International Aero Tech Academy

CHAPTER

20

STANDARD PRACTICES - AIRFRAME

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International Aero Tech Academy

MD-80
AIRCRAFT MAINTENANCE MANUAL

CHAPTER 20
STANDARD PRACTICES - AIRFRAME

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GENERAL - DESCRIPTION AND OPERATION

1. General

CAUTION: CADMIUM-PLATED TOOLS SHOULD NOT BE USED ON TITANIUM PARTS, PARTICULARLY IF PARTS ARE MOUNTED NEAR ENGINE AND SUBJECT TO HEAT. SMALL CADMIUM DEPOSITS WHICH MAY BE LEFT ON SUCH PARTS WILL REACT WITH TITANIUM WHEN HEATED RESULTING IN BRITTLENESS AND POSSIBLY CRACKS.

A. The use and application of repair materials and general hardware used for maintenance of the aircraft are described in the standard practices chapter. Included are procedures, practices, and processes that are not specifically covered in other chapters of the Maintenance Manual. Information includes tables, charts, illustrations, and technical data to aid in general maintenance of the airplane.

NOTE: Lead, zinc, silver, and tin react in a similar manner with titanium at temperatures above 250°F (121°C)

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TITANIUM - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides instructions for cleaning titanium which has been contaminated with undecomposed or thermally decomposed fire resistant hydraulic fluid.

WARNING: CLEANING OPERATIONS USING SOLVENTS SHOULD BE PERFORMED IN A WELL-VENTILATED ATMOSPHERE. EXERCISE NORMAL SAFETY PRECAUTIONS DURING USE.

CAUTION: DO NOT ALLOW CADMIUM, TIN, ZINC, OR SILVER PLATED METALS TO CONTACT TITANIUM USED IN HOT AREAS.

B. Fire resistant hydraulic fluid decomposes into a black viscous, acidic fluid or solid, beginning at 300°F (148.9°C). At 500°F (260°C), the decomposition rate is very rapid and the acidic decomposition product reacts rapidly with titanium. The result of this reaction is pitting, etching, hydrogen embrittlement, and possible cracking. Titanium structure damaged in this way is subject to brittle failure.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Solvent, dry cleaning, MIL-PRF-680 Type 1, DPM 518	
Abrasive pads, aluminum oxide impregnated nylon	3M Co.
Alkaline cleaner, waterbase DPM 5278	Chemetall Oakite Products
Abrasive blast equipment, vacu-blast or equal	
Plastic scrapers	
Aluminum oxide - 150 mesh	

3. Check Titanium

A. Titanium parts exposed to fire resistant hydraulic fluid that has been subject to thermal decomposition require no special treatment or check after cleaning other than repair of damaged paint areas. However, where primer or paint has been removed by hydraulic fluid, bare metal surfaces should be carefully checked for etching, mottling, cracking, or pitting. This type of attack occurs as a result of exposure to thermally decomposed hydraulic fluid.

B. Titanium parts that exhibit chemical attack require careful evaluation to determine their structural integrity. All incidents of chemical attack of titanium by decomposed hydraulic fluid should be reported in detail to Douglas Aircraft Company.

4. Cleaning/Painting Titanium

A. Clean Undecomposed Hydraulic Fluid from Titanium

(1) Titanium contaminated with hydraulic fluid can be cleaned by either of following methods:

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WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1227, CLEANER/ALKALINE/WATERBASE (DPM 5278)

HAZMAT 1097, SOLVENT/MIL-PRF-680 TYPE 1 (DPM 518)

HAZMAT 1000, REFER TO MSDS

CAUTION: DO NOT USE CHLORINATED SOLVENTS FOR CLEANING.

(a) Remove hydraulic fluid from titanium using clean dry cheesecloth, then wipe area with cheesecloth dampened with solvent.

(b) Remove hydraulic fluid from titanium using clean dry cheesecloth, then wipe area with cheesecloth dampened with waterbase alkaline cleaner. Finish wipe with water dampened cheesecloth to remove cleaner residue.

B. Clean Thermally Decomposed Hydraulic Fluid from Titanium

(1) Remove decomposed hydraulic fluid from titanium, depending on degree of decomposition, by following methods, used singly or in combination:

(a) Solvent wiping. (Paragraph 4.A.(1)(a))

(b) Alkaline cleaning. (Paragraph 4.A.(1)(b))

(c) Nylon abrasive pads

(d) Plastic scrapers

(e) Abrasive blasting - 150 mesh or finer aluminum oxide.

C. Titanium parts that have a dull or mottled appearance with no visible etching, pits, or cracks, do not require immediate removal or repair. However, depending on titanium alloy and exposure conditions, such parts may have suffered a reduction in mechanical properties. An engineering review of such parts is recommended.

5. Approved Repairs Titanium

A. Titanium parts that are etched, pitted, or cracked are considered to be permanently embrittled and should be replaced or repaired. Such repairs should be in accordance with engineering instructions.

B. Repairs of embrittled titanium parts by mechanical rework of damaged surfaces is not effective since embrittlement of entire thickness of part is probable.

C. At present, degree of titanium embrittlement can only be accomplished by laboratory analysis of metal removed from suspect areas by means of spotfacing or fastener hole enlargement under engineering direction. This procedure provides a means of evaluating severity of an apparently slight attack.

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AIRCRAFT HARDWARE - DESCRIPTION AND OPERATION

1. General

A. The use and application of general hardware that is used throughout the airplane are described in the hardware section of the standard practices chapter. The section includes information on such hardware as nuts, bolts, clamps, ducts, hose, tubing, fittings, and safety wire. Tables, figures and specifications are presented in appropriate subsections.

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BEARINGS AND BUSHINGS - MAINTENANCE PRACTICES

1. General

A. Care is required in handling all bearings and bushings. Bearing and bushings should be free of nicks, scratches, gouges, tool marks, and out-of-round conditions. Bearings and bushings should only be removed from their protective packaging material immediately before installation.

2. Check Bearings and Bushings

A. Check Bearings (Non-preloaded)

(1) Bearings should be visually checked for proper retention, loose, bent or punctured shields, corrosion on any surfaces.

(2) Bearings should be physically checked for rough turning due to dirt, hard grease, dragging shield, broken retainer, missing bearings or other imperfections. Excessive wear may be checked by rocking the installation and observing amount of looseness, also by comparison with an uninstalled like bearing.

B. Check Bearings (Preloaded)

(1) Bearings in eyebolts mounting some flight controls and their tabs are manufactured with an intentional preload, thereby holding surface under any vibration condition without appreciable looseness. These bearings operate under conditions with essentially zero rotation.

(2) During bearing rotation, drag and/or preload should be evident. However a bearing which has lost its preload, but has no radial play and is free in movement, is satisfactory to use. Bearing should not have a definite ratcheting or detent effect which would indicate brinelled races.

(3) When lubricating bearing, a red rust-colored grease usually means a fret corrosion condition and is cause for bearing replacement.

C. Check Bushings

(1) Bushings should be checked for proper retention and presence of corrosion on any surface. Looseness and excessive wear may be checked by rocking the installation and observing the amount of looseness.

NOTE: If signs of wear exist, the dimension of the bushing should be measured to ensure that wear is not beyond tolerances.

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DUCTS, CLAMPS, AND COUPLINGS - MAINTENANCE PRACTICES

1. General

A. Care is required in handling, assembly and installation of ducts and fluid lines that require special clamps and couplings. This section contains information pertaining to storage, handling, and installation procedures necessary to ensure satisfactory functioning and maximum service life of the applicable system.

NOTE: Additional detailed information for air conditioning ducts can be found in, (GENERAL - REMOVAL/INSTALLATION, PAGEBLOCK 21-00-00/401) and (GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 36-00-00/201).

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Petrolatum VV-P-236 DPM 675	
Tape, silicone adhesive, high temperature (DMS 2186 Type 1)	Kirkhill-TA Co. 300 E. Cypress Ave Brea, CA 92621
Lockwire, Inconel, NASM20995N32, DPM 684	Not Specified
Lockwire, Corrosion Resistant Steel, NASM20995C32, DPM 5865	Not Specified

3. Storage and Handling

A. General

(1) Store tubing and ducts so no damage will occur from falling objects. Stack in a manner to prevent crushing or damaging containers or contents.

NOTE: Ducts should not be removed from containers, except for issue.

(2) When issued in quantities less than a full container, protect each item with single-faced corrugated fiberboard, fiberboard separators, vendor-supplied paperboard sleeves, or equivalent wrapping or cushioning material.

(3) To ensure protection of contents during transportation and handling, place protected, covered items in original container or in strong box, preferably wooden.

(4) Use transporting equipment of adequate dimensions to support ducting properly. Arrange load to prevent crushing or damaging containers and contents.

(5) Keep protective covers in place at all times on precision flanges, precision mating surfaces, and threaded fittings, except during fabrication, pressure testing, and installation. If necessary, keep protectors in place with acetate tape.

NOTE: Protective coverings should not be removed from ducts until fabrication or installation.

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4. Fabrication

A. Fabrication, forming, and welding of components requires special equipment, tooling, and in-process control. Detailed instructions are not given in this manual. Address specific inquiries to: Douglas Aircraft Co., Inc., Service Department, Long Beach, Calif.

5. Removal/Installation Duct

A. Remove Duct

(1) Disconnect clamps or couplings and remove duct.

(2) Place protective cover on precision flanges, precision mating surfaces, and threaded fittings. Keep protectors in place with acetate tape, if necessary.

(3) Close ends of flared tube connections with shipper-type caps or plugs.

(4) Close ends of other metal or plastic ducts with vendor-furnished protectors or equivalents.

B. Install Duct

NOTE: Threads on fittings or clamps should not be lubricated. Tighten to specified torque with threads free of lubricants or antiseize compounds.

(1) Remove protective covering from new assembly.

(2) Check new assembly for damage or foreign matter.

(3) Position ducts so that duct flanges on mating parts are parallel and ducts are in a common plane.

(4) Do not force or bend ducts.

(5) If necessary, to prevent slippage, install high temperature silicone adhesive tape (DMS 2186 Type 1) between duct end and connector and under clamps.

(6) Install clamps loosely at all joints in system before tightening any one clamp.

(7) Adjust ducting until proper fit is obtained and lightly tighten each clamp.

(8) Check alignment of ducts.

(9) Tighten clamps to specified torque value. (Paragraph 9.)

(10) If required, following appropriate pressure test, check torque values of clamps and tighten to specified torque.

(11) Clean assembled system and test for integrity, as necessary.

6. Removal/Installation Hoses

A. Install Hose

CAUTION: DO NOT APPLY TAPE ON SHROUDED PNEUMATIC DUCTS IN FUSELAGE.

(1) Align duct ends to dimensions shown in Figure 201. Check that offset and deflection are within tolerance. Check that gap between duct ends is within specified limits.

(2) Install specified hose. If necessary, on pneumatic duct, moisten outside of duct with only water to facilitate installation. With duct installed, wipe area dry with a dry cloth.

NOTE: Wipe off excess bubble fluid with a clean, water dampened cloth.

(3) If necessary, to prevent slippage, install high temperature silicone adhesive tape (DMS 2186 Type 1) between duct end and hose.

7. Removal/Installation Clamps

A. Install Clamp

(1) Install specified clamp as shown in Figure 201.

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(2) Install one clamp only on each end of any hose connection, unless otherwise specified.

(3) Tighten clamps to specified torque.

(4) If required, following appropriate pressure test, check torque values of clamps and tighten to specified torque.

8. Removal/Installation Special Clamps and Couplings

A. Install Clamps (Marman 53064 Series)

(1) Wrap strap around tube and insert strap end through saddle loop.

(2) Draw strap through snugly and wrap around tube again.

(3) Insert strap end into slot in reel up to brake.

(4) Turn reel clockwise with allen wrench to draw strap in and tighten to torque of 25 inch-pounds (2.83 N·m).

NOTE: To keep windings tight on reel, pull slack in the strap by hand when installing clamp.

B. Install Clamps (Wemac 2000 Series)

(1) Place clamp immediately behind bead.

(2) Tighten until screw bottoms.

C. Install Janitrol Dubl-Lock Clamp (With Dubl-Lock Tang)

(1) Slip expanded clamp over mating surfaces and insert T-bolt into trunnion.

WARNING: WHITE PETROLATUM IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN WHITE PETROLATUM IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT BREATHE THE MIST.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

CAUTION: DO NOT EXCEED TORQUE VALUE STAMPED ON CLAMP.

(2) Position Dubl-Lock tang in opening beneath head of T-bolt and tighten nut using torque wrench until tang locks. While tightening nut, tap clamp with plastic mallet around circumference of any accessible clamp surface to aid distribution of load.

NOTE: To aid seating of clamp, inside of retainer segment may be lubricated with light coating of petrolatum lubricant (VV-P-236), being careful not to allow lubricant to contact T-bolt.

