	Methyl-ethyl-ketone 2-butanone
AIRCRAFT PAINT AND PRIMER THINNERS			
Epoxy and urethane	Two component mixtures	These paint materials are specific catalyst/ thinner mixtures which are normally supplied as a “kit” and should not be used separately for any other purpose.	
Lacquer thinner (C-206)	Mixtures of solvents such as toulene, alcohols and esters. Flammable. Flash point approximately 50°F (10.0°C)	Normally used with specific lacquer formulation to produce desired results. Not to be used on paints or plastics.	Thinner
Toluene (C-306)	Highly flammable Flash point 45°F (7.22°C)	Normally used for thinning zinc chromate primers (alkyd types) and other paints. Not to be used on paints or plastics.	Methylbenzene Phenylmethane

CHAPTER 12 — NICKEL-CADMIUM AIRCRAFT STORAGE BATTERY

NOTE

Chapter 12 has been deleted in its entirety at Rev. 1. Please refer to the Electrical Standard Practices Manual (BHT-ELEC-SPM) for information on Nickel-Cadmium Aircraft Storage Batteries.

CHAPTER 13 — CONSUMABLE MATERIALS

TABLE OF CONTENTS

TABLES

CONSUMABLE MATERIALS

13-1. CONSUMABLE MATERIALS

WARNING

MAKE SURE TO FOLLOW ALL SAFETY PRECAUTIONS WHEN YOU USE CONSUMABLE MATERIALS. FAILURE TO OBEY CAN CAUSE DAMAGE TO EQUIPMENT, INJURY TO PERSONNEL, OR DEATH.

Consumable material required to support Bell helicopters are listed in Table 13-1.

For the latest listing of consumable materials, please refer to the Electronic Commercial Technical Publications Web site at www.bellhelicopter.net. The web site consumable listing will be kept up to date between paper copy manual revisions.

Federal Supply Codes for Manufacturers (FSCM) or Commercial and Government Entity (CAGE) codes are listed in the source column (when known) to provide a specific approved source for material listed.

NOTE

Federal Supply Codes for Manufacturers (FSCM) listing of vendors name, address (Name-to-Code, or Code-to-Name) may be obtained from:

IHS Markit
15 Inverness Way East
Englewood, Colorado 80112
http://www.ihs.com

Technical Support:
1-800-447-2273 (USA/Canada)
1-303-858-6187 (America (Outside US & Canada))
+ 44 1344 328 300 (Europe and Middle East)
+ 604 291 3600 (Asia Pacific)
1-303-397-2599 (Fax)
custsvc@ihs.com

Telemarketing:
U.S. and International Phone Number
1-800-525-7052

For any additional information pertaining to the safety precautions, definition, application, and use of these consumables, please refer to the manufacturers Technical Data Sheet, Material Safety Data Sheet (MSDS), or any other applicable documentation available through Bell Helicopter Textron or the manufacturer of the product.

Links to MSDS and other consumable data are available via the Electronic Commercial Technical Publications Web site at www.bellhelicopter.net.

13-2. ADHESIVE DATA

Table 13-2 provides acceptable alternates for Bell Helicopter Textron adhesives (299-947-XXX), including the characteristics for curing and the storage life.

WARNING

MAKE SURE TO FOLLOW ALL SAFETY PRECAUTIONS WHEN YOU USE CONSUMABLE MATERIALS. FAILURE TO OBEY CAN CAUSE DAMAGE TO EQUIPMENT, INJURY TO PERSONNEL, OR DEATH.

For any additional information pertaining to the safety precautions, definition, application, and use of these alternate adhesives, please refer to the manufacturers Technical Data Sheet, Material Safety Data Sheet (MSDS), or any other applicable documentation available through Bell Helicopter Textron or the manufacturer of the product.

Links to MSDS and other consumable data are available via the Electronic Commercial Technical Publications Web site at www.bellhelicopter.net.

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-001	Grease, Aircraft, General Purpose	MIL-PRF-81322	2400-00225-00	14 OZ	Aeroshell Grease 22	54527
		MIL-PRF-81322	2400-00024-00	14 OZ	Royco 22CF	7950
		MIL-PRF-81322	2400-00017-00	5 LB	Mobilgrease 28	1ZAY6
		MIL-PRF-81322	None	N/A	Aeroshell Grease 22CF	7950
		MIL-PRF-81322	2400-11378-00	1 LB	Mobilgrease 28	1ZAY6
C-002	Hydraulic Fluid, Petroleum Base	MIL-PRF-5606	2400-00036-00	1 QT	Any product listed in current issue of QPL-5606	Commercial
C-003	Turbine Fuel	MIL-DTL-83133, Grade JP-8	None	N/A	Refer to Flight Manual for approved fuels	Commercial
		MIL-DTL-5624, Grade JP-5	None	N/A	Refer to Flight Manual for approved fuels	Commercial
		MIL-DTL-5624, Grade JP-4	None	N/A	Refer to Flight Manual for approved fuels	Commercial
		ASTM D1655, Type Jet A	None	N/A	Refer to Flight Manual for approved fuels	Commercial
		ASTM D1655, Type Jet A-1	None	N/A	Refer to Flight Manual for approved fuels	Commercial
		ASTM D6615	None	N/A	Refer to Flight Manual for approved fuels	Commercial
C-004	Use C-043	None	None	N/A	Use C-043	N/A
C-005	Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting	AS5272	None	N/A	Lube-Lok 2109	11770
		AS5272	None	N/A	Sandstrom 9A	34227
		AS5272	2400-11536-00	1 QT	Tiolube 460	34568
C-006	Use C-021	None	None	N/A	Use C-021	N/A

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-007	Grease, Aircraft, Helicopter, Oscillating Bearing	MIL-G-25537	2400-12084-00	1 LB	Any product listed in current issue of QPL-25537	Commercial
C-008	Petrolatum, Technical Grade	VV-P-236	2400-00184-00	13 OZ		Commercial
		VV-P-236			Any product meeting specification	Commercial
C-009	Lubricating Oil, Jet Engine	MIL-PRF-6081, Grade 1010	G013194	1 GAL	Any product listed in current issue of QPL-6081	Commercial
C-010	Lubricating Oil, Turbine Engine, Synthetic Base	MIL-PRF-7808, Grade 3	None	N/A	Royco 808H	7950
		MIL-PRF-7808, Grade 3	None	N/A	Aeroshell Turbine Oil 308	Commercial
		MIL-PRF-7808, Grade 3	None	N/A	BP Turbo Oil 2389	Commercial
		MIL-PRF-7808, Grade 3	2400-06821-00	1 QT		Commercial
C-011	Lubricating Oil, Turbine Engine, Synthetic Base	MIL-PRF-23699, Class HTS	2400-00223-00	1 QT	AeroShell Turbine Oil 560	Commercial
		MIL-PRF-23699, Class STD	2400-10401-01	1 QT	Royco Turbine Oil 500	7950
		MIL-PRF-23699, Class HTS	2400-00189-00	1 QT	Royco Turbine Oil 560	7950
		MIL-PRF-23699, Class STD	None	N/A	Aeroshell Turbine Oil 500	Commercial
		MIL-PRF-23699, Class HTS	2400-00003-00	1 QT	Mobil Jet Oil 254	Commercial
		MIL-PRF-23699, Class STD	None	N/A	Mobil Jet Oil II	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-012	Lubricating Grease	None	2400-00201-00	14 OZ	Plastilube #3	1V074
					Molykote No. 3	70904
					ML 7 PLUS 2	
C-013	Lubricating Oil	J 2362 (10W30)			10W30	Commercial
C-014	Grease, Aircraft and Instruments	MIL-PRF-23827, Type I or II	MIL-G-23827	14 OZ	Any product listed in current issue of QPL-23827	Commercial
C-015	Lubricant, Tube Pack, Driveshaft Coupling	None	G005975	6 OZ	204-040-755-005	97499
C-016	Lubricating Oil, Jet Engine	MIL-PRF-6081, Grade 1005			Any product listed in current issue of QPL-6081	Commercial
C-017	Lubricant, Fluorosilicone	NLGI Grade 3	2400-10674-00	N/A	Molykote 3452	71984
C-018	Silicone Compound	AS8660	2010-00072-00	5.3 OZ	DC-4	71984
C-019	Use C-028	None	None	N/A	Use C-028	N/A
C-020	Lubricating and Preservative Oil, Low Volatility	MIL-PRF-6085	2400-06272-00	1 GA	Any product listed in current issue of QPL-6085	Commercial
		MIL-PRF-6085	2400-00199-00	1 PT	Any product listed in current issue of QPL-6085	Commercial
		MIL-PRF-6085	2400-00200-00	1 QT	Any product listed in current issue of QPL-6085	Commercial
C-021	Lubricant, Solid Film, Air Cured, Corrosion Inhibitor	MIL-L-23398, Type II	None	N/A	Perma Slik G	
		MIL-L-23398, Type II	2400-00238-00	12 OZ	Tiolube 70	34568
C-021A	Use C-031	None	None	N/A	Use C-031	N/A
C-022	Use C-005	None	None	N/A	Use C-005	N/A

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-023	Grease, Petroleum Lubricant				Lubriplate 130-AA	73219
					Lubriplate 130-A	73219
C-024	Assembly Fluid	None	2845-12320-00	4 OZ	Ultrachem Assembly Fluid No. 1	56385
C-025	Graphite Petrolatum, Thread Antiseize Compound	AMS 2518			Any product meeting specification	98308
		AMS 2518	MIL-T-5544	1 LB		
C-026	Grease, Aircraft, Ball and Roller Bearing	MIL-G-25013			Royco 13D	7950
		MIL-G-25013	2400-11132-01		Royco 13CF	7950
C-027	Lubricant, Semi-Fluid	MIL-L-46000			Royco 46	7950
C-028	Lubricant, Dry Film	None	5300-63681-00	12 OZ	Permalon 327	8M506
C-029	Hydraulic Fluid, Synthetic Hydrocarbon, Fire Resistant	MIL-PRF-83282			Any product listed in current issue of QPL-83282	Commercial
C-030	Lubricating Oil	DOD-PRF-85734	None	N/A	BP Turbo Oil 25	Commercial
		DOD-PRF-85734	2400-00020-00	1 QT	Royco Turbine Oil 555	7950
		DOD-PRF-85734	2400-00202-00	1 QT	Aeroshell Turbine Oil 555	Commercial
C-031	Lubricating Oil, Piston Engine	J 1966, Grade 1100				Commercial
C-032	Lubricant				3201-86217-01-0	99167
C-033	Use C-005	None	None	N/A	Use C-005	N/A
C-034	Lubricant, Solid Film				Everlube 620	11770
C-035	Use C-021	None	None	N/A	Use C-021	N/A
C-036	Cleaning Compound				Hoppe's No. 9 or equivalent	73266

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-037	Use C-003	None	None	N/A	Use C-003	N/A
C-038	Soluble Oil, Corrosion Inhibitor	MIL-I-24453				81349
		MIL-I-24453				29700
C-039	Lubricating Oil, General Purpose, Low Temperature	MIL-PRF-7870			Any product listed in current issue of QPL-7870	Commercial
C-040	Lubricating Oil, Light Machine				3 in 1 or equivalent	Commercial
C-041	Heatsink Compound, Silicone Base		2010-10923		Thermalcote 250	13103
C-042	Resin Coating, Permanent, Thermosetting, Engine Components	MIL-PRF-3043	2230-00695-00	Each	A-7729	60003
C-043	Grease, Molybdenum Disulfide, Low & High Temperatures	MIL-G-21164	2400-07054-00	1 LB	Any product listed in current issue of QPL-21164	Commercial
C-044	Tape, Antichafe, Rubber Sealant		2330-00234-00		3M No. 5423 , 1.0 inch wide	612
			2330-00227-00	Roll (0.75" wide)	3M No. 5423 , 0.75 inch wide	612
			2330-00237-00		3M No. 5423 , 0.375 inch wide	612
C-045	Potassium Hydroxide [KOH] (Caustic Potash), Solid Form, Technical Grade	ASTM E1456, Type I	None	N/A	Any product meeting specification	Commercial
C-046	Paint Remover, No Hazardous Air Pollutants	TT-R-2918	None	N/A	PR-3133	55208
		TT-R-2918	None	N/A	Turco 6813-ED	1N6B3
		TT-R-2918	None	N/A	Turco 6813-E	1N6B3

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-047	Tape, Foam, Vinyl, Double Coated, 1/16" Thick	None	2000-11541-00	Roll (0.75" wide)	3M No. 4416	52152
		None	2000-12031-00	Roll (1" wide)	3M No. 4416	52152
C-048	Rubber Sheet, Flexible Cellular, Oil/Flame Resistant, 0.5" thick	ASTM D6576, Type II, Grade A, Soft	2330-00410-00		Any product meeting specification	Commercial
C-049	Torque Seal, Lacquer	None	2230-05704-00	0.5 OZ	F-900	1195
C-050	Couplant, Ultrasonic	None	2400-00083-00	12 OZ	Ultragel II	0JXX2
		None	2400-00181-00	8 OZ	Couplant	52039
C-051	Fire Retardant Penetrant, Interior, Spray	None	5900-68677-00	1 QT	Flamex PF	Commercial
C-052	Contact Enhancer, Electrical, Concentrate	None	2900-00321-00	15 ML KIT	Stabilant 22	38948
C-053	Mineral Oil (All Grades)	None	None	N/A	Baby oil	Commercial
C-054	Insulating Compound, Electrical (Conformal Coatings)	MIL-I-46058	2010-00146-00	1 GAL	Any product listed in current issue of QPL-46058	Commercial
		MIL-I-46058	2010-10295-00	1 QT	Any product listed in current issue of QPL-46058	Commercial
		MIL-I-46058	2010-10482-00	1 QT	Any product listed in current issue of QPL-46058	Commercial
C-055	Corrosion Preventive Compound	None	None	N/A	Ardrox AV 8	0L040
C-056	Paper, Wrapping, Non-corrosive, Chemically Neutral	MIL-DTL-17667, Type II	None	N/A	Any product meeting specification	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-057	Adhesive, Clear Epoxy, Two-Part	None	2000-00852-00	6 OZ	Scotch-Weld DP-105 Clear	52152
		None	2000-00909-00	1.7 OZ	Scotch-Weld DP-105 Clear	52152
C-058	Solvent, Blended Organic, Cold Degreasing	None	5130-67131-00	N/A	BIOACT 105	0WUA8
C-059	Tape, Aluminum Foil with Electrically Conductive Acrylic Adhesive	None	1000-03606-00	N/A	3M No. 1170	53387
C-061	Tape, Adhesive, Acrylic Foam, Black	None	2550-00111-00	Roll (36 yards)	3M VHB Tape 5962	52152
C-063	Primer for Adhesive Film, Epoxy, Modified, Supported and Unsupported	299-947-038, Class 5 or 10	2000-00940-00	1 QT	BR1009-49 10% Solids	09BV7
		299-947-038, Class 5 or 10	2000-09099-01	1 QT	BR1009-49 5% Solids	09BV7
C-067	Tape, Foam, Vinyl, Single Coated, 1/16" Thick	None	2000-09787-00	Roll (0.50" wide)	3M No. 4516	76381
C-068	Rubber Extrusion	None	2330-00545-00	1 FT	RUBBER-RUBBER TRIM - 6UE6625875750	L1204
C-070	Rubber Sheet, General Purpose, 0.125" thick	MIL-PRF-6855, Class 1, Grade 80	None	Each	10884	