(3) After Dubl-Lock tang has engaged, continue to tighten nut until torque value specified on clamp is reached. While tightening nut to specified torque value, tap clamp with plastic mallet around circumference or any accessible clamp surface until torque value is achieved.

NOTE: Reject clamp if tang does not seat by maximum torque value specified on clamp.

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WJE 401-412, 414, 873-881, 883, 884, 886, 887, 892, 893

(4) If required, install safety pin. (Figure 202)

WJE 415-427, 429, 861-866, 868, 869, 871, 872, 891

(5) Install safety pin. (Figure 203)

WJE ALL

CAUTION: DO NOT EXCEED TORQUE VALUE STAMPED ON CLAMP.

(6) If required, following appropriate pressure test, check torque value of nut and tighten to specified torque.

D. Install Janitrol T-Bolt Clamp

(1) Slip expanded clamp over mating surfaces and insert T-bolt into trunion.

WARNING: WHITE PETROLATUM IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN WHITE PETROLATUM IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT BREATHE THE MIST.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

CAUTION: DO NOT EXCEED TORQUE VALUE STAMPED ON CLAMP.

(2) Tighten nut using torque wrench to value stamped on clamp. While tightening nut, tap clamp with plastic mallet around circumference of any accessible clamp surface to aid distribution of load.

NOTE: To aid seating of clamp, inside of retainer segment may be lubricated with light coating of petrolatum lubricant (VV-P-236), being careful not to allow lubricant to contact T-bolt.

CAUTION: DO NOT EXCEED TORQUE VALUE STAMPED ON CLAMP.

(3) If required, following appropriate pressure test, check torque value of nut and tighten to specified torque.

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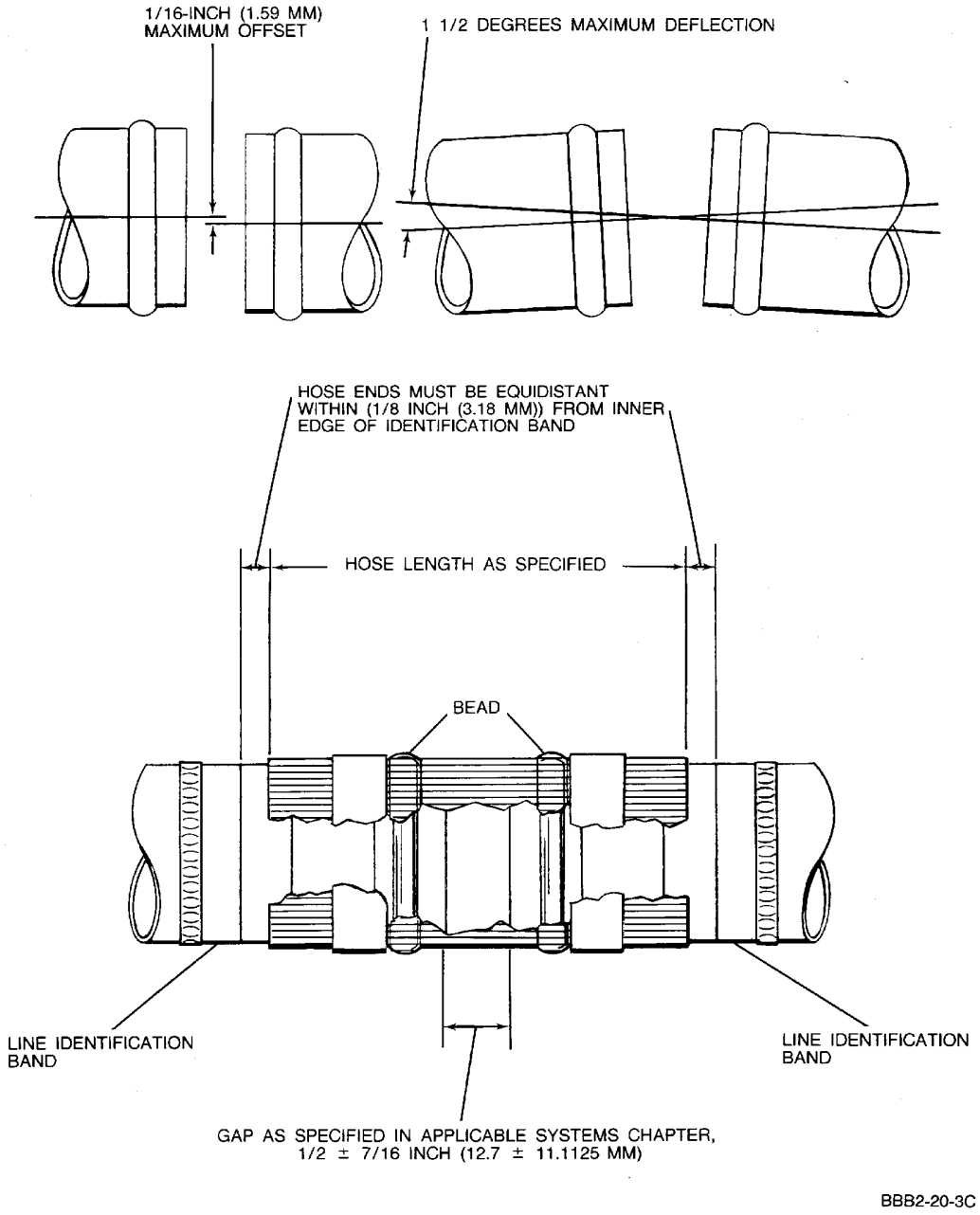

Hose and Clamp Installation
Figure 201/20-10-11-990-801

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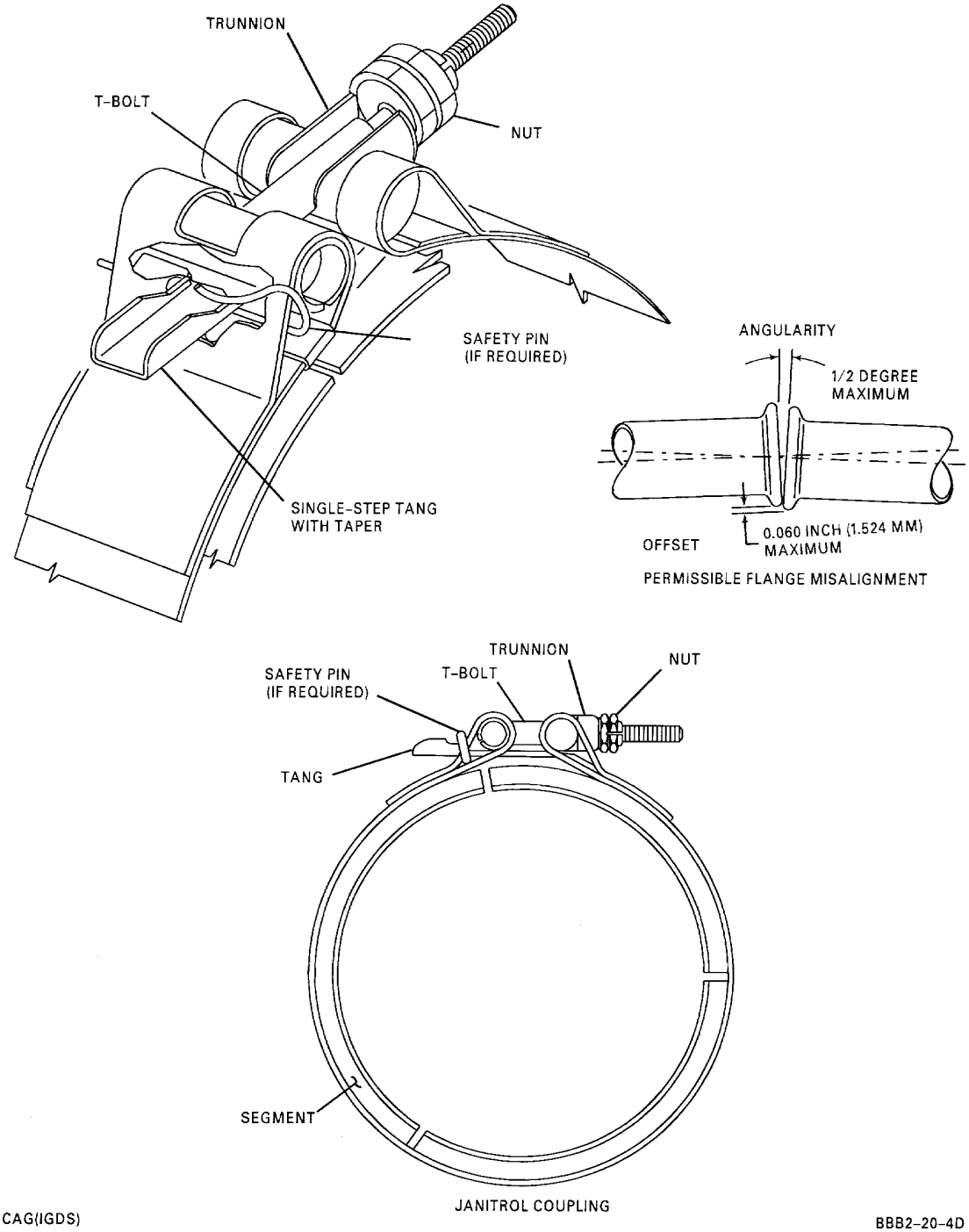

Janitrol Clamp Installation
Figure 202/20-10-11-990-802

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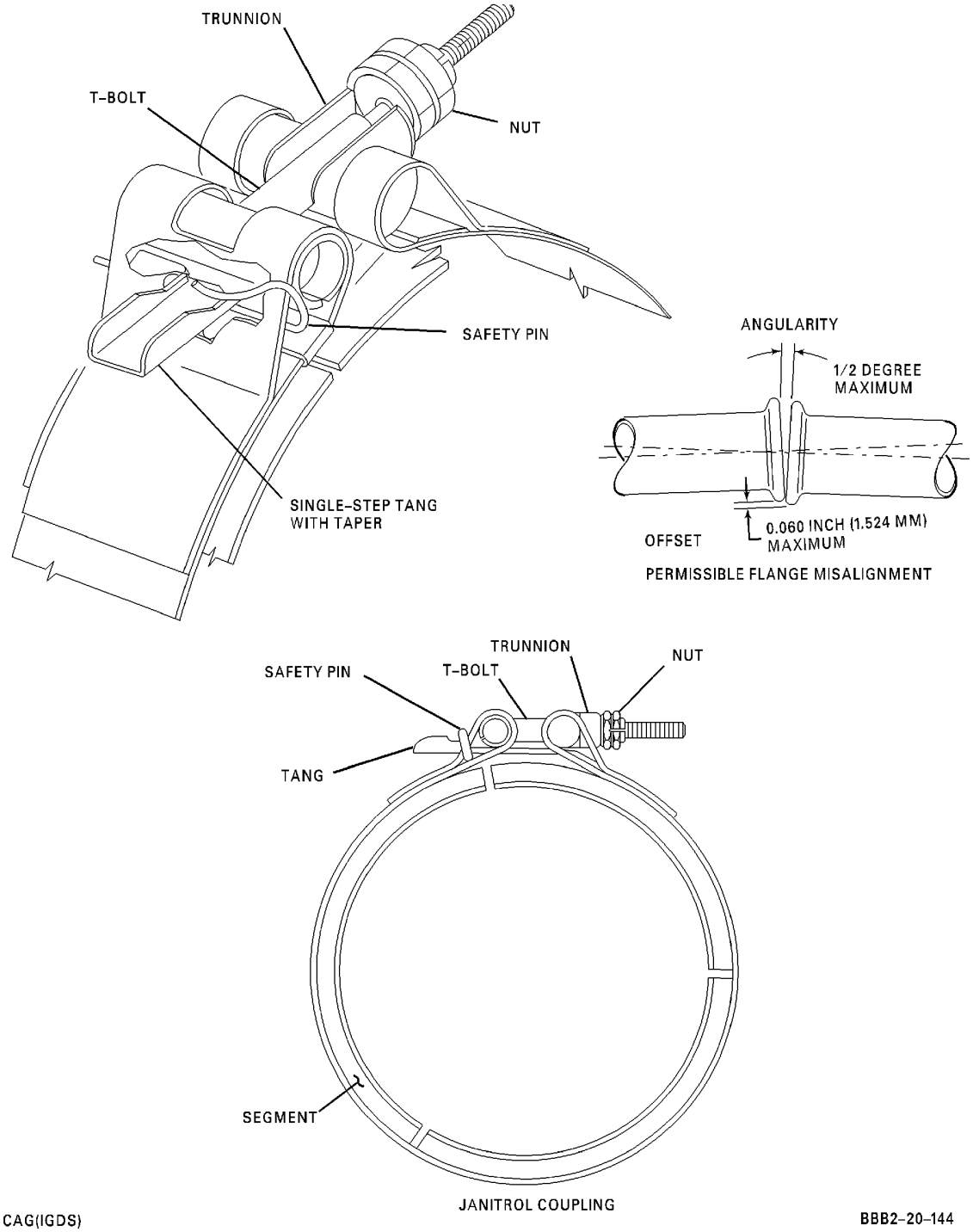

Janitrol Clamp Installation
Figure 203/20-10-11-990-808

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9. Torque Value Clamps

A. General Instructions

CAUTION: DO NOT USE TORQUE VALUES WHEN CLAMPS ARE USED AS SUPPORTS AND A SEALED JOINT IS NOT REQUIRED: RATHER; TIGHTEN CLAMPS ONLY UNTIL DUCT IS SUPPORTED WITHOUT BEING DEFORMED.