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-072	Hydraulic Fluid, Synthetic Hydrocarbon, Fire Resistant, Low Temperature	MIL-PRF-87257	2400-00066-00	1 QT	Royco 777	7950
		MIL-PRF-87257	2400-00066-00	1 QT	Aeroshell Fluid 51	7950
		MIL-PRF-87257	2400-00066-00	1 QT	Brayco Micronic 881	98308
		MIL-PRF-87257	2400-00029-00	1 GAL	Royco 777	7950
		MIL-PRF-87257	2400-00054-00	55 GAL	Royco 777	7950
		MIL-PRF-87257	2400-00029-00	1 GAL	Aeroshell Fluid 51	7950
		MIL-PRF-87257	2400-00054-00	55 GAL	Aeroshell Fluid 51	7950
		MIL-PRF-87257	2400-00029-00	1 GAL	Brayco Micronic 881	98308
		MIL-PRF-87257	2400-00054-00	55 GAL	Brayco Micronic 881	98308
C-073	Tape, Safety, Anti-slip, Pressure Sensitive, Conformable	299-947-513	2560-00001-00	Roll (2"x60')	3M Safety-Walk	27293
C-074	Lubricant, Solid Film, Heat Cured, Corrosion Inhibitor	MIL-L-23398, Type I	None	N/A	Tiolube 70	34568
		MIL-L-23398, Type I	None	N/A	Perma Slik G	
		MIL-L-23398, Type I	None	N/A	Molykote 3402C	
		MIL-L-23398, Type I	None	N/A	Surf-Kote A-5021	1094
C-075	Corrosion Inhibitor	None	2900-08001-00	500 ML	SOCOPAC 65H	Commercial
		None	2900-08002-00	5 L	SOCOPAC 65H	Commercial
C-092	Strap, Tiedown, Adjustable, Self-Clinching, Plastic	None	PLB2S-C0	Each	Cable tie, 7.6", double head, weather resistant	6383
C-093	Corrosion Inhibitor	None	2900-08003-00	10 OZ	PROCYON 04216	Commercial
		None	2900-08004-00	1 GAL	PROCYON 04228	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-099	Chemical Film Material for Aluminum Bonding and Grounding	MIL-DTL-81706, Class 3, Form II	2100-00051-00	1 LB	Iridite 14-2	0PX54
		MIL-DTL-81706, Class 3, Form VI	None	N/A	Alodine 1132 (Touch-N-Prep)	71410
		MIL-DTL-81706, Class 3, Form II	None	N/A	Alodine 600	71410
C-100	Chemical Film Material for Aluminum	MIL-DTL-81706, Class 1A, Form II	5130-63353-00	2 LB		
		MIL-DTL-81706, Class 1A, Form II	None	N/A	Alodine 1200S (Immersion)	71410
		MIL-DTL-81706, Class 1A, Form II	None	N/A	Alumibond 1200 (Immersion)	1DZU6
		MIL-DTL-81706, Class 1A, Form III	2100-00345-00	1 QT		
		MIL-DTL-81706, Class 1A, Form III	2100-00030-00	1 GAL		
		MIL-DTL-81706, Class 1A, Form III	None	N/A	Alodine 1201 (Brush-on)	71410
		MIL-DTL-81706, Class 1A, Form VI	None	N/A	Alodine 1132 (Touch-N-Prep)	71410
C-101	CPC, Solvent Cutback, Cold-Application (Hard Film)	MIL-PRF-16173, Grade 1	2100-07336-02	1 GAL	Any product listed in current issue of QPL-16173	Commercial
		MIL-PRF-16173, Grade 1	2100-00044-00	1 PT	Any product listed in current issue of QPL-16173	Commercial
		MIL-PRF-16173, Grade 1	2100-10442-00	2 OZ	Any product listed in current issue of QPL-16173	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-102	Use C-101	None	None	N/A	Use C-101	N/A
C-103	Chromic Acid Treatment, Brush-on	AMS-M-3171, Type VI	None	N/A	Any product meeting specification	Commercial
C-104	CPC, Solvent Cutback, Cold-Application (Soft Film)	MIL-PRF-16173, Grade 2	2100-06504-00	1 GAL	Any product listed in current issue of QPL-16173	Commercial
		MIL-PRF-16173, Grade 2	2100-09016-02	1 PT	Any product listed in current issue of QPL-16173	Commercial
		MIL-PRF-16173, Grade 2	2100-00031-00	6 OZ	Any product listed in current issue of QPL-16173	Commercial
		MIL-PRF-16173, Grade 2	2100-00350-00	2.5 OZ	Any product listed in current issue of QPL-16173	Commercial
		MIL-PRF-16173, Grade 2	2100-00033-00	1 GAL	Any product listed in current issue of QPL-16173	Commercial
C-105	Corrosion Preventive Compound, Fingerprint Remover	MIL-C-15074	MILC15074 GALLON	1 GAL	Any product listed in current issue of QPL-15074	Commercial
C-106	Corrosion Preventive, Reciprocating Aircraft Engine	MIL-C-6529, Type II			Any product listed in current issue of QPL-6529	Commercial
C-107	Hydraulic Fluid, Petroleum Base, Preservation/Operation	MIL-PRF-6083			Any product meeting specification	Commercial
C-108	Cadmium Plating Solution, Brush-on	MIL-STD-865	2100-08437-00	1 QT	5070	11924
		MIL-STD-865	None	N/A	LDC 4803	57868
		MIL-STD-865	None	N/A	2023	11924

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-109	Use C-125	None	None	N/A	Use C-125	N/A
C-110	CPC, Solvent Cutback, Cold-Application (Water Displacing Film)	MIL-PRF-16173, Grade 3	2100-06704-00	1 GAL	Any product listed in current issue of QPL-16173	Commercial
		MIL-PRF-16173, Grade 3	2100-00043-00	1 PT	Any product listed in current issue of QPL-16173	Commercial
C-111	Use C-020	None	None	N/A	Use C-020	N/A
C-111A	Use C-020	None	None	N/A	Use C-020	N/A
C-112	Cadmium Chromate Conversion Coating	None	None	N/A	SSS 3002, Brush	76071
		None	2100-00328	1 QT	Dalic 5005, Brush	11924
C-113	Calcium Fluoride [CaF2], Technical Grade	MIL-C-11162	2100-06429-00	1 LB	Calcium Fluoride	Commercial
C-114	Dichromate Treatment	AMS-M-3171, Type III	None	N/A	Any product meeting specification	Commercial
C-115	Magnesium Fluoride [MgF2], Technical Grade	JAN-M-621	None	N/A	Magnesium Fluoride	Commercial
C-116	Chromic Acid [CrO3] (Chromium Trioxide), Technical Grade	A-A-55827	2100-00326-00	1 LB	Any product meeting specification	Commercial
C-117	Hydrofluoric Acid, Technical Grade	MIL-A-24641	None	N/A	Any product meeting specification	Commercial
C-118	Sodium Hydroxide [NaOH] (Caustic Soda), Technical Grade	ASTM D456	None	N/A	Any product meeting specification	Commercial
C-119	Use C-112	None	None	N/A	Use C-112	N/A
C-120	Calcium Sulfate [CaSO4], Technical Grade	None	5130-63447-00	4.4 LB	Calcium Sulfate	Commercial
		None	5130-68605-00	1.3 OZ	Calcium Sulfate	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-121	Use C-100	None	None	N/A	Use C-100	N/A
C-122	Coating, Corrosion Preventative, for Aircraft Integral Tanks	AMS-C-27725, Type I	2010-00077-00	1 GAL	833K086 (Base) and 930K088 (Activator)	0ZX56
C-123	Metal Surface Conditioner				Deoxidine 299	
					E-Pik 272	
					Cor D Smut 5215	
					Turco T4338	61102
C-124	Corrosion Preventive Compound, Oil Additive		2400-11660-00	8 OZ	Brayco Concentrate 599	98308
C-125	Corrosion Preventive Compound	None	5300-61653-01	12 OZ	WD 40	9137
		None	None	N/A	CRC 3-36	023V4
		None	None	N/A	3M 5-Way Penetrant	4963
		None	None	N/A	Castrol Rustilo 4135 HF	2R128
		None	None	N/A	Castrol Rustilo 4169	2R128
C-126	Corrosion Preventive Compound, Aircraft Turbine Engine	MIL-PRF-8188			Any product listed in current issue of QPL-8188	Commercial
C-127	Corrosion Preventive Compound, Petrolatum, High Temp	MIL-C-11796, Grade 3	2400-11480-00	1 LB	Any product listed in current issue of QPL-11796	Commercial
		MIL-C-11796, Grade 3	2100-10443-00	1 LB	Any product listed in current issue of QPL-11796	Commercial
C-128	Corrosion Preventive Compound	None	2000-12494-02	160 ML	Mastinox 6856K	0ZX56
C-129	Use C-125	None	None	N/A	Use C-125	N/A

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-130	Cleaning Compound, Solvent, Oil Cooler	MIL-PRF-6864				Commercial
C-131	Use C-018	None	None	N/A	Use C-018	N/A
C-132	Brush Cadmium, Electro-cleaning Solution				SCM 4100	13929
					1010	11924
C-133	Tape, Anti-seize, Tetrafluoroethylene (TFE), with Dispenser	MIL-T-27730	None	N/A	Any product meeting specification	Commercial
C-134	Use C-483	None	None	N/A	Use C-483	N/A
C-135	Paint Remover, Hot Tank-Type, Water Rinsable	MIL-PRF-83936	None	N/A	Cee-Bee A-477	Z08B0
C-136	Caps and Plugs, ESDS Protective, Electrical Connector	None	None	N/A	3M No. 4270	20999
C-137	Cooling Agent	None	5900-65635-00	Each	Quik-Freeze MS-242N	18598
C-138	Staining Medium, Dye, Opaque	None	None	N/A	DYKEM Staining Color 81413	98148
		None	None	N/A	DYKEM Staining Color 81713	98148
C-139	Sealing Compound, Polythioether, Electrically Conductive	299-947-537	None	N/A	PR-2200 Class B	83574
		AMS 3266	2010-05953-00	2 OZ	PR-1764 Class B	83574
		AMS 3266	2010-05953-00	2 OZ	PR-1764 Class B	83574
C-140	Adhesive Tape for Nameplate, Film Type, Pressure Sensitive	None	None	N/A	3M No. 468	4963
C-141	Twine, Fibrous, Nylon, Waxed, Lacing and Tying	MIL-T-713, Type P, Class 1	2600-07349-00	Roll (1 LB)	Any product meeting specification	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-142	Coating, Reflective Aerosol, Basecoat	None	None	N/A	Aluminum Base Coat #16-532	59581
C-143	Coating, Reflective Aerosol, Topcoat	None	None	N/A	Fire Hydrant Red #16-530	56581
C-144	Glass Fabric, Woven, Epoxy Resin-Impregnated	299-947-326, Type II, Class E	2700-99939-00	1 LB	120-38-F161	91610
C-145	Coating, Polyurethane, Two Parts, for Polycarbonate Plastic	None	None	N/A	POLANE T Polyurethane Enamel (F63B12)	54636
C-146	Coating, Polyurethane, Elastomeric, Rain Erosion Resistant	MIL-C-85322	None	N/A	Aeroglaze M1433 Coating	30676
C-147	Sodium Chromate, Tetrahydrate [Na2CrO4.4H2O], Technical Grade	None	None	N/A	Sodium Chromate Tetrahydrate	Commercial
C-148	Tape, Polyester, Double Coated	None	2000-00317-00	Roll (0.5" wide)	3M No. 415	52152
C-149	Edge Sealer, Erosion Protective Tape	None	2000-01000-00	1.7 OZ	DP190	52152
C-151	Sealing Compound, Corrosion Inhibitive, Premixed, Prefrozen	299-947-074, Type IV	None	N/A	P/S 870 B-2	0ZX56
		299-947-074, Type IV	None	N/A	AC-665 B-2	1DWR5
C-152	Cable, Safety, CRES and Heat Resistant Steel, 0.032	AS4536	None	N/A	AS3510-02(any length)C	Commercial
C-153	Cable Ferrule, Safety, CRES and Heat Resistant Steel, 0.032	AS4536	None	N/A	AS3510-02F	Commercial
C-154	Wire, Safety, CRES, 0.015	NASM20995	1650-51674-00	Roll (1 LB)		Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-155	Carbon Fabric, Woven, Epoxy Resin-Impregnated	299-947-321, Type II, Class B	2650-12804-00	1 LB	HMF 937A/5HS	0LHZ4
C-156	Caps and Plugs, Protective, Electrical Connector	NAS 820	None	N/A	Any product meeting specification	Commercial
C-157	Tape, Adhesive, Pressure Sensitive, PTFE Coated Fiberglass	None	None	N/A	Tooltec A005	53912
		None	None	N/A	CHR A2005	1ECV7
C-158	Sealant, Polythioether Rubber, Fuel Resistant, Fast Curing	AMS 3277, Type II, Class B	2010-00140-00	3 OZ	PR-1828 Class B-1/2	0ZX56
		AMS 3277, Type II, Class B	2010-00186-00	2.5 OZ KT	PR-1828 Class B-2	0ZX56
C-159	Penetrating Fluid, High Solvency, VOC compliant	NSF H2	None	N/A	KB 88 - The Ultimate Penetrant	66724
C-160	Tape, Adhesive, Hot-Melt, Thermoplastic	None	2000-12496-00	Roll (1" wide)	S-1048	6090
C-161	Sealing Compound, Dielectric	MIL-PRF-8516, Type II	2010-00005-00	1 PT		
		MIL-PRF-8516, Type II	2010-10210-00	12 OZ		
		MIL-PRF-8516, Type II	None	N/A	CS 3100, Type II, Class 2	14439
		MIL-PRF-8516, Type II	None	N/A	WS-516, Type I and II	
C-162	Cable, Safety, Kit, Corrosion Resistant Steel, 0.032	AS4536	None	N/A	AS3511-0(any length)K	Commercial
C-163	Tape, Adhesive, Acrylic Foam, Black	None	2000-00592-00	Roll (0.75" wide)	3M No. 4949	76381

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-164	Masking Tape, High Temperature, Fine Line	None	None	N/A	3M No. 222	52152
C-165	Tape, Masking, High Temperature, Pressure Sensitive	None	2000-03125-00	Roll (1" wide)	3M No. 2525	52152
		None	None	N/A	3M No. 214	52152
C-166	Glass Fabric, Woven, Epoxy Resin-Impregnated	299-947-076, Type C	2620-08394-00	1 LB		97499
		299-947-076, Type C	None	N/A	Rigidite 3200/7781	4622
		299-947-076, Type C	None	N/A	F185-1/7781	ISPP9
		299-947-076, Type C	2620-11315-00	1 LB		97499
C-167	Corrosion Preventive Compound, Water Displacing, Soft Film	MIL-PRF-81309, Type II	None	N/A	Corrosion X Aviation	0VJ14
C-168	Epoxy Resin, Dielectric Grade, General Purpose	None	None	N/A	Stycast 2651 Black	1TD36
C-169	Adhesion Promoter	None	2010-12701-00	N/A	PR-142	83574
C-171	Stainless Steel Wool	None	None	N/A	Stainless Steel Wool	Commercial
C-172	Grease, High Pressure	299-947-554	2400-00070-00	440 GR	ThixO SYN (3820-0)	L1028
C-173	Tape, Lacing, Nylon	A-A-52080	2640-00141-00	Roll (500 yards)	Any product meeting specification	Commercial
C-174	Adhesive, Instant, Ethyl-2-Cyanoacrylate, Medium/ High Viscosity	A-A-3097, Type II, Class 3	2000-09273-01	1 OZ	Any product meeting specification	Commercial
		A-A-3097, Type II, Class 3	2000-00651-00	8 OZ	Any product meeting specification	Commercial
C-186	Wipe, Removal, for Uncured Sealant and Adhesives	None	5900-68556-00	N/A	PolyWipes AG	48AB0

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-192	Thread, Nylon, Twisted Multiple Cord, Bonded Finish, General Purpose	A-A-59826, Type II, Class A	None	N/A	Any product meeting specification	Commercial
C-200	Putty, General Purpose, Non-Hardening, Corrosion Inhibiting	MIL-PRF-8116	2010-06083-00	16 OZ	Any product meeting specification	Commercial
C-201	Zinc Chromate Primer	TT-P-1757	2230-08195-00	3 OZ	Any product meeting specification	Commercial
		TT-P-1757	2230-00178-00	12 OZ	Any product meeting specification	Commercial
		TT-P-1757	2230-06771-00	1 GA	Any product meeting specification	Commercial
		TT-P-1757	None	N/A	Any product meeting specification	Commercial
C-202	Primer, Catalyzed Epoxy	299-947-060, Type I	2230-07608-00	2 QT KIT	Super Koropon	K5635
		299-947-060, Type I	2230-05950-00	1 GAL KIT	Super Koropon	K5635
C-202A	Use C-204	None	None	N/A	Use C-204	N/A
C-203	Use C-245	None	None	N/A	Use C-245	N/A

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-204	Primer, Epoxy Polyamide, High-Solids	MIL-PRF-23377, Type I or II, Class C1 or C2	2230-00580-00	2 GAL KIT		Commercial
		MIL-PRF-23377, Type I or II, Class C1 or C2	2230-00425-00	1 PT		Commercial
		MIL-PRF-23377, Type I or II, Class C1 or C2	2230-00451-00	1 OZ		Commercial
		MIL-PRF-23377, Type I or II, Class C1 or C2	2230-00559-00	8 OZ		Commercial
C-205	Thinner, Dope, Cellulose Nitrate	MIL-T-6095			Any product meeting specification	Commercial
C-206	Thinner, Nitrate Cellulose Lacquer	MIL-T-19544				Commercial
		A-A-857				Commercial
C-207	Use C-210	None	None	N/A	Use C-210	N/A
C-208	Epoxy/Zinc Coating	299-947-204			02-X-011 Base + Catalyst + Zinc Dust	
		299-947-204	2230-00384-00	2 GAL		
C-209	Use C-245	None	None	N/A	Use C-245	N/A

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-210	Coating, Epoxy, High-Solids	MIL-PRF-22750	2230-05896-00	1.5 GAL KIT		Commercial
		MIL-PRF-22750	2230-00399-00	1 GAL KIT		Commercial
		MIL-PRF-22750	2230-05699-00	2 GAL KIT		Commercial
		MIL-PRF-22750	2230-05701-00	1 QT KIT		Commercial
		MIL-PRF-22750	2230-05700-00	1 QT		Commercial
		MIL-PRF-22750	2230-00401-00	4 OZ		Commercial
		MIL-PRF-22750	None	N/A		Commercial
		MIL-PRF-22750	None	N/A		Commercial
C-211	Shellac Varnish	A-A-8, Type I, Grade B, Body 2	2230-10532-00	1 GAL		Commercial
C-212	Sodium Dichromate [Na2Cr2O7], Technical Grade	A-A-59123	None	N/A	Any product meeting specification	Commercial
C-213	Use C-245	None	None	N/A	Use C-245	N/A
C-214	Anti-Static Coating	299-947-085			528X306	85570
C-215	Use C-216	None	None	N/A	Use C-216	N/A
C-216	Lacquer, Gloss, Clear	A-A-3165			Any product meeting specification	Commercial
C-217	Peelable Plastic Coating				Micropeel Glo-Rubber Indian Red	
			2100-00363-00	5 GAL	Turco T-5580G	61102
C-218	Coating, Aliphatic Polyurethane, Chem. Agent Resistant	MIL-C-46168, Type II				Commercial
C-219	Epoxy Resin, Liquid, Laminating, General Purpose	None	2010-12063-00	1 PT	Epon 828	86961

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-220	Catalyst, DTA (for Epoxy Resins)	None	None	N/A	EPI-Cure 3223 (Diethylenetriamine)	
C-221	Chemical Conversion Coating Material, Ferrous Surface	TT-C-490				2731
C-222	Catalyzed Epoxy Primer (3 Part Kit)				Catalyzed Epoxy Primer (3 Part Kit)	22783
C-223	Nonslip Compound, Walkway	A-A-59166, Type II	BLK,37038 GAL	1 GAL	Any product meeting specification	Commercial
C-224	Paint, Conductive, Silver				P/N 13220E8197	97403
C-225	Release Film, High Temperature, Non-perforated	None	None	N/A	E3760	85670
		None	None	N/A	Tedlar PVF film, grade 200SG40TR	18873
C-226	Synthetic Lacquer, Camouflage, Exterior, VOC Compliant	A-A-3164			Any product meeting specification	Commercial
C-227	Use C-228	None	None	N/A	Use C-228	N/A
C-228	Sanding Surfacer, Polyurethane, VOC Compliant	299-947-127			09GY006/09GY006CAT, Parts A & B	33461
C-229	Use C-245	None	None	N/A	Use C-245	N/A
C-230	Use C-245	None	None	N/A	Use C-245	N/A
C-231	Use C-245	None	None	N/A	Use C-245	N/A
C-232	Polyurethane Conductive Coating, Copper Filled	299-947-328			Lightning Guard, 599-A8574-1	87354
		299-947-328			Antenna Guard, Y-1306	87354

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-233	Polyurethane Enamel	299-947-117, Type II	None	N/A	Imron 6000	9V583
		299-947-117, Type II	None	N/A	Imron AF700/AF740	9V583
		299-947-117, Type III	None	N/A	Imron 5000	9V583
		299-947-117, Type III	None	N/A	Imron AF400	9V583
C-234	Primer, Urethane Compatible	299-947-322, Type II			DeSoto, 513x411 Primer Base, 910x811 Curing Solution	97460
		299-947-322, Type I			DeSoto, 513x384 Primer Base, 910x456 Curing Solution	97460
C-235	Polyurethane Thinner	MIL-T-81772, Type I			(Polyurethane)	Commercial
		MIL-T-81772, Type II			(Epoxy)	Commercial
		MIL-T-81772, Type III	2110-06255-00	1 GAL	(Acrylic and Alkyd)	Commercial
C-236	Use C-259	None	None	N/A	Use C-259	N/A
C-237	Varnish, Alkaline Resistant	A-A-1800, Type I or II			Any product meeting specification	Commercial
C-238	Use C-298	None	None	N/A	Use C-298	N/A
C-239	Use C-245	None	None	N/A	Use C-245	N/A
C-240	Enamel Overcoat, Alkyd, Exterior, Low VOC	TT-E-489				Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-241	Coating, Aliphatic Polyurethane, Chem. Agent Resistant	MIL-C-53039				Commercial
C-242	Use C-436	None	None	N/A	Use C-436	N/A
C-243	Sodium Thiosulphate [Na2S2O3], Anhydrous,Technical Grade	None	None	N/A	Sodium Thiosulphate	Commercial
C-244	Use C-248	None	None	N/A	Use C-248	N/A
C-245	Coating, Polyurethane, Aircraft Support	MIL-PRF-85285, Type I	2230-05541-00	1 GAL KIT		Commercial
		MIL-PRF-85285, Type I	2230-06022-00	2 GAL KIT		Commercial
		MIL-PRF-85285, Type I	2230-06027-00	2 GAL KIT		Commercial
		MIL-PRF-85285, Type I	2230-00368-00	1 GAL KIT		Commercial
		MIL-PRF-85285, Type I	2230-06035-00	3 GAL KIT		Commercial
		MIL-PRF-85285, Type I	2230-00357-00	2 GAL KIT		Commercial
		MIL-PRF-85285, Type I	2230-00316-00	2 GAL KIT		Commercial
		MIL-PRF-85285, Type I	2230-06023-00	5 QT KIT		Commercial
		MIL-PRF-85285, Type I	2230-06013-00	5 QT KIT		Commercial
		MIL-PRF-85285, Type I	None	N/A		Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-246	Coating, Epoxy Primer, Waterborne	MIL-PRF-85582, Type I, Class C2	2230-00441-00	5 QT KIT	EWDE072A/B	85570
C-247	Use C-262	None	None	N/A	Use C-262	N/A
C-248	Coating, Polymer	None	2230-05878-00	1 PT	SermeTel 1122	58913
C-249	Varnish	MIL-V-173 Amend 2, Type 2				Commercial
		MIL-V-173 CP2				Commercial
		MIL-V-173				Commercial
		MIL-V-173 CP1				Commercial
C-250	Adhesive, Silicone Base				6282PC12	80064
					RTV-738	71984
					217-548	80064
C-251	Sealant, Corrosion Inhibitor	MIL-PRF-81733	None	N/A	AC-665 B-1/2	1DWR5
		MIL-PRF-81733	2010-05988-00	2.5 OZ		
		MIL-PRF-81733	2010-00070-00	3.5 OZ		
		MIL-PRF-81733	2010-12763-01	1 QT		
		MIL-PRF-81733	None	N/A	P/S 870 B-1/2	0ZX56
		MIL-PRF-81733	2010-00082-00	6 Oz	P/S 870 A-2	0ZX56
		MIL-PRF-81733	2010-12792-01	1 PT		
		MIL-PRF-81733	2010-12481-01	1 PT	TY II, CL1, GR B-2	
C-252	Adhesive Film, Intermediate Cure Temperature	299-947-320, Type I	None	N/A	3M No. AF 163-2K	6A670
C-253	Adhesive Primer, Intermediate Cure Temperature	299-947-320, Class 1	2000-11999-00	1 QT	3M No. EC 3924B	6A670