(1) Tighten hose clamps (AN737 and Witteck WWD) to torque of 18 to 22 inch-pounds (2.03 to 2.49 N·m) on thin wall tubing and ducts, and 28 to 32 inch-pounds (3.16 to 3.62 N·m) on other than thin wall. Tighten all other hose clamps, except Wemac 2000 (Paragraph 8.) to torque of 20 to 22 inch-pounds (2.26 to 2.49 N·m). Where torque wrench cannot be used, use fingertight-plus method as follows.

(2) Tighten wormscrew-type clamps (including AN737 and Witteck WWD clamps) fingertight plus 1/2 to 5/8 turn.

(3) Tighten NAS 1922 lightweight wormscrew type clamps to a torque of 10 in-lb (1 N·m) to 18 in-lb (2 N·m).

(4) Tighten radial-type and other type clamps, fingertight plus 1 1/2 complete turns.

(5) If clamp screw can be tightened by hand, tighten according to Paragraph 9.A.(1). On duct systems specified for initial break-in hot run (45 minutes minimum, cumulative), tighten all clamps to original torque value after break-in hot run. If torque wrench cannot be used, tighten all clamps finger tight plus 1/2 turn.

(6) After checking and tightening operations (Paragraph 9.A.(5)), replace saddle-type clamps if less than four threads are exposed outside clamp. Replace worm-type clamps if less than four unused notches remain.

(7) Do not safety clamps unless otherwise specified.

10. Check Ducts

CAUTION: FOLLOWING DAMAGE TO THIN WALL DUCTS IS CAUSE FOR REJECTION.

A. Check Ducts

(1) Scratches and cuts with depth in excess of 10 percent of wall thickness.

(2) Sharp dents in excess of 1/8 inch (3.2 mm) in depth where surface of metal is scratched or broken.

(3) Bend wrinkles in excess of 3/64 inch (1.19 mm), unless otherwise specified.

(4) Damage to precision mating surfaces or couplings.

(5) Bends in which flattening at any point exceeds 5 percent (bends in which minimum outside diameter is less than 95 percent of maximum outside diameter).

11. Ram Air Duct Installation Tolerances

A. When installing hose connectors on nonround ducts of ram air system, mismatch between ducts and length of mismatch on edge of duct must not exceed the following tolerances:

Table 202

Mismatch Between Ducts		Length of Mismatch – Allowable Percent of Duct Edge
Inches	(mm)	
1/4	(6.4)	10
7/32	(5.6)	15

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Table 202 (Continued)

Mismatch Between Ducts Inches	(mm)	Length of Mismatch – Allowable Percent of Duct Edge
3/16	(4.8)	20
5/32	(7.9)	25
1/8	(3.2)	40
3/32	(2.4)	60
1/16	(1.6)	100

NOTE: To determine tolerance, measure mismatch at maximum point of misalignment between ducts. Measure length of mismatch on edge of duct. Do not install ducts which exceed specified tolerances.

12. Swaging of Gamah Flexible Couplings

A. Swage Coupling Flanges

(1) Check tube end and flange for deburring, squarecut 90 degrees (±1/2 degree), cleanliness, and freedom from moisture.

(2) Place flange in swage block and insert in clamp fixture. Ensure that block is clean.

NOTE: Care should be used to keep inside surface of swage block free of nicks and scratches and split line of block free of dirt particles which may cause separation when the two halves of the block are tightened.

(3) Slip coupling, nut or sleeve, as applicable, over tube end. Ensure that inside shoulder of nut or sleeve is facing in correct direction.

(4) Slip tube end into flange and ensure that end butts against inside shoulder of flange.

(5) Tighten bolt of clamp fixture to torque of 1800 inch-pounds (203.4 N·m) for tube sizes up to 2 inches (50.8 mm) and 2200 inch-pounds (248.6 N·m) for tube sizes above 2 inches (50.8 mm).

(6) With tubing held firmly inside flange, insert expander into tube end. Expander mandrel should be fully retracted and lightly lubricated with a low viscosity machine oil. Advance mandrel until engaged and turn clockwise a few turns by hand while maintaining concentricity between tubing, flange, and expander. (Figure 204)

(7) Turn mandrel clockwise until proper torque is reached (Table 204). Retract mandrel by turning counterclockwise. Remove expander. Release clamp fixture bolt and take out flanged end of tube.

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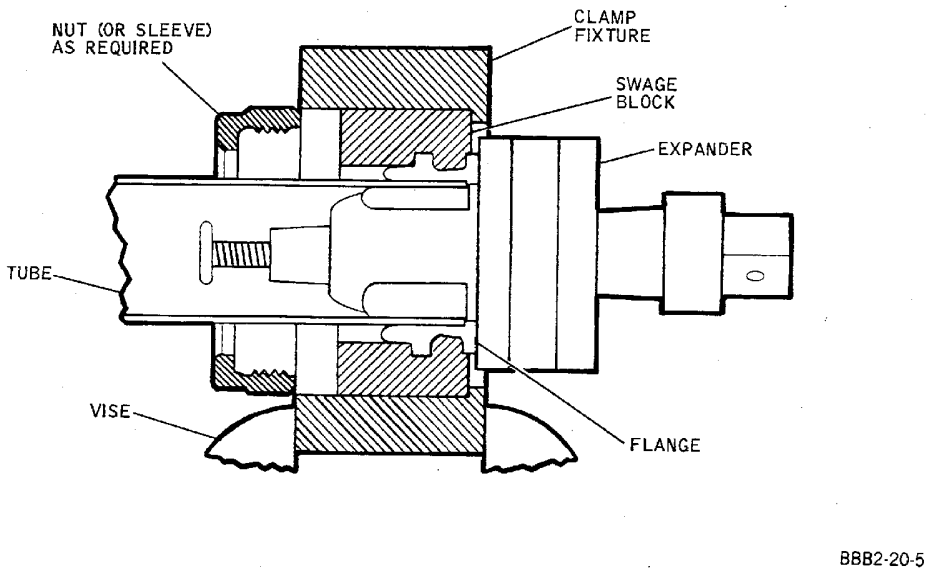

Swaging of Flanges
Figure 204/20-10-11-990-803

13. Tooling Requirements

A. Tooling requirements for swaging Gamah couplings are shown below.

Table 203

Tube Size				
Inches	(mm)	Swage Block (1)	Clamp Fixture (1)	Expander (1)
1/2	(12.7)	MB6-050	MB2-3	ME1-050 **
1/2	(12.7)	B20005	MB2-2	ME1-050 **
3/4	(19.1)	MB6-075	MB2-3	ME1-075 **
3/4	(19.1)	B20007	MB2-2	ME1-075 **
1	(25.4)	MB6-100	MB2-3	ME1-100 **
1	(25.4)	B20010	MB2-2	ME1-100 **
1 1/4	(31.8)	MB6-125	MB2-3	ME1-125 **
1 1/4	(31.8)	B20012	MB2-2	ME1-125 **
1 1/2	(38.1)	MB35-150	MB2-3	ME3-150 ****
1 1/2	(38.1)	B20015	MB2-3	ME3-150 ****
1 3/4	(44.5)	MB35-175	MB2-3	ME3-175 ****
1 3/4	(44.5)	B20017	MB2-3	ME3-175 ****
2	(50.8)	MB35-200	MB2-3	ME3-200 ****

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Table 203 (Continued)

Tube Size		Swage Block (1)	Clamp Fixture (1)	Expander (1)
Inches	(mm)			
2	(50.8)	B20020	MB2-3	ME3-200 ****
2 1/4	(57.2)	MB35-225	MB2-3	ME3-225 ****
2 1/4	(57.2)	B20022	MB2-3	ME3-225 ****
2 1/2	(63.5)	MB35-250	MB2-3	ME3-250 ****
2 1/2	(63.5)	B20025	MB2-3	ME3-250 ****
2 3/4	(69.9)	MB35-275	MB2-3	ME3-275 ****
2 3/4	(69.9)	B20027	MB2-3	ME3-275 ****
3	(76.2)	MB35-300	MB2-3	ME3-300 ****
3	(76.2)	B20030	MB2-3	ME3-300 ****
3 1/2	(88.9)	MB41-350	MB2-5	ME3-350 ****
3 1/2	(88.9)	B20035	MB2-5	ME3-350 ****
4	(101.6)	MB41-400	MB2-5	ME3-400 ****
4	(101.6)	B20040	MB2-5	ME3-400 ****
4 1/2	(114.3)	B20045	MB2-5	ME3-450 ****

(1) Can be purchased from Gamah Division, Stanley Aviation Corp., 2501 Dallas Street, Aurora, Colorado, 80010.

** Give tube wall thickness in thousandths (inches).

**** First two asterisks indicate minimum tube wall thickness in thousandths (inches). Second two asterisks indicate maximum tube wall thickness in thousandths (inches).

B. MB series clamp fixtures are standard for all flange sizes of a particular series, regardless of type or gage of tubing over which flange is to be installed.

Table 204 Torque in Inch-Pounds and Newton·Meters

Tube Size		5020-0		6061-T4 or 6061-T6		Stainless Steel 1/8 Hard		Stainless Steel Annealed	
Inches	(mm)	IN-LB	(N·m)	IN-LB	(N·m)	IN-LB	(N·m)	IN-LB	(N·m)
3/8	(9.5)	-	-	10	(1.13)	30	(3.39)	20	(2.26)
1/2	(12.7)	10	(1.13)	15	(1.70)	60	(6.78)	35	(3.95)
5/8	(15.9)	-	-	18	(2.03)	90	(10.1)	45	(5.08)
3/4	(19.1)	25	(2.83)	20	(2.26)	125	(14.1)	65	(7.34)
1	(25.4)	65	(7.35)	75	(8.48)	200	(22.6)	120	(13.6)
1 1/4	(31.8)	120	(13.6)	150	(16.9)	275	(31.1)	175	(19.8)
1 1/2	(38.1)	180	(20.3)	220	(24.9)	360	(40.7)	240	(27.1)
1 3/4	(44.5)	240	(27.1)	290	(32.8)	450	(50.9)	320	(36.1)
2	(50.8)	310	(35.0)	365	(41.2)	540	(61.0)	395	(44.6)

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Table 204 Torque in Inch-Pounds and Newton·Meters (Continued)

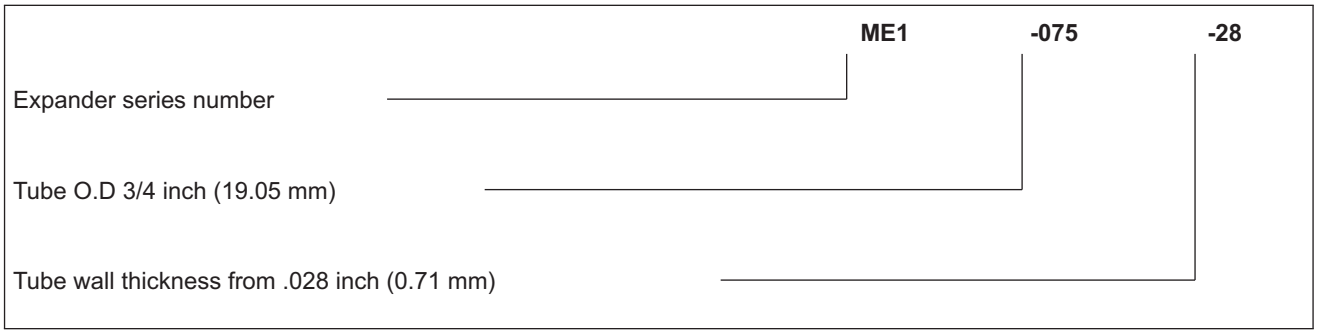
Tube Size		5020-0		6061-T4 or 6061-T6		Stainless Steel 1/8 Hard		Stainless Steel Annealed	
Inches	(mm)	IN-LB	(N·m)	IN-LB	(N·m)	IN-LB	(N·m)	IN-LB	(N·m)
2 1/4	(57.2)	375	(42.4)	445	(50.3)	640	(72.3)	490	(55.4)
2 1/2	(63.5)	450	(50.9)	500	(56.5)	745	(84.2)	580	(65.5)
				525	(59.3)				
Type									
F1041 F1042				400	(45.2)				
2 3/4	(69.9)	520	(58.8)	575, 600	(64.9) (67.8)	800	(90.4)	680	(76.8)
3	(76.2)	615	(69.5)	600, 650	(67.8) (73.5)	985	(111.3)	785	(88.7)
Type									
F1041 F1042				575, 600	(64.9) (67.8)				
3 1/2	(88.9)	835	(94.4)	700, 800	(79.1) (90.4)	1300	(146.9)	1075	(121.5)
4	(101.6)	1075	(121.5)	900, 1000	(101.7) (113.0)	1690	(191.0)	1360	(153.7)

NOTE: A torque deviation of ± 5 percent is permitted.

C. ME1 and ME3 series expanders will perform a swaging operation on tubing with bend radii of 2D to tube centerline located 1 inch (25.4 mm) from end of tube for tubing size 3 inches (76.2 mm) or less, or 1 1/2 inches (38.1 mm) from end of tube for tubing size greater than 3 inches (76.2 mm).

D. ME1 series expanders are available for sizes 1 1/4inch (31.7 mm) and over and are coded for tube diameter and wall thickness.

EXAMPLE:



E. ME2 series expanders are available for sizes 1 1/2 inch (38.1 mm) and over and are coded for tube diameter and a multiple range of tube wall gages.

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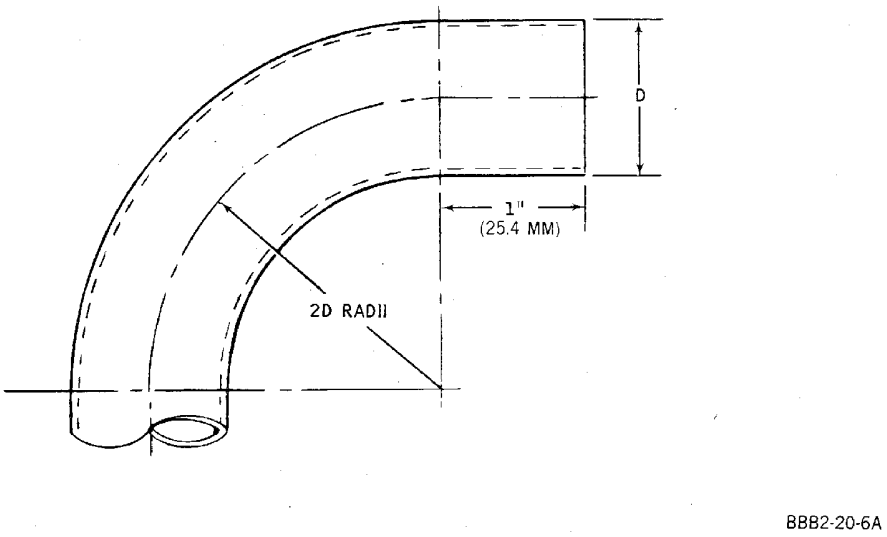
EXAMPLE:

	ME3	-150	-2835
Expander series number			
Tube O.D 1 1/2 inch (38.1)			
Tube wall thickness from .028 through .035 (0.71 through 0.89 mm)			



Bend Radii
Figure 205/20-10-11-990-804

14. Check Swaged Coupling

A. Check Coupling

(1) An overswaged coupling will have following characteristics:

(a) Highly glossy, burnished finish over most of flange outer surface.

(b) Breakdown or excessive deformation of flange inner shoulder, coupled with burnished strip of tubing showing aft of flange skirt, indicating that an excessive amount of tube material flow has taken place.

(c) Inspect swaged flanges to dimensions shown in Table 205.

NOTE: A quick check for a swaged coupling consists of slipping the proper sleeve over the flange. The sleeve should slide over the swaged flange with a minimum of drag.

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15. Adjustment/Test Coupling

A. Test Coupling

(1) Perform leak test on all fabricated couplings, under water, using pressure source of 50 psi (345 kPa) for sizes up through 2 1/2 inches (63.5 mm), 25 psi (172.5 kPa) for sizes from 2 3/4 inches (69.8 mm) through 3 1/2 inches (88.9 mm) and 15 psi (103.5 kPa) for 4 inch (101.6 mm) tubing. Use M1238 test fixture, or equivalent, connected to a pneumatic pressure source (Figure 206). Dry pressure plugs before use and after completion of pressure test to prevent water from entering into coupling and tube. Dry tubing by wiping and air blasting.

(2) Perform leak test on concentric (double wall) tubular coupling using water pressure as test medium. Drain thoroughly and dry in oven at 217° to 227°F (102.8° to 108.3°C) for 1/2 hour, or blast dry with filtered (10 micron) shop air until dry to touch.

16. Assemble/Disassemble Coupling

A. Disassemble Coupling

(1) Back off nut 3 to 4 turns.

(2) Slide sleeve back using nut for extra leverage, until nut is against flange.

(3) Repeat Paragraph 16.A.(1) and Paragraph 16.A.(2) until sleeve is completely off nut flange.

B. Assemble Coupling

(1) Connect couplings with tube end alignment and end gap dimensions per Figure 207 and in following manner:

NOTE: When lines are removed and replaced after service, the same overall length of line should be installed.

(2) Install seals over both flanges.

WARNING: WHITE PETROLATUM IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN WHITE PETROLATUM IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT BREATHE THE MIST.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(3) Lubricate seals lightly with petrolatum.

(4) Slide sleeve over both flanges.

(5) Check sleeve for presence of a positive-lock thread insert.

(6) Thread nut over sleeve until shoulder stop is reached. Fingertight pressure on nut is adequate for most applications.

NOTE: Taper on threads may cause gap when coupling nut contacts shoulder stop on sleeve. Make certain that at least one point between nut and sleeve has a zero gap.

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CAUTION: DUE TO STATIC DISCHARGE, USE OF SAFETY WIRE WITHIN FUEL TANKS IS PROHIBITED.

(7) Safetying nut on sleeve is optional on those couplings external to fuel tanks only.

(8) Tube supports should be adjusted and tightened after couplings are assembled.

Table 205 Maximum Growth Dimension of Swaged Flanges

Dimension After Swaging				
	Size		Maximum	
*Part Number	Inch	(mm)	Inch	(mm)
F31	1.50	(38.1)	1.7865	(45.37)
F32	1.750	(44.5)	2.0365	(51.73)
F1133	2.000	(50.8)	2.2865	(58.08)
	2.250	(57.2)	2.5365	(64.43)
	2.500	(63.5)	2.7865	(70.78)
	2.750	(69.9)	3.0365	(77.13)
	3.000	(76.2)	3.2865	(83.48)
F32-	1.000	(25.4)	1.2885	(32.73)
	1.250	(31.8)	1.5385	(39.08)
	3.500	(88.9)	3.7865	(96.18)
	4.000	(101.6)	4.2865	(108.88)
F1111	0.500	(12.7)	0.7425	(18.86)
	0.750	(19.1)	1.0375	(26.35)
	1.000	(25.4)	1.2885	(32.73)
	1.250	(31.8)	1.5385	(39.08)

NOTE: *May be purchased from Gamah Corp., 2501 Dallas Street, Aurora, Colorado 80010.

17. Removal/Installation Wig-O-Flex 3614D29640 Flex Connector

A. Remove Connector

(1) Disconnect nuts from connector body.

(2) Remove body, split seals and washers. Retain parts for installation.

(3) Remove nuts from duct sections.

B. Install Connector

(1) Install nut on each section of duct. (Figure 208)

CAUTION: LAMINATED GRAPHITE SEALS ARE VERY FRAGILE AND MUST BE HANDLED WITH EXTREME CARE. DAMAGED SEALS MUST BE REPLACED.

(2) Check split seals and washers for visible damage and replace if necessary.

(3) Install two seals and two washers on each section of duct. Seals must be installed with split in seal 180(±30) degrees to each other. (Figure 208)

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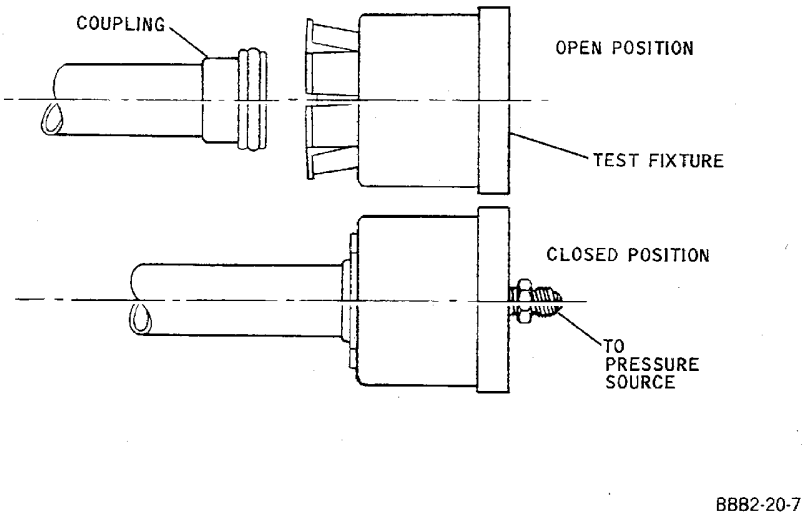
CAUTION: MAKE CERTAIN THAT GAP BETWEEN DUCT SECTIONS IS HELD BETWEEN ZERO TO 5/8 INCH (15.87 MM) TOLERANCE.

(4) Slide connector body into position over duct ends.

NOTE: If necessary, remove seal laminations to obtain required tolerance.

(5) Tighten connector nuts handtight. Safety nuts with lockwire. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)



M1238 Test Fixture
Figure 206/20-10-11-990-805

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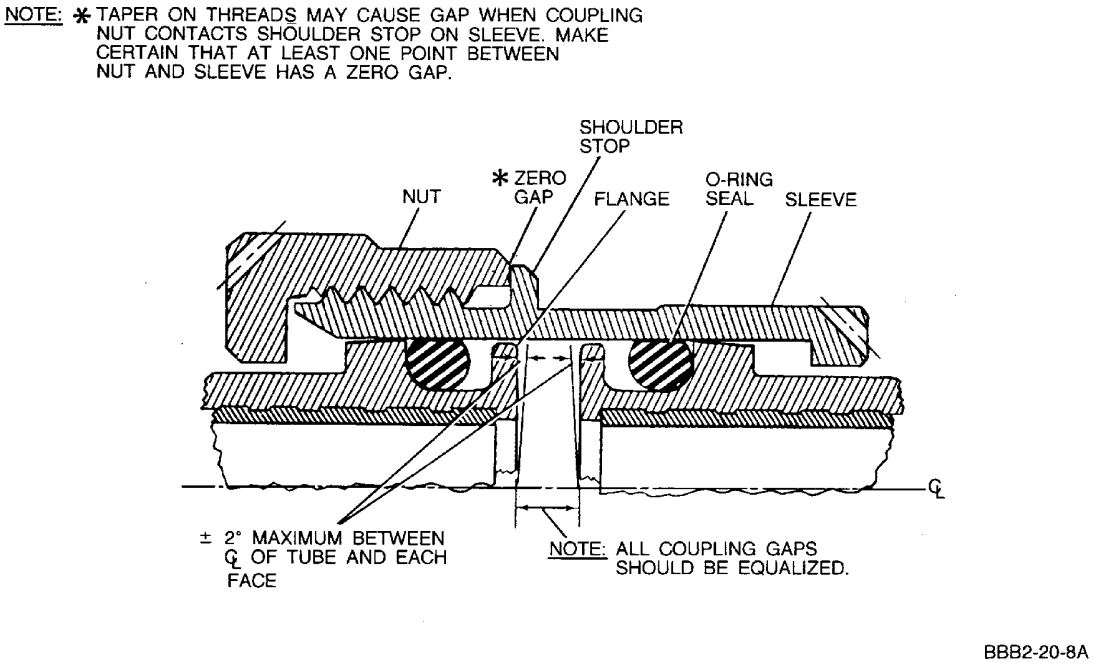