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-254	Paper, Kraft, Wrapping, Untreated and Unbleached	None	None	N/A	Kraft Paper	Commercial
C-255	Carbon Fabric, Woven, Dry, Plain Weave	299-947-499, Type II, Class 2, Form 3K-PW	None	N/A	PW 60" 195GSMTR7X12AS4 GP-3K	0LHZ4
		299-947-499, Type II, Class 2, Form 3K-PW	2620-06090-01	1 FT	PW 42" 195GSMTR7X12AS4 GP-3K	0LHZ4
C-256	Release Film, Fluoropolymer, Non-perforated	None	2000-00267-01	Roll (50"x500')	A5000	0F451
		None	None	N/A	A4000	53912
		None	None	N/A	Wrightlon 5200	53912
C-257	Bagging Film, Nylon	None	None	N/A	Wrightlon 7400	53912
C-258	Breather Felt, Non-Woven, Polyester, 10 oz, High Pressure	None	None	N/A	Airweave Super 10	53912
C-259	Sealant Tape, Extruded, General Purpose, Cure Temp < 375Â°F	None	2010-11492-00	Each	GS 100 (1/8" x 1/2")	53912
C-260	Masking Tape, Polyester, High Temperature	None	2000-09122-01	Each	3M No. 8403	76381
		None	2000-08293-01	Each	3M No. 8403	76381
C-261	Epoxy Resin, Wet Layup	BMS-8-301, Class 1, Grade 1	2230-05939		Hysol EA9390	1UW17
		BMS-8-301, Class 1, Grade 1	2000-03139		Hysol EA9390	1UW17
C-262	Anti-Seize Compound, Thread, Molybdenum, Disulfide, Petrolatum	MIL-PRF-83483	2400-00005-00	1 LB	Any product meeting specification	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-263	Sealant, Anaerobic, Threadlocking	None	2000-00477-00	50 ML	Loctite 243	5972
C-264	Emulsifier, Cured Sealant (Polysulfide)	None	None	N/A	PolyGone 300-AG Gel	48AB0
C-265	Coating, High Solids Polyurethane, Mar-Resistant	299-947-494	2230-05544-00	Each	18 Series Coating	33461
		299-947-494	None	N/A	838G045BE/930G976	0ZX56
		299-947-494	None	N/A	831G160BE/930G976	0ZX56
		299-947-494	2230-05543-00	Each	18 Series Coating	33461
C-282	Primer, Tape, Adhesion Promoter	None	2900-00555-00	1 GAL	3M Tape Primer 94	52152
C-283	Polyurethane Enamel, Urethane Activator for	299-947-117, Type III	2230-00709-00	N/A	Axalta 13100S	9V583
C-284	Solvent, Cleaner, Biodegradable	None	5130-65424-00	N/A	DS-108	30256
C-285	Isopropyl Alcohol	None	None	N/A	Isopropyl Alcohol	Commercial
		None	None	N/A	Isopropyl Alcohol	Commercial
C-286	Tack Rag or Cloth	None	None	N/A	I-Tack Super	H7816
		None	None	N/A		52004
		None	None	N/A		16241
C-287	Adhesion Promoter, Mid-Coat	None	None	N/A	Dupond 222S	9V583
C-292	Strap, Tiedown, Adjustable, Self-Clinching, Plastic	None	4868-00073-00	Each	Cable tie, 4.0", miniature cross section	6383
		None	4868-00074-00	Each	Cable tie, 7.4", miniature cross section	6383

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-293	Tubing, Insulation, Heat Shrinkable	None	2530-06181-00	1 FT	DR-25-1/4-0-SP	6090
		None	None	N/A	DR-25-1/8-0-SP	6090
		None	None	N/A	DR-25-3/16-0-SP	6090
C-294	Sealant, Anaerobic, Threadlocking, Fast Curing	ASTM D5363, Group 03, Class 2, Grade 1	2010-00012-00	10 CC	Loctite 242	5972
C-295	Release Agent, Dry Lubricant, PTFE	None	None	N/A	MS-122AD	1DD67
C-296	Tape, Sealing, Polyurethane, PTFE, Adhesive Backed	None	2000-01095-00	Roll (0.50"x12')	TufSeal (HT3000-050)	1NPE1
		None	2000-01094-00	Roll (0.75"x12')	TufSeal (HT3000-075)	1NPE1
		None	2000-01093-00	Roll (1.00"x12')	TufSeal (HT3000-100)	1NPE1
C-297	Polish, Liquid	None	None	N/A	RMP Crystal Diamond Glaze Aviation Polish	Commercial
C-298	Adhesive, Epoxy, Metal Repair & Fairing Compound		2000-00697-00	1 OZ	Devcon 2-Ton	16059

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-299	Sealant, Anaerobic, Threadlocking, Fast Curing	ASTM D5363, Group 03, Class 1, Grade 1	None	N/A	Loctite 222	5972
		ASTM D5363, Group 03, Class 1, Grade 1	None	N/A	Permabond LM113	3R2V1
		ASTM D5363, Group 03, Class 1, Grade 1	2010-05928-00	50 CC		
		ASTM D5363, Group 03, Class 1, Grade 1	None	N/A	Saf-T-Lok T22	4Z400
C-300	Adhesive, Silicone Base, Two-Part	299-947-152, Type I, Class 1	None	N/A	Silgrip SR-529 with 3% SRC-18 Catalyst	1139
		299-947-152, Type I, Class 1	None	N/A	Dapco 3300	58093
		299-947-152, Type I, Class 1	2000-06013-01	1 OZ		
		299-947-152 Type I, Class 1	2000-00715-00	1 QT		
C-301	Adhesive, Urethane Base	299-947-066, Type I			3M No. EC3549 (Tan)	6A670
		299-947-066, Type I	2000-01042-00	N/A		
		299-947-066, Type I	2000-09910-01	N/A		
		299-947-066, Type I			Dapcotac 3013 (Natural Color)	58093
C-302	Use C-339	None	None	N/A	Use C-339	N/A

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-303	Adhesive, Acrylic Monomer-polymer Base, for Acrylic Plastics	299-947-092	None	N/A	PS-18 (Three components)	0VHD7
		299-947-092	None	N/A	PS-30 (Two components)	0VHD7
		299-947-092	2000-09554-00	1 PT		
C-304	Solvent, Drycleaning, Degreaser	MIL-PRF-680,Type II	2110-07015-00	1 GAL	Any product meeting specification	Commercial
		MIL-PRF-680, Type II	2110-00009-00	5 GAL	Any product meeting specification	Commercial
C-305	Aliphatic Naphtha	TT-N-95, Type II	2110-00010-00	1 GAL	Any product meeting specification	Commercial
C-306	Toluene, Technical Grade	A-A-59107	2110-06227-00	1 GAL	Any product meeting specification	Commercial
C-307	Adhesive, Silicone Base	299-947-152, Type I, Class 2			RTV-108 (Translucent)	1139
		299-947-152, Type I, Class 2				97499
		299-947-152, Type I, Class 2	2000-00056-00	3 OZ		
		299-947-152, Type I, Class 2	2000-00007-00	3 OZ		
		299-947-152, Type I, Class 2	2000-08895-00	3 OZ		
		299-947-152, Type I, Class 2			RTV-732 (White, Black or Clear)	71984

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-308	Sealant, Fuel Resistant, Rubber Base, High Adhesion, 2-part	299-947-107, Type III, Class 7	None	N/A	P/S 890 Class B	83574
		299-947-107, Type III, Class 7	None	N/A	PR-1440 Class B	83574
		AMS-S-8802, Class B	None	N/A	CS 3204 Class B	14439
		AMS-S-8802, Class B	2010-07915-01	6 OZ		
		AMS-S-8802, Class B	2010-10345-01	1 PT		
		299-947-107, Type III, Class 7	2000-09430-00	50 GRAMS		97499
		299-947-107, Type III, Class 7	None	N/A	CS 3204 Class B	14439
		AMS-S-8802, Class B	2010-00088-00	2 OZ		
		AMS-S-8802, Class B	2010-00134-00	1 QT		
		AMS-S-8802, Class B	None	N/A	PR-1440 Class B	83574
		AMS-S-8802, Class B	None	N/A	AC-236 Class B	1DWR5
		AMS-S-8802, Class B	None	N/A	AC-240 Class B	1DWR5
C-309	Methyl-Ethyl-Ketone (MEK)	ASTM D740	2110-06257-00	1 GAL	Any product meeting specification	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-310	Adhesive, Rubber Base, General Purpose, Fuel & Oil	299-947-107, Type III, Class 6				97499
		299-947-107, Type III, Class 6			Magna-Tac M-24	85091
		299-947-107, Type III, Class 6	2000-06010-00	1 QT		
		299-947-107, Type III, Class 6	299-947-107TY3C L6 8OZ	8 OZ		
		299-947-107, Type III, Class 6			Magna-Tac M-24	5B981
C-311	Adhesive, Rubber Base, General Purpose, Vinyl	299-947-107, Type II, Class 4	2000-08214-01	4 OZ		
		299-947-107, Type II, Class 4	2000-07963-00	1 QT		
		299-947-107, Type II, Class 4	299-947-107TYIIC L4	1 PT		
		299-947-107, Type II, Class 4	None		Stabond C-111	25670
C-312	Adhesive, Rubber Base, General Purpose	None	2000-06021-01	5 OZ	3M EC-847	6A670
C-313	Adhesive, Room Temperature Cure, General Purpose	299-947-099			Hysol EA9340	1UW17
		299-947-099	2000-07673-00	11 OZ		
		299-947-099			Araldite AV1258/HV1258	2684
		299-947-099			Metalset A-4	90414

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-314	Adhesive, Silicone Base, Room Temperature Vulcanizing	299-947-152, Type III				97499
		299-947-152, Type III			RTV-730 (White)	71984
		299-947-152, Type III			RP1258	2684
		299-947-152, Type III	299-947-152, TY III	6 OZ		
		299-947-152, Type III			FRV-1106	1139
C-315	Nitrogen [N], Gaseous, Technical Grade	A-A-59503, Type I	None	N/A	Any product meeting specification	Commercial
C-316	Acetone	ASTM D329	2100-00061-00	1 GAL	Any product meeting specification	Commercial
C-317	Adhesive, Epoxy Base, Heat Resistant, General Purpose	299-947-100, Type II, Class 2	None	N/A	Hysol EA9392	1UW17
		299-947-100, Type II, Class 2	None	N/A	Magnobond 6398	22121
		299-947-100, Type II, Class 2			Hysol EA934NA	1UW17
		299-947-100, Type II, Class 2	2000-00245-01	1 PT	299-947-100,TY II,CL 2	None
		299-947-100, Type II, Class 2	2000-12587-00	1 QT	299-947-100,TY II,CL 2	None
		299-947-100, Type II, Class 2	2000-09182-01	50 GRAMS	299-947-100,TY II,CL 2	None
		299-947-100, Type II, Class 2	2000-01022-00	1 PT	299-947-100,TY II,CL 2	None

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-317A	Use C-317	None	None	N/A	Use C-317	N/A
C-318	Cleaning Compound, Alkaline Base, Detergent	MIL-PRF-87937, Type I	2100-00006-00	5 GAL	Any product listed in current issue of QPL-87937	Commercial
		MIL-PRF-87937, Type III			Any product listed in current issue of QPL-87937	Commercial
		MIL-PRF-87937, Type IV			Any product listed in current issue of QPL-87937	Commercial
C-319	Use C-305, C-309, C-389, or C-524	None	None	N/A	Use C-524	N/A
		None	None	N/A	Use C-305, C-309, or C-389	N/A

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-320	Sealant, Anaerobic, Threadlocking, Slow Curing	ASTM D5363, Group 01, Class 1, Grade 1	None	N/A	Permabond HL126	3R2V1
		MIL-S-22473, Grade N, Form R	None	N/A	Permabond ASC10	3R2V1
		ASTM D5363, Group 01, Class 4, Grade 2	2010-05846-00	50 CC	Loctite 083	5972
		MIL-S-22473, Grade N, Form R	2010-00053-00	4.5 OZ	Loctite 7649	5972
		ASTM D5363, Group 01, Class 1, Grade 1	2010-05847-00	50 CC	Loctite 089	5972
		ASTM D5363, Group 01, Class 6, Grade 1	2010-12674-00	50 CC	Loctite 078	5972
		ASTM D5363, Group 01, Class 2, Grade 3	2010-07782-00	50 CC	Loctite 087	5972
		ASTM D5363, Group 01, Class 5, Grade 1	2010-10938-00	50 CC	Loctite 080	5972
		MIL-S-22473, Grade T, Form R	2010-05977-00	6 OZ	Loctite 7471	5972
		MIL-S-22473, Grade N, Form R	2010-07906-00	6 OZ	Loctite 7649	5972
		ASTM D5363, Group 01, Class 6, Grade 1	2010-00027-00	50 CC	Loctite 078	5972
		MIL-S-22473, Grade T, Form R	None	N/A	Permabond ASC10	3R2V1

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-321	Use C-317	None	None	N/A	Use C-317	N/A
C-322	Adhesive, Epoxy Base, Room Temperature Cure, High Peel Strength	DOD-A-82720	2000-07899-01	1 PT	3M No. 2216 B/A Gray	4963
		DOD-A-82720	2000-00387-00	1.7 OZ	3M No. 2216 B/A Tan NS	4963
		DOD-A-82720	2000-07942-01	2 OZ	3M No. 2216 B/A	4963
C-323	Fairing Compound, Aerodynamic, Epoxy Filler	299-947-072, Type I	None	N/A	RP1257-3	2684
		299-947-072, Type I	2010-08610-01	500 GRAMS		
		299-947-072, Type I	None	N/A	Hysol EA960	1UW17
C-324	Adhesive, Rubber Base, General Purpose, Neoprene	299-947-107, Type I, Class 1			3M Scotchgrip 1300L (EC1300L)	6A670
		299-947-107, Type I, Class 1			3M Scotchgrip 1300	6A670
		299-947-107, Type I, Class 1			Pro-Seal 596	83574
		299-947-107, Type I, Class 1	299-947-107 TYPE-1	1 PT		
		299-947-107, Type I, Class 1				97499
C-325	Adhesive, Rubber Base, General Purpose, Urethane	299-947-107, Type II, Class 5	2000-07514-00	1 PT		
		299-947-107, Type II, Class 5	2000-08634-00	2 OZ	3M EC-776	6A670
		299-947-107, Type II, Class 5	2000-01034-00	1 PT		
C-326	Denatured Alcohol	None	2100-06114-00	1 GAL	Denatured Alcohol	Commercial
C-327	Adhesion Promoter, Metal Bonds	None	2000-00915-00	1 PT	INSTAbond 900	5V071

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-328	Sealant, Low Adhesion, Removable Panels	AMS 3267/4	None	N/A	PR-1428, Class B-2	83574
		AMS 3267/4	None	N/A	AC-615, Class B-2	1DWR5
		AMS 3284, Type I	2010-00118-00	3.5 OZ KIT		
		AMS 3284, Type I	2010-00113-00	1 QT KIT		
		AMS 3284, Type I	None	N/A	PR-1773, Class B-2	83574
		299-947-074, Type III	None	N/A	PR-1773, Class B-2	83574
		AMS 3284, Type I	None	N/A	CS 3330, Class B-2	14439
		AMS 3284, Type I	2010-00109-00	2 OZ KIT		
		AMS 3284, Type I	2010-00115-00	25 GRAMS KIT		
C-329	Use C-320	None	None	N/A	Use C-320	N/A
C-330	Cleaner, Glass and Acrylic Plastic	None	None	N/A	TEND Anti-static Plastic Cleaner	1N960
		None	None	N/A	CADCO Anti-static Plastic Cleaner	
		None	None	N/A	GLISTEN Glass Cleaner	20913
		None	None	N/A	PRIST Acrylic, Plastic & Glass Cleaner	0YFV5
		None	None	N/A	Airglas AGL Glass Cleaner	70127
		None	None	N/A	210 Plastic Cleaner / Polish	3J317
		None	5130-63241-00	Each	GLEME Glass Cleaner	31834

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-331	Adhesive, Room Temperature Cure, High Peel Strength	299-947-125, Type I	299-947-125 TYPE 1	1 QT		
		299-947-125, Type I	299-947-125TYI50GM	50 GRAMS		
		299-947-125, Type I				97499
		299-947-125, Type I	2000-00678-00	25 GRAMS KIT	Hysol EA 9309NA	33564
C-332	Use C-362	None	None	N/A	Use C-362	N/A
C-333	Adhesive, Rubber Base, General Purpose, Styrofoam	299-947-107, Type I, Class 2	None	N/A	3M Scotch-Grip Industrial Adhesive 4550	6A670
		299-947-107, Type I, Class 2	2000-09250-00	1 PT		97499
		299-947-107, Type I, Class 2	2000-08627-00	1 GAL		97499
C-334	Use C-309, C-389, or C-563	None	None	N/A	Use C-309 or C-389	N/A
		None	None	N/A	Use C-563	N/A
C-335	Use C-320	None	None	N/A	Use C-320	N/A
C-336	Adhesive		2000-08605		Hysol Epoxy Patch Kit No. 0151 (Clear)	4347
C-337	Primer, Silicone Adhesive	None	2000-08529-00	1 PT	SS4004 Silicone Primer	1139
		None	2000-09991-00	1 PT	Dow Corning PR-1200 RTV Prime Coat - Red	71984
		None	2000-09990-00	1 PT	Dow Corning PR-1200 RTV Prime Coat - Clear	71984
		None	2000-12550-00	4 OZ	Dow Corning PR-2260 Prime Coat	71984

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-338	Use C-356	None	None	N/A	Use C-356	N/A
C-339	Ethyl Alcohol	A-A-59342, Grade 3	None	N/A	Any product meeting specification	Commercial
C-339A	Use C-385	None	None	N/A	Use C-385	N/A
C-340	Adhesive Tape for Nameplate, Film Type, Pressure Sensitive	299-947-111, Type II	None	N/A	3M No. 467	4963
		299-947-111, Type I	2000-11039-00	1 Roll	3M No. 465	4963
C-341	Oakite Rust Stripper				Oakite 90	44389
C-342	Cleaning Compound, Aircraft Surface	MIL-C-43616			Oakite 8	44389
C-343	Electrolytic Cleaner, Alkaline				Anodex NP-2	34568
					Cor Clean 6000	
					Oakite 90	44389
					O-S 590	
					Cor Clean 6300	
C-344	Alcoholic Phosphoric Cleaner	MIL-C-10578, Type I	2100-00371-00	1 GAL	Turco W.O. #1	1N6B3
C-345	Use C-304 or C-305	None	None	N/A	Use C-304 or C-305	N/A
C-346	Adhesive, Silicone Base, Room Temperature Vulcanizing	299-947-152, Type II	None	N/A	RTV-106	1139
		299-947-152, Type II	None	N/A	RTV-736	71984
		299-947-152, Type II	2000-08724-00	3 OZ		
C-347	Use C-305	None	None	N/A	Use C-305	N/A

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-348	Alkaline Steel Cleaner				Oakite LFL	44389
C-349	Edge Sealer, Vinyl and Mylar Films	None	2010-06640-00	8 OZ	3M Scotchcal No. 3950	4963
C-350	Ammonium Nitrate [NH4NO3], Technical Grade	A-A-59476	None	N/A	Any product meeting specification	Commercial
C-351	Adhesive	None	2000-11324-00	Each	Q2-0046	71984
C-352	Sealant, Anaerobic, Retaining Compound	ASTM D5363, Group 04, Class 1, Grade 1	None	N/A	Permabond HL138	3R2V1
		ASTM D5363, Group 04, Class 1, Grade 1	None	N/A	Saf-T-Lok R01	4Z400
		ASTM D5363, Group 04, Class 1, Grade 1	2010-05973-00	50 CC	Loctite 609	5972
		ASTM D5363, Group 04, Class 1, Grade 2	None	N/A	Loctite 640	5972
		ASTM D5363, Group 04, Class 1, Grade 2	2000-00236-00	Each	Permabond HM160	3R2V1
C-353	Sealing Compound, One-part Silicone, Firewall	AMS 3374, Type I	2010-05919-01	6 OZ	Dapco 2100	58093
		AMS 3374, Type I	None	N/A	Dapco 2200	58093
C-354	Use C-320	None	None	N/A	Use C-320	N/A
C-355	Detergent, Mild Liquid				Mild Detergent	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-356	Sealant, Anaerobic, Retaining Compound	ASTM D5363, Group 04, Class 2, Grade 1	None	N/A	Saf-T-Lok R80	4Z400
		ASTM D5363, Group 04, Class 2, Grade 1	None	N/A	Loctite 635	5972
		ASTM D5363, Group 04, Class 2, Grade 1	2010-00106-00	50 CC		
		ASTM D5363, Group 04, Class 2, Grade 1	None	N/A	Permabond HM161	3R2V1
C-357	Adhesive, Rubber Base, Spray	299-947-107, Type I, Class 3			3M Spray Adhesive No. 77	6A670
		299-947-107, Type I, Class 3				97499
C-358	Use C-122	None	None	N/A	Use C-122	N/A
C-359	Use C-320	None	None	N/A	Use C-320	N/A
C-360	Use C-308	None	None	N/A	Use C-308	N/A

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-361	Adhesive Film	299-947-121, Type II			Cytec N-1113	4622
		299-947-121, Type II			FM 53	09BV7
		299-947-121, Type II			3M No. AF-163-2(U/S)	6A670
		299-947-121, Type II				97499
		299-947-121, Type II			FM 87	09BV7

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-362	Adhesive Film, Intermediate Cure	299-947-121, Type I			FM 87	09BV7
		299-947-121, Type I			3M No. AF-163-2K	6A670
		299-947-121, Type I			FM 53	09BV7
		299-947-121, Type I			Cytec N-1113	4622
		299-947-121, Type I			AF-126 0.08 lbs/sq.ft	55119
		299-947-121, Type I			FM 123-2 0.06 lbs/sq.ft	09BV7
		299-947-121, Type I			AF-126 0.06 lbs/sq.ft	55119
		299-947-121, Type I			AF-126-2 0.06 lbs/sq.ft	55119
		299-947-121, Type I			Narmco 227 0.06 lbs/sq.ft	4622
		299-947-121, Type I			AF-126-3 0.06 lbs/sq.ft	55119
		299-947-121, Type I				97499
		299-947-121, Type I			Hysol EA9601 0.06 lbs/sq.ft	94565

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-363	Adhesive, Epoxy Base, Heat Resistant, Wet Layup	299-947-100, Type II, Class 3	2000-03178-00	1 PT		
		299-947-100, Type II, Class 3	2000-00582-00	25 GRAMS		
		299-947-100, Type II, Class 3	None	N/A	Hysol EA956	1UW17
		299-947-100, Type II, Class 3	2000-00964-00	N/A	Magnobond 6367	22121
C-364	Adhesive Film, Epoxy, Modified, Supported and Unsupported	299-947-038, Type I	None	N/A	FM1000	09BV7
		299-947-038, Type I	2000-00932-00	1 SQ FT	FM1000-EP15	09BV7
		299-947-038, Type I	2000-09955-00	1 SQ FT	FM1000-5302	09BV7
C-365	Adhesive				Eccobond 45 / Catalyst 15	
C-366	Adhesive				Fusor 304-1 and 304-2	30676
C-367	Use C-353	None	None	N/A	Use C-353	N/A
C-368	Etchant for Teflon	None	5130-65773-01	500 ML	Tetra Etch	60622
C-369	Chromate Test Strip, Cadmium Conversion Coating				9859-N42	59728
C-370	Sealant Tape, Extruded, Cure Temp < 400Â°F	None	None	N/A	Tacky-Tape SM 5127	53309
C-371	Use C-344	None	None	N/A	Use C-344	N/A
C-372	Fairing Compound, Aerodynamic, Polyester Filler	299-947-072, Type IV	None	N/A	APF 4, Grey	
C-373	Use C-253	None	None	N/A	Use C-253	N/A
C-374	Use C-337	None	None	N/A	Use C-337	N/A
C-375	Use C-337	None	None	N/A	Use C-337	N/A

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-376	Adhesive, Rubber Base	299-947-107, Type IV, Class 8	2000-11879-00	1 QT	A1503B	1HS43
C-377	Adhesive, Rubber Base, Accelerator	299-947-107, Type IV, Class 8	2000-11870-01	1 QT	A1343B	1HS43
C-378	Estane Primer	299-947-107, Type IV, Class 9	2000-11987-01	1 GAL	Thixon P-5-2	0KED9
C-379	Methyl-Isobutyl-Ketone (MIBK)	ASTM D1153			Any product meeting specification	Commercial
C-380	Use C-334	None	None	N/A	Use C-334	N/A
C-381	Use C-363	None	None	N/A	Use C-363	N/A
C-382	Use C-308	None	None	N/A	Use C-308	N/A
C-383	Use C-024	None	None	N/A	Use C-024	N/A
C-384	Use C-355	None	None	N/A	Use C-355	N/A
C-385	Isopropyl Alcohol, 99%, Electronic Applications	TT-I-735	2100-06673-00	1 GAL	Any product meeting specification	Commercial
C-386	Solvent, Cleaner, VOC compliant	None	None	N/A	Prep-Sol 3919S	18873
C-387	Use C-331	None	None	N/A	Use C-331	N/A
C-388	Aromatic Naphtha	TT-N-97, Type I, Grade A				Commercial
C-389	Stoddard Solvent, Mineral Spirits, Degreasing	MIL-PRF-680, Type I				Commercial
C-390	Ethyl Acetate	TT-E-751	TTE751	1 GAL	Ethyl Acetate	Commercial
C-391	Lubricant, Cleaning and Preservation	MIL-L-63460				81349
C-392	Use C-251	None	None	N/A	Use C-251	N/A

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-393	Luse-Lok				No. 2109	Commercial
C-394	De-icing/Anti-Icing Fluid, Aircraft, SAE Type I	AMS 1424	None	N/A	ARCOplus, Type I	0FWN7
		AMS 1424	2900-05843-00	5 GAL	Octaflo Type I	82925
		AMS 1424	None	N/A	Kilfrost DF Plus (88)	4V360
C-395	Titanium Cleaner		PASAJEL107	1 QT	Pasa-Jell 107	2B665
C-396	Use C-158	None	None	N/A	Use C-158	N/A
C-397	Adhesive, Room Temperature Cure, High Peel Strength	299-947-125, Type II, Class 2	2000-09358-01	1 QT	EA 9320NA	33564
C-398	Detergent, General Purpose, Nonionic Liquid	MIL-D-16791				Commercial
C-399	Adhesive, Urethane Superfast, Windows				3M No. 08609	4963
C-400	Insulation, Thermal, Aluminum Backed Fiberglass, Reflective Facing	ASTM C665, Type III	2900-08904-00	4 SQ FT	Any product meeting specification	Commercial
C-401	Tape, Aluminum Foil/Glass Cloth, High Temperature	None	2000-08884-02	Roll (2" wide)	3M No. 363	4963
C-402	Use C-401	None	None	N/A	Use C-401	N/A
C-403	Tape, Adhesive, Pressure Sensitive, Glass Cloth, Heat Resistant	299-947-110, Type I	2000-12722-00	Roll (2" wide)	3M No. 361	76381
C-404	Glass Cloth, 0.010 inch thick	AMS-C-9084, Class 2, Type VIIIA	2620-06034-00	Roll (1 LB)	Any product meeting specification	Commercial
		AMS-C-9084, Class 1, Type VIIIA	2620-06055-00	3 SQ FT	Any product meeting specification	Commercial
		AMS-C-9084, Class 2, Type VIIIB	2620-06049-00	3 SQ FT	Any product meeting specification	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-405	Wire, Safety, CRES, 0.032", AS100028	AS5685	1650-03296-00	Roll (5 LB)		Commercial
C-406	Abrasive Cloth or Paper, Aluminum Oxide	None	None	N/A	Aluminum Oxide Abrasive Cloth or Paper	Commercial
		None	2900-05806-00	Each	Aluminum Oxide Abrasive Cloth or Paper	Commercial
		None	5060-60154-00	Each (9"x11")	Aluminum Oxide Abrasive Cloth or Paper	Commercial
C-407	Abrasive Pad, Nylon Web, Aluminum Oxide	None	None	N/A	Anderlex Abrasive Roll (P/N 60135)	58564
		None	5040-60115-00	Roll (4"x30')	3M Scotch-Brite, Type A, Very Fine	76381
C-408	Talcum Powder, Technical Grade, 35/65 Silicon Dioxide	A-A-59303, Type T1	2100-06179-00	5 LB	Any product meeting specification	Commercial
C-409	Use C-500	None	None	N/A	Use C-500	N/A
C-410	Tape, Packaging, Waterproof	ASTM D5486/D 5486M, Type III			Any product meeting specification	Commercial
C-411	Steel Wool	None	None	N/A	Steel Wool	Commercial
C-412	Wax, Waterproof, Solvent Type	MIL-W-18723	2100-00081-00	1 GAL	VOC 388	3LBA0
		MIL-W-18723	None	N/A	MIL-W-18723	012L8
C-413	Strip Aid, Copper				ALK-Cu Strip	Commercial
					Rostrip M-10	Commercial
					Metex Strip Aid	Commercial
					Enstrip S	Commercial
					Wetalyne Stripper No. 1	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-414	Wire, Shear, Copper, 0.020	NASM20995	1250-49103-00	1 LB	Any product meeting specification	Commercial
C-415	Corrosion Inhibitor	None	2400-00012-00	Each	LPS 3	66724
		None	None	N/A	Castrol Rustilo 4169	2R128
		None	5300-65820-00	Each	LPS 2	66724
		None	None	N/A	Turco Aquasorb	71410
		None	None	N/A	Castrol Rustilo 4135 HF	2R128
		None	None	N/A	Castrol Rustilo 4163	2R128
		None	None	N/A	Special Protective Oil, Oakite	44389
C-416	Corrosion Preventive Oil				Oakite 77	44389
					Oakite 90	44389
					Pensalt K-7	Commercial
					Presolv B	Commercial
					Poro Kleen	Commercial
C-417	Inhibitor, Corrosion, Acid Pickle	MIL-I-17433	2100-07721-00	N/A	Rodine 213	84063
C-418	Use C-434	None	None	N/A	Use C-434	N/A
C-419	Use C-466 or C-503	None	None	N/A	Use C-466 or C-503	N/A
C-420	Paper, Masking	None	5530-60870-00	N/A	3M No. 6512	76381
		None	5530-63146-00	N/A	3M No. 6536	76381
C-421	Use C-318	None	None	N/A	Use C-318	N/A
C-422	Aluminum Wool	A-A-1043, Type II	1090-04513-00	1 LB	Aluminum Wool	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-423	Abrasive Cloth or Paper, Silicon Carbide	None	5060-60171-00	Each	Silicon Carbide Abrasive Cloth or Paper	Commercial
		None	5060-60160-00	Each (9"x11")	Silicon Carbide Abrasive Cloth or Paper	Commercial
		None	None	N/A	Silicon Carbide Abrasive Cloth or Paper	Commercial
C-424	Use C-323	None	None	N/A	Use C-323	N/A
C-425	Fairing Compound, Aerodynamic, Epoxy Filler	299-947-072, Type II	2010-09585-00	1 QT		
C-426	Tape, Masking	None	2000-06383-00	Roll (1" wide)	3M No. 232	52152
C-427	Barrier Material, Grease & Water Proof, Flexible	MIL-PRF-121	MIL-B-121 TY1 CL1	Roll (36"x200 yards)	Any product meeting specification	Commercial
C-428	Caps and Plugs, Protective, Dust and Moisture Seal	NAS 847	None	N/A	Any product meeting specification	Commercial
C-429	Use C-308	None	None	N/A	Use C-308	N/A
C-429A	Use C-423	None	None	N/A	Use C-423	N/A
C-430	Use C-456	None	None	N/A	Use C-456	N/A
C-431	Hydrochloric Acid (Muriatic Acid), Technical Grade	ASTM E1146	None	N/A	Any product meeting specification	Commercial
C-432	Nitric Acid [HNO3], Technical Grade	A-A-59105	None	N/A	Any product meeting specification	Commercial
C-433	Surgical Tubing				Surgical Tubing	43729