Tube End Gap Figure
Figure 207/20-10-11-990-806

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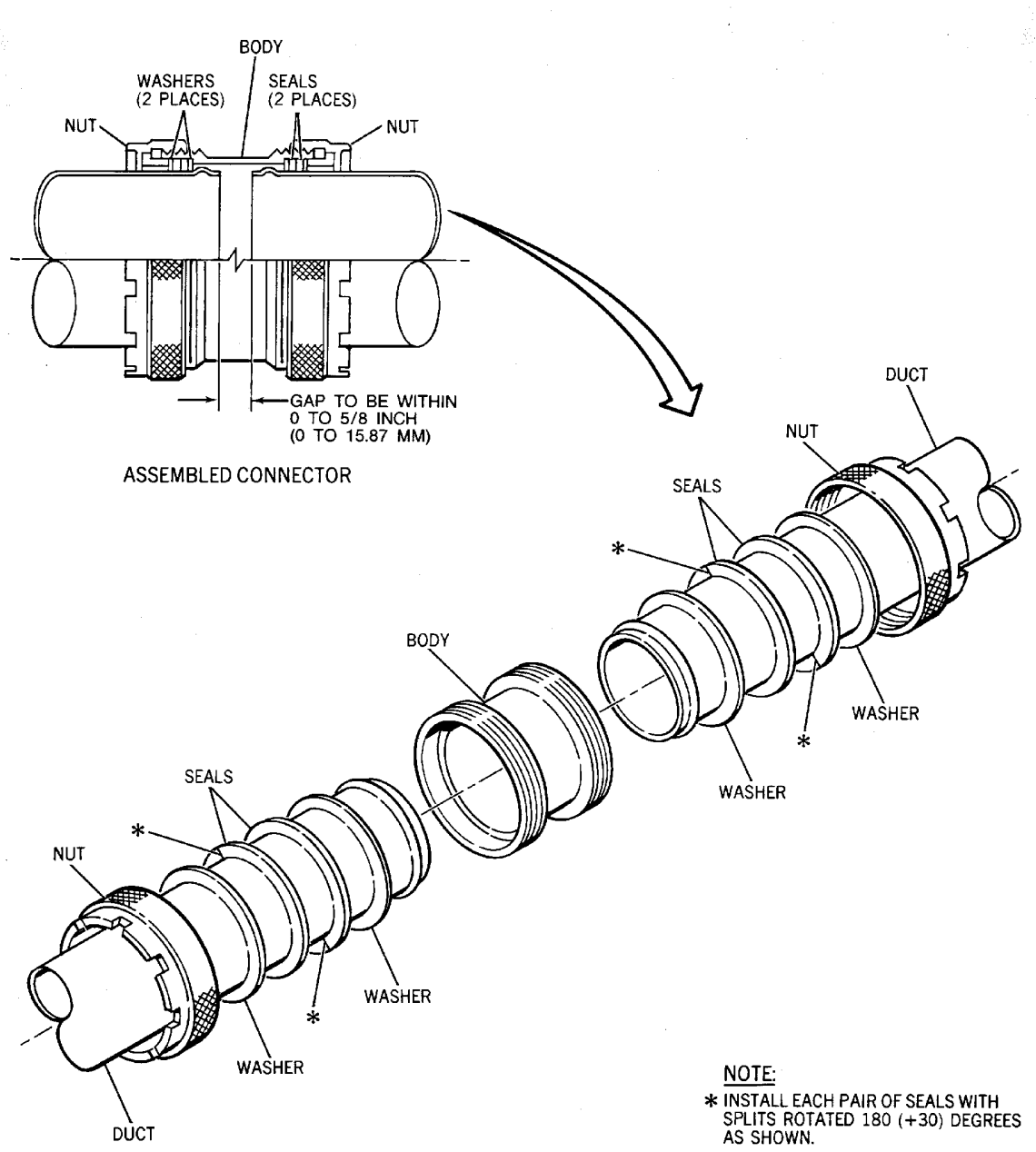

Wig-O-Flex Connector -- Removal/Installation
Figure 208/20-10-11-990-807

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18. "TAIL TEMP HI" Pneumatic and Air Conditioning Clamp Map

A. "TAIL TEMP HI" Clamp Locator Sheets.

(1) The following pages provide the mechanic with a general three dimensional map of the tail compartment pneumatic and air conditioning clamps that may cause a TAIL TEMP HI light to illuminate in the flight compartment. The clamps are numbered and identified by legends on the sheets to assist the mechanic in identifying a clamp when being worked on. This will assist the mechanic by providing a quick access site for the identification of clamps referred to in the forms sign-off.

(2) This map will provide a means to track areas and clamps with recurring problems in the tail compartment.

(3) This map does not provide the actual torque values or the process for replacing or tightening the clamps. This data is found in the AMM in the pageblocks for the specific item for which the clamps are used.

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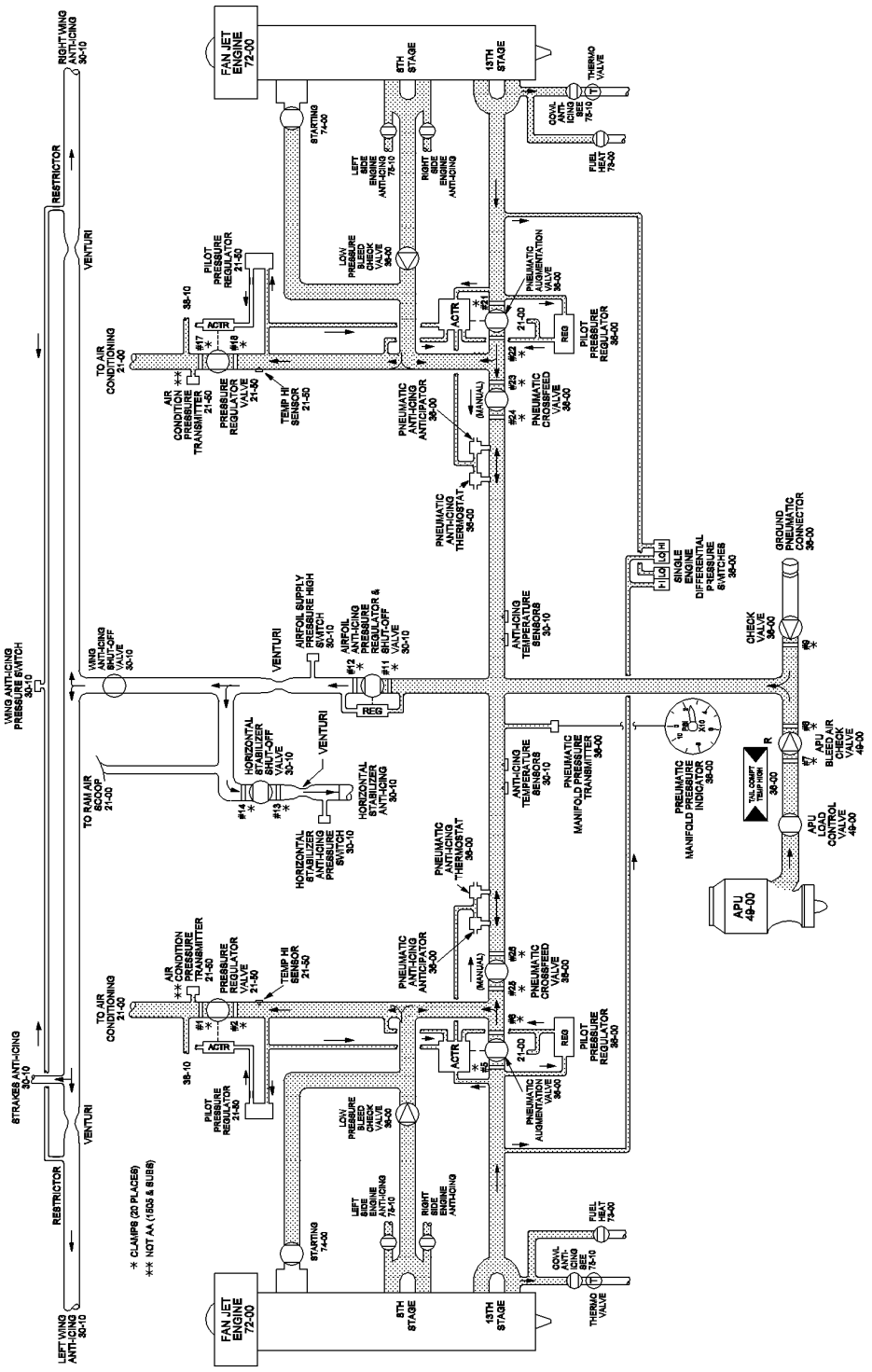

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Tail Section Pneumatic Distribution - Clamp Map
Figure 209/20-10-11-990-809

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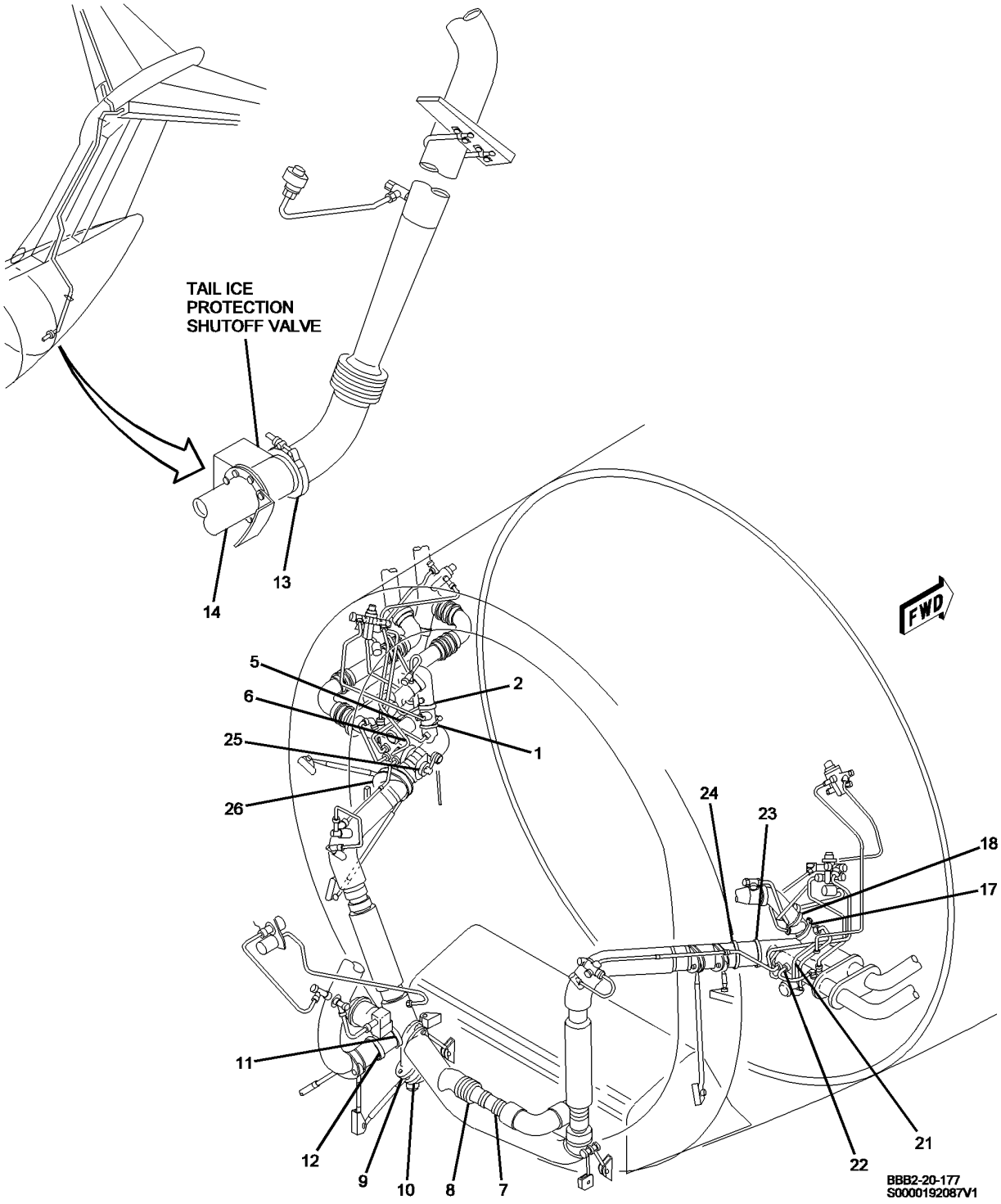

Tail Section Clamp Map - General
Figure 210/20-10-11-990-810

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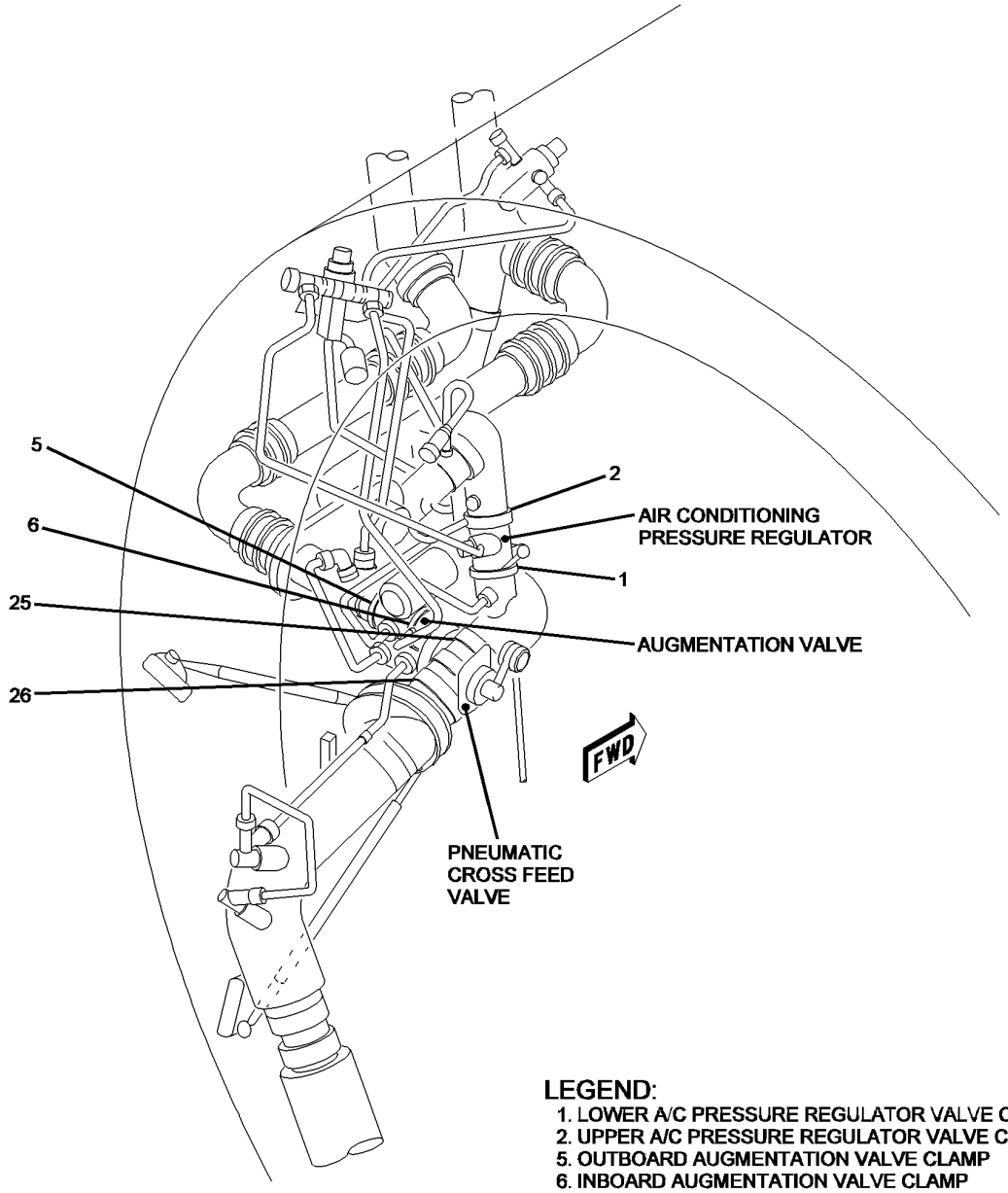

LEGEND:
1. LOWER A/C PRESSURE REGULATOR VALVE CLAMP
2. UPPER A/C PRESSURE REGULATOR VALVE CLAMP
5. OUTBOARD AUGMENTATION VALVE CLAMP
6. INBOARD AUGMENTATION VALVE CLAMP
25. AFT PNEUMATIC CROSS FEED VALVE CLAMP
26. FORWARD PNEUMATIC CROSS FEED VALVE CLAMP

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Tail Section Clamp Map - Left Side
Figure 211/20-10-11-990-811

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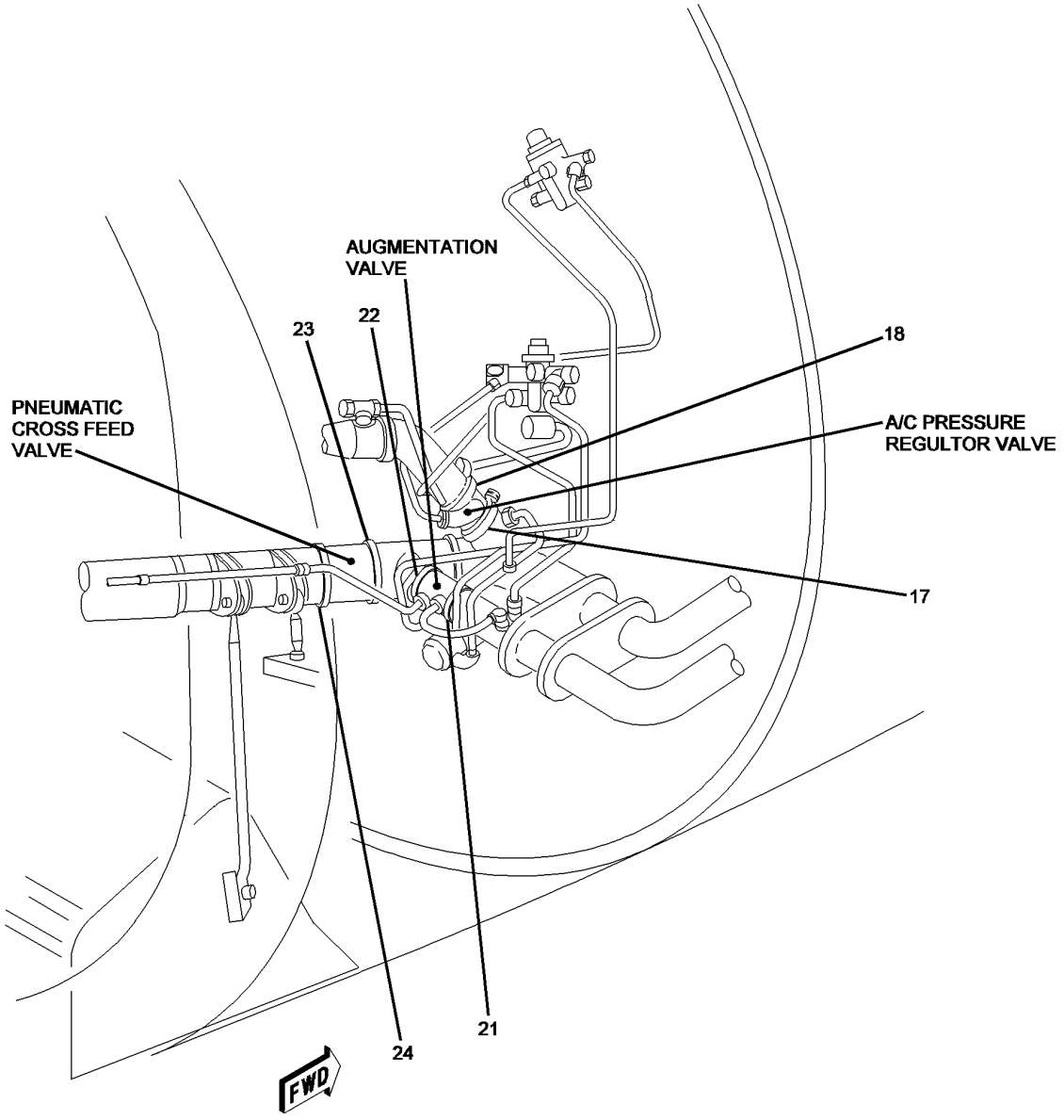

LEGEND:
17. LOWER A/C PRESSURE REGULATOR VALVE CLAMP
18. UPPER A/C PRESSURE REGULATOR VALVE CLAMP
21. OUTBOARD AUGMENTATION VALVE CLAMP
22. INBOARD AUGMENTATION VALVE CLAMP
23. FORWARD PNEUMATIC CROSS FEED VALVE CLAMP
24. AFT PNEUMATIC CROSS FEED VALVE CLAMP

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Tail Section Clamp Map - Right Side
Figure 212/20-10-11-990-812

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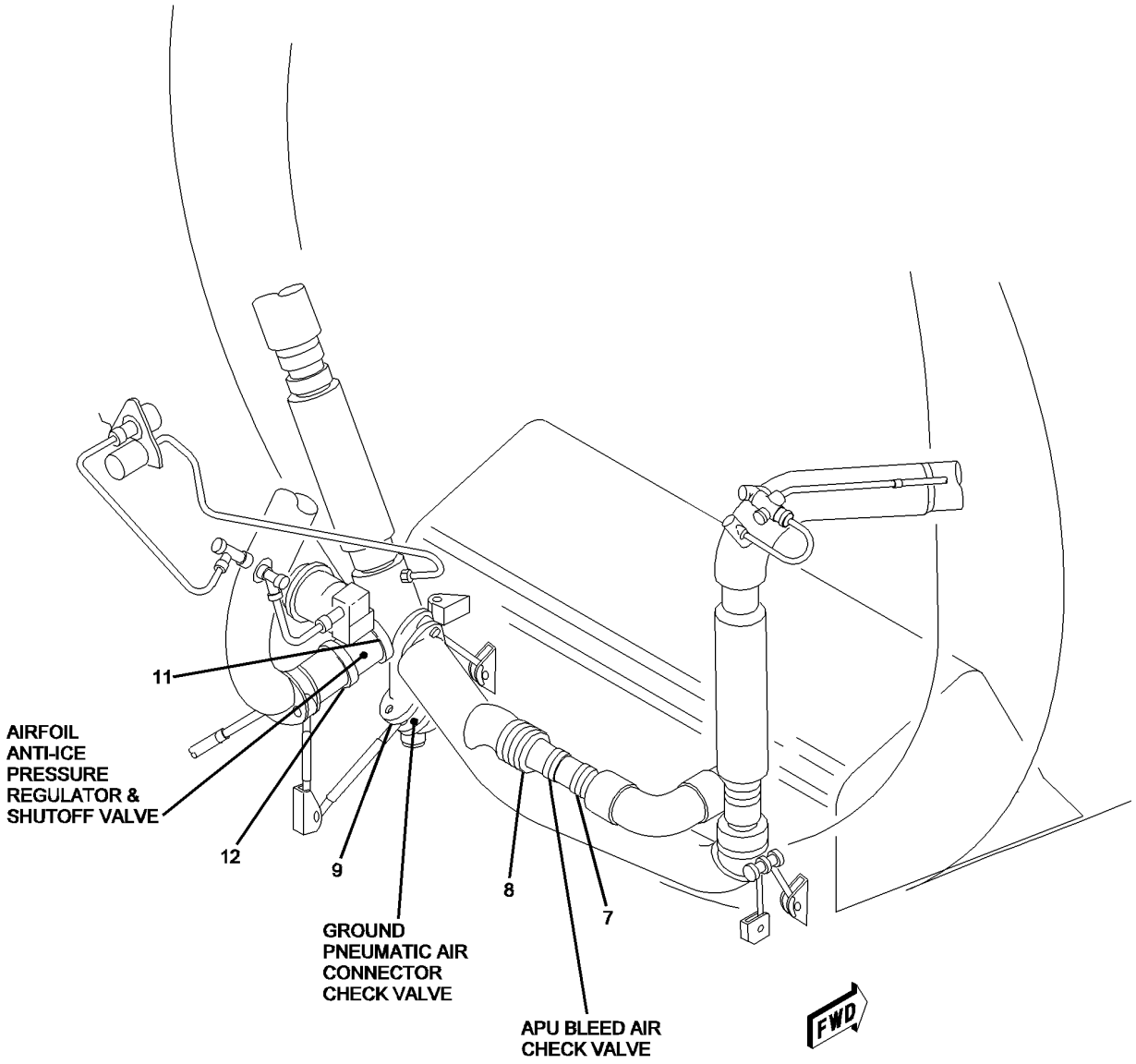

LEGEND:
7. LEFT APU BLEED AIR CHECK VALVE CLAMP
8. RIGHT APU BLEED AIR CHECK VALVE CLAMP
9. UPPER GROUND PNEUMATIC AIR CONNECTOR CHECK VALVE CLAMP
11. FORWARD AIRFOIL ANTI-ICE PRESSURE RELIEF & SHUTOFF VALVE CLAMP
12. AFT AIRFOIL ANTI-ICE PRESSURE RELIEF & SHUTOFF VALVE CLAMP

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Tail Section Clamp Map - Center Lower
Figure 213/20-10-11-990-813