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-434	Plating Tape, Age Control				3M No. 471 (Purple)	4963
					Borden Chemical No. 6404 (Yellow)	14429
					SC-1 (Yellow)	56059
					4-HTP (Green)	56059
			471,BLK,.75 WIDE	Roll (0.75" wide)	3M No. 471	4963
			471,YEL,.75 WIDE	Roll (0.75" wide)	3M No. 471	4963
			420 1.00 WIDE	Roll (1" wide)	3M No. 420 (Lead Foil)	4963
			420 2.00 WIDE	Roll (2" wide)	3M No. 420 (Lead Foil)	4963
					3M No. 420 (Lead Foil)	4963
					3M No. 470 (Purple)	4963
C-435	Paint Remover, General, Chlorinated Hydrocarbon, Water Rinsable	None	2100-12322-00	5 GAL	PR-3700	55208
C-436	Paint Remover, Epoxy & Polyurethane, Water Rinsable	MIL-R-81294, Type I or II	None	N/A	Any product listed in current issue of QPL-81294	Commercial
		MIL-R-81294, Type I or II	2230-05688-00	1 PT	Turco 5469	1N6B3
C-437	Ammonium Hydroxide, Technical Grade	A-A-59370, Type I	None	N/A	Any product meeting specification	Commercial
C-437A	Use C-242	None	None	N/A	Use C-242	N/A
C-438	Tinting Medium, Pigment, Enamel	A-A-3108	None	N/A	AA3108B	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-439	Tape, Aluminum Foil	None	2000-07650-00	Roll (2" wide)	3M No. 425	4963
			None	N/A	BT 102	0E7C4
		None	2000-08499-00	Roll (12" wide)	3M No. 425	4963
C-440	Sealing Compound, Pipe, Joint and Thread White, Lead Free	TT-S-1732	2400-10529-00	1 PT	Any product meeting specification	Commercial
C-441	Rubber Coated Fabric		2330-00218		No. 5253	89373
C-442	Synthetic Rubber Coated Fabric				Synthetic Rubber Coated Fabric	89373
C-443	Fabric, Sandwich				No. 5063	89373
C-444	Cement		2000-00261		No. 3230	89373
C-445	Sheet, Hard Felt (Rabbit Fur), 0.062 inch thick				No. 2610-7087	97499
		C-F-206, Type I, Class 16R1X, 1/16" thick				91801
C-446	Use C-471	None	None	N/A	Use C-471	N/A
C-447	Wire, Safety, CRES, 0.041", AS100029	AS5685	1650-03291-00	Roll (1 LB)		Commercial
C-447	Wire, Safety, CRES, 0.041", AS100029	AS5685	1650-03295-00	Roll (5 LB)		Commercial
C-448	Use C-596	None	None	N/A	Use C-596	N/A
C-449	Fuel Cell Repair Kit				2F1-3-35123	5H725
C-450	Penetrant Inspection Kit, Fluorescent Dye	None	4488-00721-00	Each	ZA-70 Zyglo Kit	37676
C-451	Use C-454	None	None	N/A	Use C-454	N/A

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-452	Anti-Seize Compound, Thread, High Temperature	MIL-PRF-907	2400-07427-00	16 OZ		Commercial
C-453	Tape, Vinyl	None	2000-09237-00	Roll (1" wide)	3M Vinyl Tape 472	76381
		None	2000-06047-00	Roll (2" wide)	3M Vinyl Tape 472	76381
		None	2000-09241-00	Roll (3" wide)	3M Vinyl Tape 472	76381
C-454	Tape, Adhesive, Pressure Sensitive, PTFE Woven Glass Cloth	299-947-110, Type II	2000-00713-00	Roll (1" wide)	3M No. 5453	76381
		299-947-110, Type II	2000-00015-00	Roll (2" wide)	3M No. 5453	76381
		299-947-110, Type II	2000-09067-02	Roll (5/8" wide)	3M No. 5453	76381
C-455	Tape, Foam, Urethane	None	2000-08772-01	Roll (0.5" wide)	3M No. 4318	76381
C-456	Tape, Adhesive, Pressure Sensitive, Dissimilar Metal Separation	A-A-59298	2000-07688-01	Roll (3.5" wide)	3M No. 853	76381
C-456	Tape, Adhesive, Pressure Sensitive, Dissimilar Metal Separation	A-A-59298	None	N/A	Any product meeting specification	Commercial
		A-A-59298	2000-07246-01	Roll (1" wide)	3M No. 853	76381
		A-A-59298	2000-06682-00	Roll (0.5" wide)	3M No. 853	76381
		A-A-59298	2000-01014-00	Roll (1" wide)	Any product meeting specification	Commercial
C-457	Mylar Tape, 3/4 inch by 72 yards				Mylar Tape, 3/4 inch by 72 yards	Commercial
C-458	Mylar Tape, 1 inch by 72 yards				Mylar Tape, 1 inch by 72 yards	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-459	Cloth, Nylon, Woven	None	None	N/A		Commercial
C-460	Tape, Adhesive, Pressure Sensitive, PTFE Extruded, 3.0 to 4.5 ÂµIN	299-947-110, Type III, Class 1	None	N/A	CHR 2285-2	1ECV7
		299-947-110, Type III, Class 1	2000-09120-00	Roll (1" wide)	3M No. 5490	76381
		299-947-110, Type III, Class 1	2000-09121-00	Roll (2" wide)	CHR HM426	71643
		299-947-110, Type III, Class 1	2000-10080-00	Roll (3" wide)		
		299-947-110, Type III, Class 1	None	N/A	CHR 2255-2	1ECV7
C-461	Ink, Etching, Acid	None	None	N/A	#25 Acid etching	38968
C-462	Tape, Polyester, High Temperature, Pressure Sensitive	None	None	N/A	Flashbreaker 1	53912
		None	None	N/A	Flashbreaker 2	53912
C-463	Fabric, Nylon, Nonwoven, Chemical and Abrasion Resistant	None			Cerex No. 23030	76541
C-464	India Stone	None	2900-05828-00	Each	Abrasive Stone	Commercial
C-465	Anti-fretting buffer				Bell standard 150-044-1	97499
C-466	Use C-503	None	None	N/A	Use C-503	N/A
C-467	Aluminum Alloy Sheet, 2024-T3, 0.020 inch thick	AMS-QQ-A-250/4A				Commercial
C-468	Vinyl Tape		2000-08637-01	Roll (0.75" wide)	3M No. 4508 (Black)	4963
			2000-09031-00	Roll (0.5" wide)	3M No. 4508 (Black)	4963
			2000-11695-00	Roll	3M No. 4508 (Black)	4963

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-469	Wicking Cloth, Fiberglass or Equivalent				HG32-38 inch	91775
C-470	Glass Beads, Abrasive, for Cleaning and Peening	MIL-PRF-9954			Any product listed in current issue of QPL-9954	Commercial
C-471	Cord, Fibrous, Nylon, Waxed	MIL-C-5040, Type III	2640-07148-00	1 FT	Any product meeting specification	Commercial
C-472	Aluminum Alloy Sheet, 2024-T3, 0.032 inch thick	AMS-QQ-A-250/4A				Commercial
C-473	Paint Remover, Solvent Type, Water Rinsable	MIL-PRF-25134	5450-63387-00	1 GAL	Any product listed in current issue of QPL-25134	Commercial
C-474	Dry Blasting Abrasive, Aluminum Oxide or Garnet				Dry Blasting Abrasive, Aluminum Oxide or Garnet	Commercial
C-475	Thread, Cotton	A-A-52094	None	N/A	Any product meeting specification	81348
C-476	Use C-397	None	None	N/A	Use C-397	N/A
C-477	Release Film, Halohydrocarbon Polymer, Perforated	None	None	N/A	E3760 P1	85670
		None	None	N/A	Wrightlon 4500 P	53912
		None	2520-05912-00	1 SQ FT	E3760 P	85670
		None	None	N/A	E3760 P2	85670
		None	None	N/A	Wrightlon 4500 P1	53912
C-478	Release Fabric, Peel Ply, Synthetic, Non-Bonding	None	None	N/A	Release Ply B	53912
		None	None	N/A	Release Ply F	53912
		None	None	N/A	Release Ply Super F	53912
C-479	Use C-427	None	None	N/A	Use C-427	N/A

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-480	Use C-471	None	None	N/A	Use C-471	N/A
C-481	Teflon-Dacron Fabric	None	2640-10695-01	1 SQ FT	No. X1106	76157
C-482	Duct Tape				3M No. 393	4963
C-483	Tape, Adhesive, Reflectorized Sheeting	None	None	N/A	3M No. 7610	76381
		None	2000-00495-00	Roll (150' long)	10605000	35012
C-484	Welding Tube (Borium), 0.125 inch Hard Facing				Welding Tube (Borium), 0.125 inch Hard Facing	57965
					Welding Tube (Borium), 0.125 inch Hard Facing	2M161
C-485	Welding Tube (DT600HM), 0.125 inch Hard Facing				Welding Tube (DT600HM), 0.125 inch Hard Facing	26195
C-486	Cheesecloth, Cotton				Rymplecloth #301	
					#300 Hermitage Hermitex "1	1L697
		CCC-C-440, Class 1			Any product meeting specification	Commercial
			CCCC0046	1 SQ FT		
C-487	Electrolyte Solution, 30% Potassium Hydroxide [KOH]	None	None	N/A	Electrolyte, 30% KOH	Commercial
C-488	Sodium Bicarbonate [NaHCO3], Technical Grade	A-A-374	None	N/A	Any product meeting specification	Commercial
C-489	Boric Acid [H3BO3]	A-A-59282	None	N/A	Boric Acid	Commercial
C-490	Cork Stopper	A-A-51056, Type I, Grade A, Class 2				Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-491	Electrical Insulation Tape, Plastic				3M No. 33	4963
					Norton No. 507	58102
C-492	Thread, Nylon, Twisted Multiple Cord, Soft Finish, Nonwiking	A-A-59826, Type I, Class B	None	N/A	Any product meeting specification	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-493	Tubing, Insulation, Heat Shrinkable	AMS-DTL-23053/ 18, Class 3	2530-00280-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00254-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00269-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00253-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00268-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00257-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00272-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00274-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00262-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00277-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00266-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00256-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00271-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00260-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/ 18, Class 3	2530-00259-00	1 FT	Any product meeting specification	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-494	Metal Marking Ink, Non-Permanent				F-1200 Vapor-Off Pen	1195
C-495	Use C-307	None	None	N/A	Use C-307	N/A
C-496	Abrasive, Wet Blasting	None	None	N/A	Flint Quartz No. 3/0, 3/0 Inspection Grade	84083
C-497	Use C-471	None	None	N/A	Use C-471	N/A
C-498	Use C-314	None	None	N/A	Use C-314	N/A
C-499	Stencil Ink	A-A-208, Type I			Any product meeting specification - Color No. 603	9800
C-500	Abrasive Cloth, Ferric (Iron) Oxide and Quartz	None	5020-63397-00	Each	Crocus Cloth	Commercial
C-501	Sodium Chloride [NaCl] (Salt), Technical Grade	A-A-694	None	N/A	Any product meeting specification	Commercial
C-502	Polyethylene Syringe				Polyethylene Syringe	52004
C-503	Tape, Polyurethane, Pressure Sensitive	299-947-113	2000-08943-00	Roll (0.5" wide)	3M No. 8671	4963
		299-947-113	2000-08974-01	Roll (1" wide)	3M No. 8671	4963
		299-947-113	2000-12713-00	Roll (6" wide)	3M No. 8671	4963
C-504	Tape, Foam, Soundproofing				3M No. 4370	4963
C-505	Nonwoven Fabric, .3 oz/sq,yd				Cerex No. 23030	41335
C-506	Potassium Cyanide [KCN], Technical Grade	None	None	N/A	Potassium Cyanide	Commercial
C-507	Sodium Cyanide [NaCN], Technical Grade	None	None	N/A	Sodium Cyanide	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-508	Wire, Safety, CRES, 0.020", AS100026	AS5685	1650-03298-00	Roll (1 LB)		Commercial
C-509	Tape, Anti-chafing		2000-11497		3M No. 4408	4963
			2000-11497	Roll (0.75" wide)	3M No. 4408	4963
			2000-11497	Roll	3M No. 4408	4963
			2000-11497	Roll (2" wide)	3M No. 4408	4963
C-510	Tape, Anti-chafing		2000-11695		3M No. 4508	4963
C-511	Tape, Double Emulsion	None	2000-11256-00	Roll (2" wide)	3M Double Coated Tape 444	4963
		None	5900-63403-00	Roll	3M Double Coated Tape 444	4963
C-512	Use C-363	None	None	N/A	Use C-363	N/A
C-513	Aluminum Alloy Sheet, 2024-T3, 0.100 inch thick	AMS-QQ-A-250/4A				Commercial
C-514	Aluminum Alloy Tube, 7075-T6, 0.156 inch thick wall	WW-T-700/7B				Commercial
C-515	Steel Metal Sheet, Normalized 4130, 0.050 inch thick	AMS 6345				Commercial
C-516	Cloth, Cleaning, Low-Lint					80244
					Cloth, Cleaning, Low-Lint	81349
C-517	Nitrogen [N], Liquid, Technical Grade	A-A-59503, Type II	None	N/A	Any product meeting specification	Commercial
C-518	Tape, Flatback, High Adhesion	None	2000-03125-00	Roll (1" wide)	3M No. 250	4963