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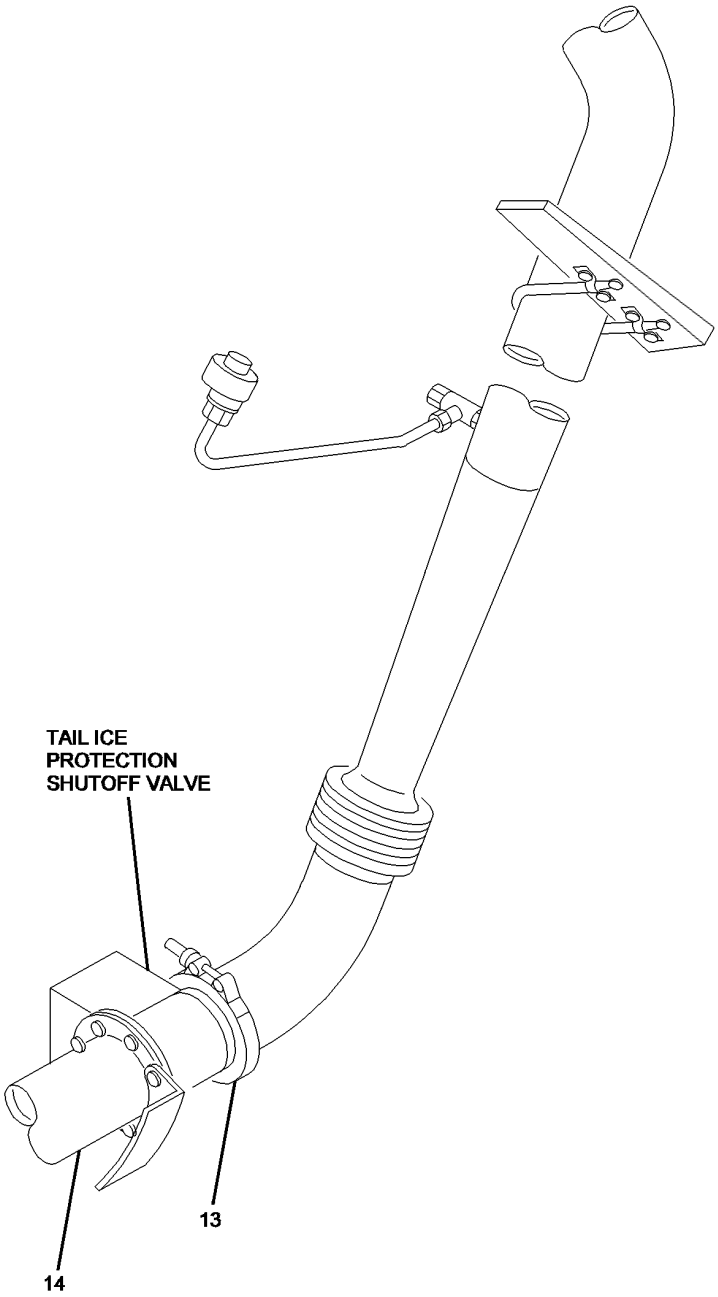

LEGEND:
13. AFT TAIL ICE PROTECTION SHUTOFF VALVE CLAMP
14. FORWARD TAIL ICE PROTECTION SHUTOFF VALVE CLAMP

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Tail Section Clamp Map - Ice Protection
Figure 214/20-10-11-990-814

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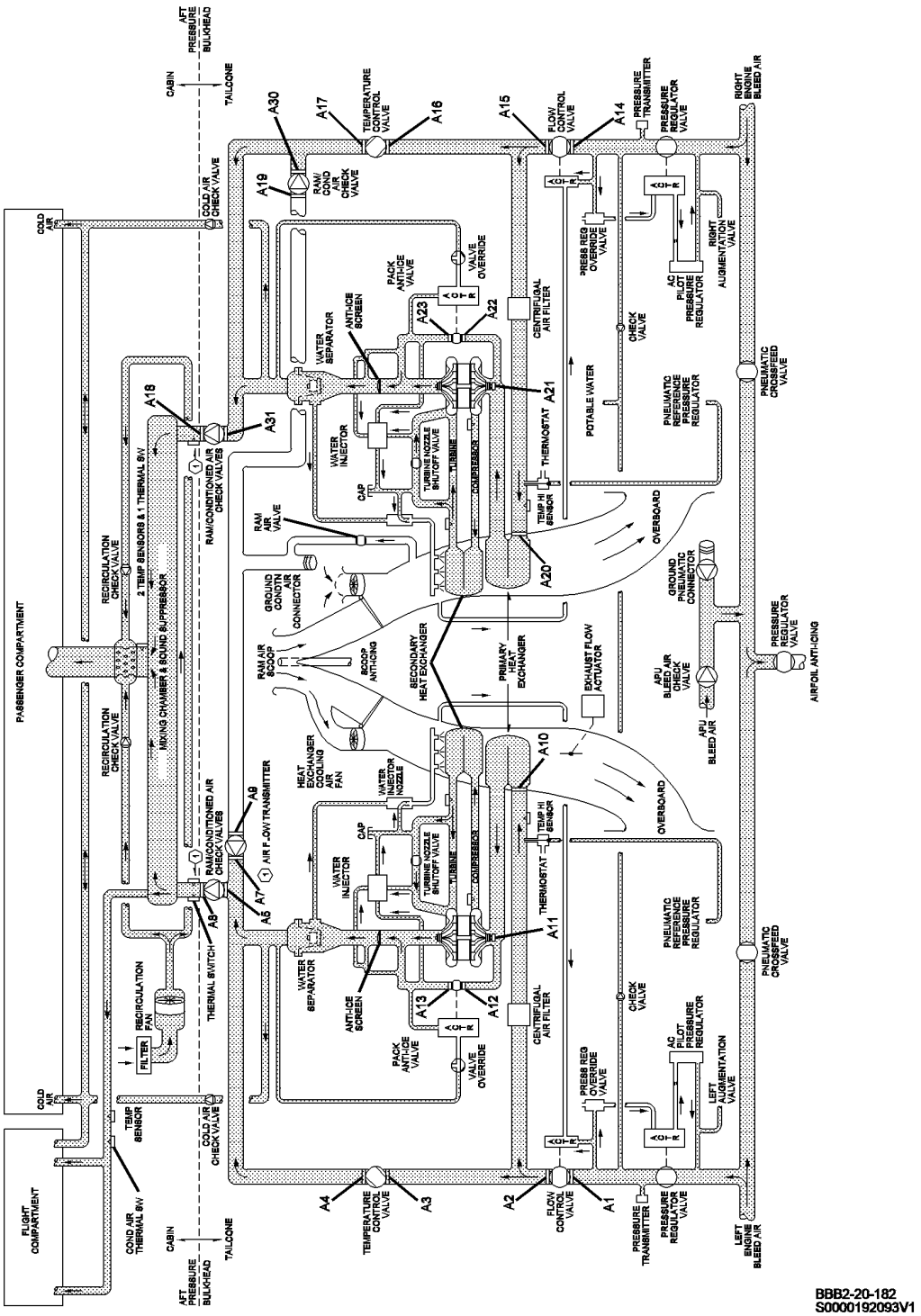

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Tail Section Air Conditioning - Clamp Map
Figure 215/20-10-11-990-815

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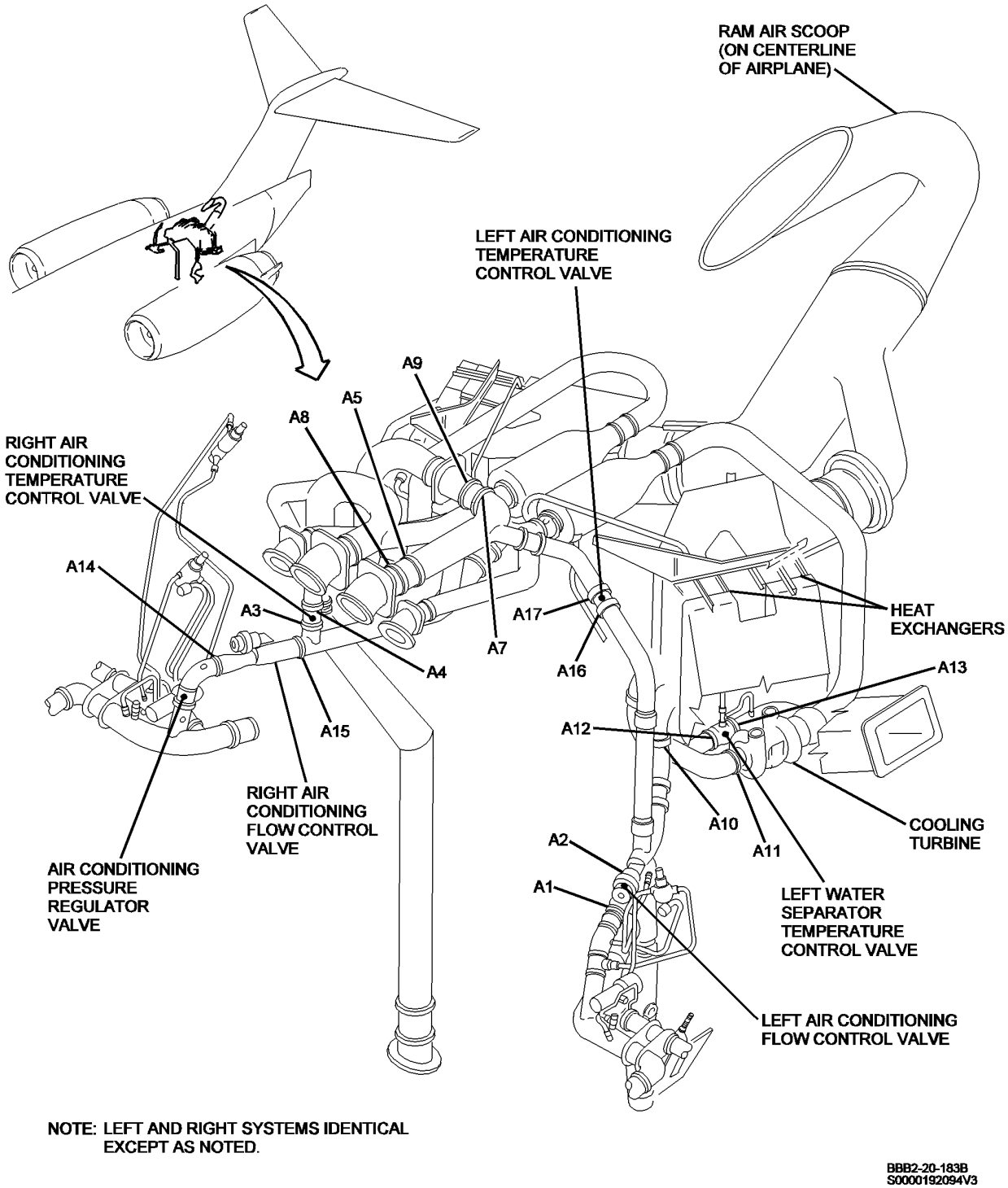

Tail Section A/C Clamp Map - General
Figure 216/20-10-11-990-816

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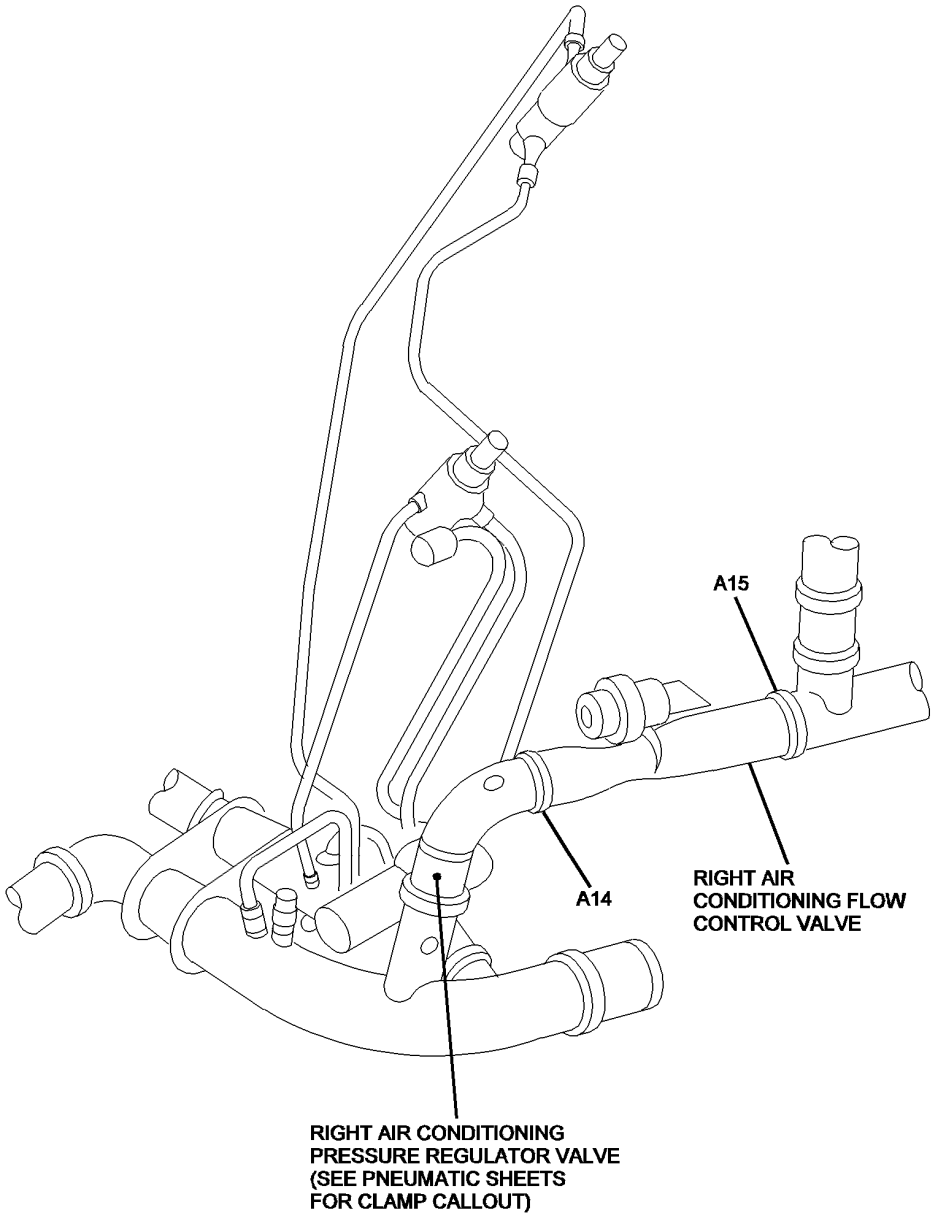