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-519	Felt Sheet, 1/16 inch	C-F-206, Type I, Class 16R1X, 1/16" thick				81348
C-520	Adhesive, Epoxy Base, Heat Resistant	MMM-A-134				81348
C-521	Lubricant, Dry High Pressure		2400-00217-00	Each	Mollylube Osborn P/N 76209	81348
C-522	Anti-Seize Compound, High Temperature	None	2400-10528-00	0.5 PT	Ease Off 990	81348
C-523	Filler, Pinhole, High Solids Compound	299-947-144	2010-10767-00	1 QT	28C1 Static Conditioner Filler	0KXA5
C-524	Trichloroethylene, Vapor Degreaser	ASTM D4080				Commercial
C-525	Grease, Aircraft, High Load Capacity	MIL-G-81827	2400-00176-00	14 OZ	Royco 22MS	7950
		MIL-G-81827	2400-00177-00	1 LB	Aeroshell Grease 23C	7950
		A-A-59173			DC 33 (Light)	71984
C-527	Grease				Armovis No. 8	Commercial
C-528	Braid, Metal Sleeving				Bell standard 20-0363-11-XX	97499
C-529	Anti-chafing Kit	None	4488-00134-00	Each	Bas Kit -010	1CP32
C-530	Coating Compound, Plastic, Strippable (Hot Dipping)	MIL-P-149	None	N/A	Any product listed in current issue of QPL-149	Commercial
C-531	Sealing Compound, Dielectric, Premixed, Prefrozen	299-947-074, Type II	2010-08205-00	6 OZ	299-947-074 Class 1, 2, or 3	97499
		299-947-074, Type II	None	N/A	CS 3100	14439
C-532	Soldering Flux, Rosin	ANSI J-STD-004	2100-00325-00	1 GAL	Kester 185	75297

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-533	Trichlorotrifluoroethane, Cleaning Compound, Standard	MIL-C-81302, Type II	None	N/A	1,1,2-Trichlorotrifluoroethane, Freon TF or 113	Commercial
C-534	Methylene Chloride, Technical Grade	ASTM D4701	None	N/A	Dichloromethane	Commercial
C-535	Primer, Adhesion Promoter, Potting	None	None	N/A	PR-1523-M	83574
C-536	Sleeving, Braided, Expandable	None	2530-00XXX-00	1 FT	130-053-( )-0	97499
C-537	Solder, Hard, Brazing Alloy, Silver	QQ-B-654, BAg-9	None	N/A		Commercial
C-538	Solder, Electronic Grade	ANSI J-STD-006	None	N/A	Sn60WRMAP3	Commercial
C-539	Solder, Electronic Grade	ANSI J-STD-006	None	N/A	Sn60WS	Commercial
C-540	Solder, Electronic Grade	ANSI J-STD-006	None	N/A	Sn62WRMAP	Commercial
C-541	Solder, Electronic Grade	ANSI J-STD-006	None	N/A	Sn62WS	Commercial
C-542	Solder, Electronic Grade	ANSI J-STD-006	None	N/A	Sn63WRMAP3	Commercial
C-543	Solder, Electronic Grade	ANSI J-STD-006	None	N/A	Sn63WS	Commercial
C-544	Spacers				Spacers	Commercial
C-545	Stripper				LAR 388	Commercial
C-546	Thermoplastic Sealant Tape		2000-00687		XTPA-080	Commercial
C-547	Tape, Lacing, Polyester	A-A-52081	None	N/A	Any product meeting specification	Commercial
C-548	Insulation Tape, Electrical, Reinforced Silicone	A-A-59163, Type I	2000-00732-00	Roll (0.5" wide)	Any product meeting specification	Commercial
		A-A-59163, Type I	2000-00653-00	Roll (1" wide)	Any product meeting specification	Commercial
		A-A-59163, Type I	2000-00731-00	Roll (1" wide)	Any product meeting specification	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-549	Tape, Adhesive, Silicone	A-A-59474				Commercial
C-550	Tetrahydrofuran (THF)	A-A-59282	None	N/A	Any product meeting specification	Commercial
C-551	Epoxy Adhesive, Potting Compound	None	2000-00020-00	Each	S-1125 Kit 1	6090
C-552	Butyl Acetate, Contact Cleaner	None	None	N/A	Butyl Acetate, Contact Cleaner	Commercial
C-553	Tape, Adhesive, Pressure Sensitive, PTFE Extruded, 5.5 to 7.5 ÂµIN	299-947-110, Type III, Class 2	None	N/A	3M No. 5491	76381
		299-947-110, Type III, Class 2	2000-10657-00	Roll (0.5" wide)		
		299-947-110, Type III, Class 2	2000-09249-00	Roll (3" wide)		
C-554	Wire, Shear, Copper, 0.015	"NASM20995	3990-23615-00	4 FT	Any product meeting specification	Commercial
C-555	Release Agent, Mold, Liquid	None	None	N/A	Loctite Frekote 44-NC	5972
		None	None	N/A	Mono-Coat E-150 N-ODS	Commercial
		None	2010-00093-00	1 GA	Loctite 700-NC	5972
C-556	Use C-415	None	None	N/A	Use C-415	N/A
C-557	Tape, Erosion, Protective, Polyurethane	None	2000-00998-00	Roll (6"x36 yards)	3M No. 8663HS	52152
		None	2000-00999-00	Roll (6"x36 yards)	3M No. 8663HS	52152
C-558	Adhesive Promoter	None	2000-00451-00	1 PT	3M No. 86A	4963
C-559	Sealing Compound, Fuel Resistant	AMS 3276	2010-05970-00	1 PT	Any product meeting specification	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-560	Glass Cloth, 0.005 inch thick	AMS-C-9084, Class 2, Type III	2620-06051-00	3 SQ FT	Any product meeting specification	Commercial
C-561	Grease, High Pressure	NLGI Grade 2	2400-00175-00	15.5 OZ	ThixO #2 (3810-0)	L1028
C-562	Adhesive, Epoxy Base, Room Temperature Cure, Heat Resistant	299-947-359, Type I	2000-00297-00	1 PT	Magnobond 6398	22121
		299-947-359, Type I	2000-00456-00	50 GRAMS KIT	Hysol EA9392	33564
		299-947-359, Type I	2000-00298-00	1 QT	Magnobond 6398	22121
		299-947-359, Type I	2000-00295-00	50 GRAMS	Magnobond 6398	22121
C-563	Vapor Degreaser	ASTM D4376			Tetrachloroethylene, Perchloroethylene	Commercial
C-564	Bagging Film, Nylon	None	None	N/A	Ipplon WN1500	53912
C-565	Breather Felt, Non-Woven, Polyester, 10 oz, High Pressure	None	None	N/A	Airweave N10	53912
C-566	Sealant Tape, Extruded, Cure Temp < 400Â°F	None	None	N/A	GS-213-3 (1/8" x 1/2")	53912
C-567	Shimming Compound, Filled Resin, Two-Part (Uncatalyzed)	AMS 3726, Class 1	2000-00070-01	50 GRAMS	DMS-4-828	30256
C-568	Copper Mesh, Non-Woven, Conductive, Perforated, 0.029 lb/sq ft	None	1100-01096-00	1 SQ FT	151-024-3	97499
		None	1100-01095-00	Each	151-024-3-13-001	97499
		None	1100-00031-00	Each	151-024-3-31-003	97499

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-569	Lubricant, Drilling and Tapping, Composites and Metals	None	None	N/A	Boelube 70104	18554
		None	None	N/A	Micro Lube	0M7L5
		None	None	N/A	ICF-31P	72008
		None	None	N/A	Cethyl Alcohol (solid blocks 1"x2"x3" approx.)	Commercial
		None	None	N/A	Joocy-Loob	
C-570	Release Film, Fluoropolymer, Perforated	None	None	N/A	A4000 P	53912
		None	2000-00268-00	Roll (48"x500')	A5000 Perforated	0F451
C-571	Adhesive, Abrasion Resistant Materials	None	2000-00686-00	87 GRAMS KIT	Larson L100	61272
C-572	Adhesive, Anaerobic, Retaining Compound	None	None	N/A	Loctite 603	5972
C-573	Heatsink Compound, Non-Curing, Thermally Conductive Silicone	None	2000-00004-00	1 PT	Dow Corning No. 340	71984
C-574	Adhesive, Instant, Ethyl-2-Cyanoacrylate, Low Viscosity	A-A-3097, Type II, Class 1	2000-00480-00	1 OZ	Any product meeting specification	Commercial
C-575	Adhesive		2000-00866-00	50 ML	Araldite 2026	Commercial
C-576	Tape, Plastic (PMB)				Tape 500 (3M)	Commercial
			2530-06070-00	Roll (2" wide)	BT-100 (Anchor Continental)	Commercial
C-577	Nylon Braid, Flat Electrical Tying, Resin Coated	AMS 3817	2640-08520-00		Any product meeting specification	Commercial
C-578	Preservative Oil	MIL-L-21260, Type I or II				Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-579	Use C-020	None	None	N/A	Use C-020	N/A
C-580	Wire, Safety, CRES, 0.025", AS100027	AS5685	None	N/A	Any product meeting specification	Commercial
C-581	Tape, Lacing, Aramid	A-A-52084	2640-05901-01	Roll (750' long)	AA52084-C-2	Commercial
		A-A-52084	2640-05900-00	Each	AA52084-C-3	Commercial
C-582	Black Oxide Solution, Touch-up Material	None	None	N/A	Presto Black BST4 Brush-On	0HLC1
C-583	Adhesive, Epoxy Base, Intermediate Cure, Heat Resistant	299-947-073	2000-00862-00		Hysol EA 9306NA	33564
		299-947-073	2000-12628-00	1 QT		97499
		299-947-073	2000-08676-00	6 OZ		97499
C-584	Insert Material, Low Density, Epoxy & Amine Base	299-947-097, Type II	2010-06016-00	1 PT		
		299-947-097, Type II	2010-09389-00	1 GAL		
		299-947-097, Type II	None	N/A	BH200A/9810	51625
		299-947-097, Type II	None	N/A	Magnobond 120-271	22121
C-585	Stencil Ink	A-A-208, Type III			Any product meeting specification	9800
C-586	Corrosion Preventive Compound	None	2010-05901-00	6 OZ	DeSoto CA 1000	K5635
C-587	Tubing, Insulation, Heat Shrinkable	AMS-DTL-23053/4, Class 3	None	N/A	ATUM (RK-6025)	6090

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-588	Tubing, Insulation, Heat Shrinkable	AMS-DTL-23053/8	2530-05933-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/8	2530-05921-00	1 FT	Any product meeting specification	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-589	Tubing, Insulation, Heat Shrinkable	AMS-DTL-23053/5, Class 1	2530-00334-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-00340-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-00356-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-00371-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-00389-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-00404-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-12640-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-12652-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-00279-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-00315-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-00325-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-00038-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-12655-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-00383-00	1 FT	Any product meeting specification	Commercial
		AMS-DTL-23053/5, Class 1	2530-00398-00	1 FT	Any product meeting specification	Commercial

Table 13-1. Consumable Materials List — Item Number Versus Nomenclature

ITEM NO.	NOMENCLATURE	SPECIFICATION	BELL ORDER NO.	ORDER QTY	MATERIAL	CAGE/FSCM/ SOURCE
C-590	Tubing, Insulation, Heat Shrinkable	AMS-DTL-23053/4, Class 2	2530-06140-00	1 FT	Any product meeting specification	Commercial
C-591	Leak Detection Compound, Oxygen Systems	MIL-PRF-25567, Type I			Sherlock 5-Second	23316
C-592	Strap, Tiedown, Adjustable, Self-Clinching, Plastic, Ty I, Cl 1	AS33671	3866-86667-01	Each	Any product meeting specification	Commercial
		AS33671	3866-81146-01	Each	Any product meeting specification	Commercial
		AS33671	3866-00077-00	Each	Any product meeting specification	Commercial
		AS33671	3866-02657-00	Each	Any product meeting specification	Commercial
		AS33671	3866-85185-01	Each	Any product meeting specification	Commercial
		AS33671	3866-85349-01	Each	Any product meeting specification	Commercial
C-593	Adhesive, Silicone, Room Temperature Vulcanizing, High Strength	MIL-A-46146	None	N/A	RTV-3145	71984
C-594	Lacquer, Acrylic, Grade P-95	299-947-069	None	N/A	Lacquer, Grade P-95	6341
C-595	Tape, Sealing, Expanded PTFE, Adhesive Backed, Non-Ribbed, Tapered	AMS 3255, Class 2			120-255-7	0AMD8
C-596	Tape, Thread Sealant and Lubricant, PTFE	None	2010-10355-01	Each	48 Thread Sealant and Lubricant	75037
		None	None	N/A	Scotch brand No.547	52004
C-597	Tape, Sealing, Expanded PTFE, Adhesive Backed, Ribbed	AMS 3255, Class 1	2000-03146-00	Roll	120-255-3	0AMD8

Table 13-2. Alternates for Bell Helicopter Textron Adhesives

BELL SPEC (ITEM NO.)	ALTERNATE	CURE TEMP	CURE TIME	CURE PRESSURE	STORAGE LIFE	PRIMER
299-947-038, Type I, Form B, Grade 08 (C-364)	FM1000-EP15	340-355°F (171 to 179.78°C)	60 to 90 minutes	10 to 50 PSI (69 to 345 kPa)	3 months at 40 to 60°F (4 to 16°C)	BR1009-49
299-947-038, Type I, Form S, Grade 06 (C-364)	FM1000-5302	340-355°F (171 to 179.78°C)	60 to 90 minutes	10 to 50 PSI (69 to 345 kPa)	3 months at 40 to 60°F (4 to 16°C)	BR1009-49
299-947-038, Type I, Form U, Grade 06 (C-364)	FM1000	340-355°F (171 to 179.78°C)	60 to 90 minutes	10 to 50 PSI (69 to 345 kPa)	3 months at 40 to 60°F (4 to 16°C)	BR1009-49
299-947-066, Type I (C-301)	Scotch-Weld 3549 (brown)	Room temp or 160°F (71°C) (alternate)	2 days or 2 hours (alternate)	5 to 20 PSI (35 to 138 kPa)	6 months at room temp	None
	Dapcotac 3013 (natural color)	Room temp or 160°F (71°C) (alternate)	2 days or 2 hours (alternate)	5 to 20 PSI (35 to 138 kPa)	6 months at room temp	None
299-947-066, Type II	Scotch-Weld 3549 (brown)	Room temp or 160°F (71°C) (alternate)	2 days or 2 hours (alternate)	5 to 20 PSI (35 to 138 kPa)	6 months at room temp	None
	Dapcotac 3013 (black)	Room temp or 160°F (71°C) (alternate)	2 days or 2 hours (alternate)	5 to 20 PSI (35 to 138 kPa)	6 months at room temp	None
299-947-066, Type III	Scotch-Weld TE031 (natural color)	Room temp	2 days	5 to 20 PSI (35 to 138 kPa)	6 months at room temp	None
299-947-072, Type I (C-323)	RP1257-3	Room temp or 125 to 175°F (52 to 80°C) (alternate)	24 hours or 1 hour (alternate)	None	12 months at room temp	None
	EA 960-A EQ 960-B	Room temp or 125 to 175°F (52 to 80°C) (alternate)	24 hours or 1 hour (alternate)	None	12 months at room temp	None

Table 13-2. Alternates for Bell Helicopter Textron Adhesives (Cont)

BELL SPEC (ITEM NO.)	ALTERNATE	CURE TEMP	CURE TIME	CURE PRESSURE	STORAGE LIFE	PRIMER
299-947-072, Type II (C-323)	RP1257-4	Room temp or 125 to 175°F (52 to 80°C) (alternate)	24 hours or 1 hour (alternate)	None	12 months at room temp	None
	EA 960-F EQ 960-B	Room temp or 125 to 175°F (52 to 80°C) (alternate)	24 hours or 1 hour (alternate)	None	12 months at room temp	None
299-947-072, Type IV	APF 4	Room temp	30 minutes	None	12 months at room temp	None
299-947-092 (C-303)	PS-18	Room temp or 120 to 150°F (49 to 66°C) (alternate)	30 minutes or 10 minutes (alternate) - additional 24 hours	Firm contact	6 months at 50 to 60°F (10 to 16°C)	None
	PS-30	Room temp or 120 to 150°F (49 to 66°C) (alternate)	30 minutes or 10 minutes (alternate) - additional 24 hours	Firm contact	6 months at 50 to 60°F (10 to 16°C)	None
299-947-099 (C-313)	Metalset A-4	Room temp or 145 to 180°F (63 to 82°C) (alternate)	24 hours or 30 minutes (alternate)	Firm contact	12 months at 40 to 80°F (4 to 27°C) or 18 months below 40°F (4°C)	None
	EA 9340	Room temp or 145 to 180°F (63 to 82°C) (alternate)	24 hours or 30 minutes (alternate)	Firm contact	12 months at 40 to 80°F (4 to 27°C) or 18 months below 40°F (4°C)	None

Table 13-2. Alternates for Bell Helicopter Textron Adhesives (Cont)

BELL SPEC (ITEM NO.)	ALTERNATE	CURE TEMP	CURE TIME	CURE PRESSURE	STORAGE LIFE	PRIMER
299-947-099 (C-313)	Araldite AV1258/ HV1258	Room temp or 145 to 180°F (63 to 82°C) (alternate)	24 hours or 30 minutes (alternate)	Firm contact	12 months at 40 to 80°F (4 to 27°C) or 18 months below 40°F (4°C)	None
299-947-100, Type I, Class 6	EC 3448	225 to 300°F (107 to 149°C)	55 to 65 minutes	Firm contact to 10 PSI (69 kPa)	180 days below 0°F (-18°C)	None
299-947-100, Type II, Class 2 (C-317)	Magnobond 6398	Room temp or 190 to 210°F (88 to 99°C) (alternate)	5 to 7 days or 55 to 65 minutes (alternate)	None or firm contact to 10 PSI (69 kPa) (alternate)	12 months below 40°F (4°C) or 90 days at 40 to 85°F (4 to 29°C) or 60 days at 85 to 100°F (29 to 38°C)	None
	Hysol EA934NA	Room temp or 175 to 185°F (80 to 85°C) (alternate)	5 to 7 days or 55 to 65 minutes (alternate)	None or firm contact to 10 PSI (69 kPa) (alternate)	12 months below 40°F (4°C) or 90 days at 40 to 85°F (4 to 29°C) or 60 days at 85 to 100°F (29 to 38°C)	None
	Hysol EA9392	Room temp or 175 to 185°F (80 to 85°C) (alternate)	5 to 7 days or 55 to 65 minutes (alternate)	None or firm contact to 10 PSI (69 kPa) (alternate)	12 months below 40°F (4°C) or 90 days at 40 to 85°F (4 to 29°C) or 60 days at 85 to 100°F (29 to 38°C)	None

Table 13-2. Alternates for Bell Helicopter Textron Adhesives (Cont)

BELL SPEC (ITEM NO.)	ALTERNATE	CURE TEMP	CURE TIME	CURE PRESSURE	STORAGE LIFE	PRIMER
299-947-100, Type II, Class 3 (C-363)	Hysol EA956	Room temp or 195 to 205°F (91 to 96°C) (alternate)	5 to 7 days or 55 to 65 minutes (alternate)	None or firm contact to 10 PSI (69 kPa) (alternate)	12 months below 40°F (4°C) or 90 days at 40 to 85°F (4 to 29°C) or 60 days at 85 to 100°F (29 to 38°C)	None
	Magnobond 6367	Room temp or 190 to 210°F (88 to 99°C) (alternate)	5 to 7 days or 55 to 65 minutes (alternate)	None or firm contact to 10 PSI (69 kPa)	12 months below 40°F (4°C) or 90 days at 40 to 85°F (4 to 29°C) or 60 days at 85 to 100°F (29 to 38°C)	None
299-947-100, Type II, Class 4	EC 1469	320 to 340°F (160 to 171°C) or 340 to 360°F (171 to 182°C) (alternate)	55 to 65 minutes or 50 to 60 minutes (alternate)	Firm contact to 10 PSI (69 kPa)	12 months below 40°F (4°C) or 90 days at 40 to 85°F (4 to 29°C) or 60 days at 85 to 100°F (29 to 38°C)	None
299-947-107, Type I, Class 1 (C-324)	Pro-Seal 596	Join after tacky stage when heated to 250 to 260°F (121 to 127°C)	None	Firm contact	180 days at 40 to 80°F (4 to 27°C)	None
	Scotchgrip 1300	Join after tacky stage at room temp	5 to 10 minutes	Firm contact	180 days at 40 to 80°F (4 to 27°C)	None
	Scotchgrip 1300L	Per manufacturers instructions			180 days at 40 to 80°F (4 to 27°C)	None

Table 13-2. Alternates for Bell Helicopter Textron Adhesives (Cont)

BELL SPEC (ITEM NO.)	ALTERNATE	CURE TEMP	CURE TIME	CURE PRESSURE	STORAGE LIFE	PRIMER
299-947-107, Type I, Class 2 (C-333)	Scotchgrip Industrial Adhesive #4550	Per manufacturers instructions			180 days at 40 to 80°F (4 to 27°C)	None
299-947-107, Type I, Class 3 (C-357)	Spray Adhesive #77	Join after tacky stage at room temp	24 hours	Firm contact	180 days at 40 to 80°F (4 to 27°C)	None
299-947-107, Type II, Class 4 (C-311)	A-1231-B	Per manufacturers instructions			180 days at 40 to 80°F (4 to 27°C)	None
299-947-107, Type II, Class 5 (C-325)	EC-776	275 to 280°F (135 to 138°C) and allow to cool to room temp	None	Firm contact	180 days at 40 to 80°F (4 to 27°C)	None
299-947-107, Type III, Class 6 (C-310)	Magna-Tac M-24	315 to 320°F (157 to 160°C) or 250 to 260°F (121 to 127°C) (alternate 1) or room temp (alternate 2)	25 to 30 minutes or 60 to 70 minutes (alternate 1) or 24 hours (alternate 2)	Firm contact	180 days at 40 to 80°F (4 to 27°C)	None
299-947-107, Type III, Class 7 (C-308)	Pro-Seal 890-B2	Room temp then 180 to 190°F (82 to 88°C)	1 hour then 1hour	Firm contact	180 days at 40 to 80°F (4 to 27°C)	None
	PR-1440, Class B-2	Room temp then 180 to 190°F (82 to 88°C)	1 hour then 1hour	Firm contact	180 days at 40 to 80°F (4 to 27°C)	None
	CS 3204-B2	Per manufacturers instructions			180 days at 40 to 80°F (4 to 27°C)	None
299-947-107, Type IV, Class 8 (C-376) (C-377)	A1503B A1343B	190 to 210°F (88 to 99°C)	12 hours	Firm contact	180 days at 40 to 80°F (4 to 27°C)	None
299-947-121, Type I (C-362)	Cytec N-1113	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	6726, 6740, or BR 6747-1

Table 13-2. Alternates for Bell Helicopter Textron Adhesives (Cont)

BELL SPEC (ITEM NO.)	ALTERNATE	CURE TEMP	CURE TIME	CURE PRESSURE	STORAGE LIFE	PRIMER
299-947-121, Type I (C-362)	FM 53	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	BR 53
	FM 87	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	BR 127
	AF 163-2K	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	EC 3924B
299-947-121, Type II (C-361)	Cytec N-1113	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	6726, 6740, or BR 6747-1
	FM 53	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	BR 53
	FM 87	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	BR 127
	AF 163-2(U/S)	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	EC 3924B
299-947-121, Type III	FM 87	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	BR 127
	FM 53L	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	BR 53
299-947-121, Type IV	Cytec N-1113	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	6726, 6740, or BR 6747-1
	FM 53	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	BR 53
	FM 87	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	BR 127
	AF 163-2K	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	EC 3924B

Table 13-2. Alternates for Bell Helicopter Textron Adhesives (Cont)

BELL SPEC (ITEM NO.)	ALTERNATE	CURE TEMP	CURE TIME	CURE PRESSURE	STORAGE LIFE	PRIMER
299-947-121, Type V	FM 87	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	BR 127
299-947-121, Type VI	FM 87	260 to 290°F (127 to 143°C)	60 minutes minimum	40 PSI (276 kPa)	180 days below 0°F (-18°C)	BR 127
299-947-125, Type I (C-331)	EA 9309NA	Room temp or 175 to 185°F (80 to 85°C) (alternate)	3 days or 60 minutes (alternate)	Firm contact	12 months at 40 to 80°F (4 to 27°C)	None
299-947-125, Type II, Class 2 (C-397)	EA 9320NA	Room temp or 175 to 185°F (80 to 85°C) (alternate)	5 days or 60 minutes (alternate)	Firm contact	12 months at 40 to 80°F (4 to 27°C)	None
299-947-152, Type I, Class 1 (C-300)	Dapcotac 3300	Room temp	5 days	Firm contact	6 months at 40 to 80°F (4 to 27°C)	S-2260
299-947-152, Type I, Class 2 (C-307)	RTV 732	Room temp	5 days	Firm contact	6 months at 40 to 80°F (4 to 27°C)	1200
	RTV 108	Room temp	5 days	Firm contact	6 months at 40 to 80°F (4 to 27°C)	SS-4004
299-947-152, Type II (C-346)	RTV 106	Room temp	5 days	Firm contact	6 months at 40 to 80°F (4 to 27°C)	SS-4004
	RTV 736	Room temp	5 days	Firm contact	6 months at 40 to 80°F (4 to 27°C)	1200
299-947-152, Type III (C-314)	RTV 730	Room temp	5 days	Firm contact	6 months at 40 to 80°F (4 to 27°C)	1200
	Q42817	Room temp	5 days	Firm contact	6 months at 40 to 80°F (4 to 27°C)	1200
	FRV 1106	Room temp	5 days	Firm contact	6 months at 40 to 80°F (4 to 27°C)	SS-4004

Table 13-2. Alternates for Bell Helicopter Textron Adhesives (Cont)

BELL SPEC (ITEM NO.)	ALTERNATE	CURE TEMP	CURE TIME	CURE PRESSURE	STORAGE LIFE	PRIMER
299-947-152, Type V, Class 2 (C-300)	3-6077	Room temp	7 days	Firm contact	6 months at 40 to 80°F (4 to 27°C)	1200

NOTE:

For any additional information pertaining to the definition, application, and use of these alternate adhesives, please refer to the manufacturers Technical Data Sheet, Material Safety Data Sheet (MSDS), or any other applicable documentation available through Bell Helicopter Textron.