LEGEND:
A14. FORWARD FLOW CONTROL VALVE CLAMP
A15. AFT FLOW CONTROL VALVE CLAMP

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Tail Section A/C - Right Side
Figure 217/20-10-11-990-817

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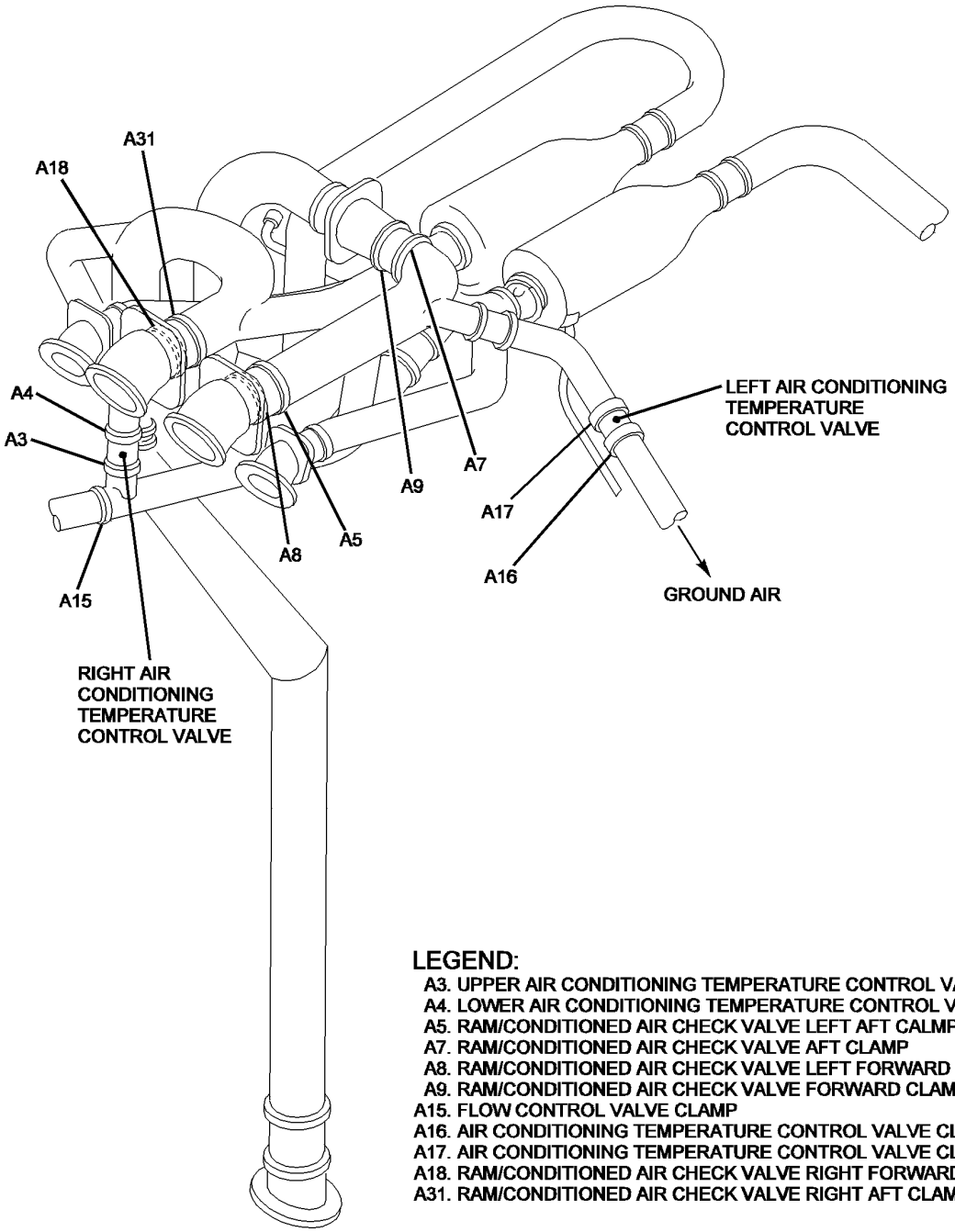

LEGEND:

A3. UPPER AIR CONDITIONING TEMPERATURE CONTROL VALVE CLAMP
A4. LOWER AIR CONDITIONING TEMPERATURE CONTROL VALVE CLAMP
A5. RAM/CONDITIONED AIR CHECK VALVE LEFT AFT CALMP
A7. RAM/CONDITIONED AIR CHECK VALVE AFT CLAMP
A8. RAM/CONDITIONED AIR CHECK VALVE LEFT FORWARD CLAMP
A9. RAM/CONDITIONED AIR CHECK VALVE FORWARD CLAMP
A15. FLOW CONTROL VALVE CLAMP
A16. AIR CONDITIONING TEMPERATURE CONTROL VALVE CLAMP
A17. AIR CONDITIONING TEMPERATURE CONTROL VALVE CLAMP
A18. RAM/CONDITIONED AIR CHECK VALVE RIGHT FORWARD CLAMP
A31. RAM/CONDITIONED AIR CHECK VALVE RIGHT AFT CLAMP

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Tail Section A/C - Center Section.
Figure 218/20-10-11-990-818

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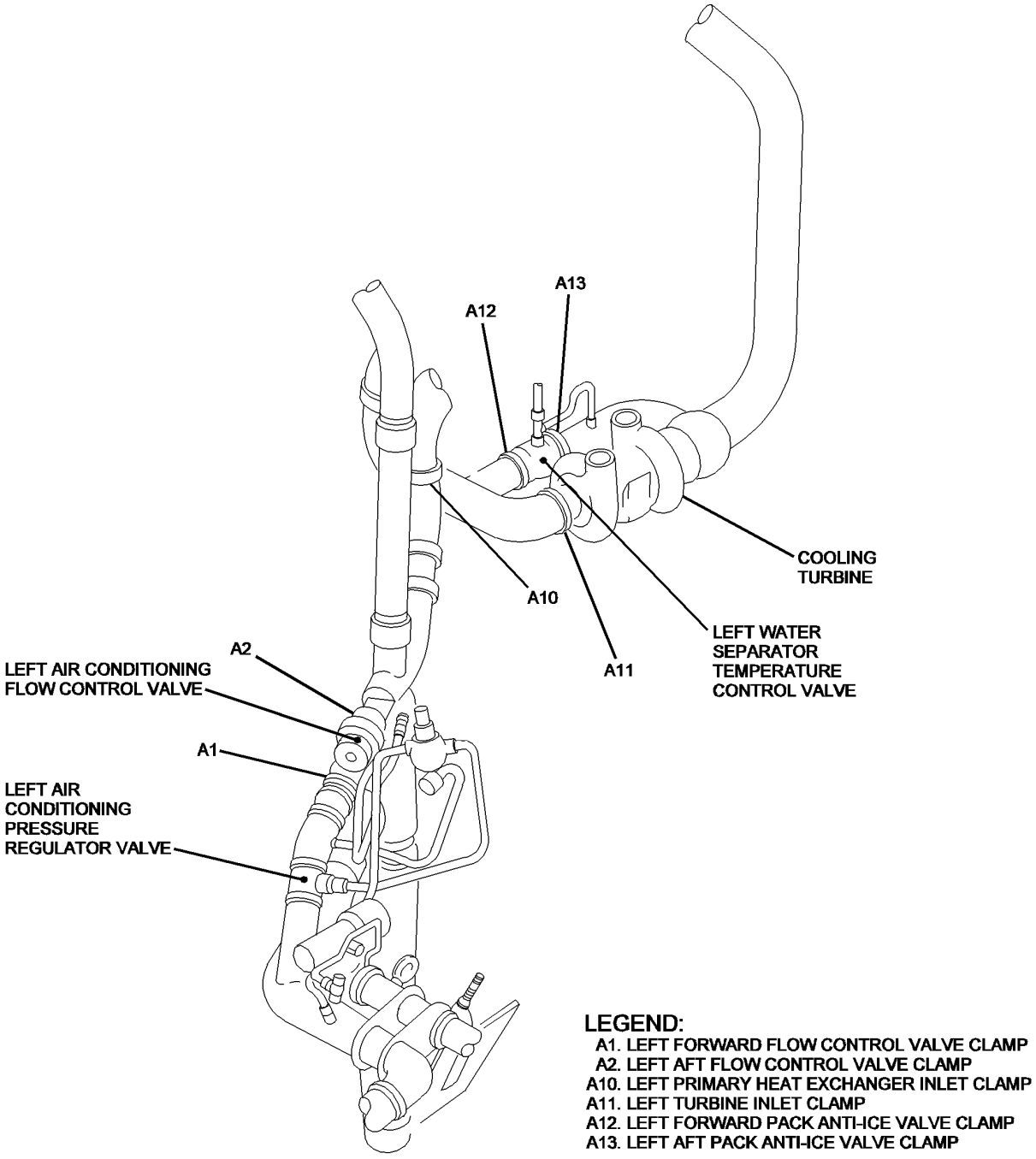

Tail Section A/C - Left Side
Figure 219/20-10-11-990-819

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RECESSED HEAD SCREWS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides identification and driver-type instructions for the tri-wing and phillips recessed head screws. Specific driver types are required to remove and install tri-wing and phillips recessed head screws. (Table 202) (Table 203)

B. An impact drive type tool may be utilized to loosen tri-wing and phillips recessed head type screws without damaging the screw head recess.

C. For recessed head screw torque values, refer to BOLT TORQUE DATA - MAINTENANCE PRACTICES, PAGEBLOCK 20-30-01/201.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following item:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Impact driver 2060	CTS Company, Inc.
Screw extractor kit DZZ7299-1	Douglas Aircraft Company

3. Tri-Wing Screw Identification

A. Tri-wing screws are identified by code numbers indicating type of driver, hex size, and tri-wing screw recess number.

Example: **NAS 4005 A 4 5**

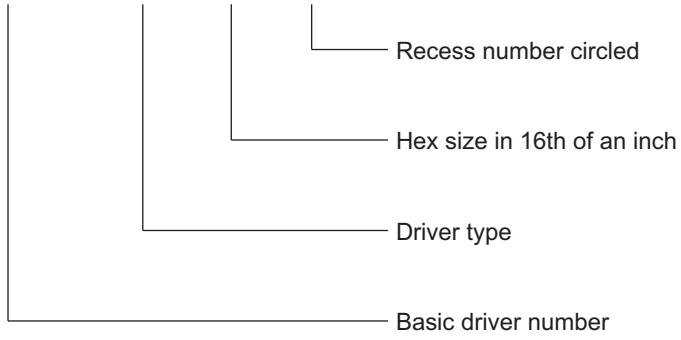

Table 202 Tri-Wing Screw Recess Number and Thread Size

Recess Number	Thread Size inch (mm)	Recess Number	Thread Size inch (mm)
0	-	8	0.3750-24 (9.5250)
1	-	9	0.4375-20 (11.1125)
2	0.1120-40 (2.8448)	10	0.5000-20 (12.7000)
3	0.1380-32 (3.5052)	11	0.5625-18 (14.2875)

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Table 202 Tri-Wing Screw Recess Number and Thread Size (Continued)

Recess Number	Thread Size inch (mm)	Recess Number	Thread Size inch (mm)
4	0.1640–32 (4.1656)	12	0.6250-18 15.8750)
5	0.1900- 32 (4.8260)	13	0.7500-16 (19.0500)
6	0.2500–28 (6.3500)	14	0.8750–14 (22.2250)
7	0.3125-24 (7.9375)	15	1.0000-12 (25.4000)

NOTE: For shear-head screws, use one driver number smaller.

Table 203 Tri-Wing Screw Driver Types

Type A Drivers					
Driver Number	Recess Number	Hex Size inch (mm)	Driver Length inch (mm)		
NAS4005A4-0	0	0.250 (6.3500)		1.25 (31.7500)	
NAS4005A4-1	1	0.250 (6.3500)		1.25 (31.7500)	
NAS4005A4-2	2	0.250 (6.3500)		1.25 (31.7500)	
NAS4005A4-3	3	0.250 (6.3500)		1.25 (31.7500)	
NAS4005A4-4	4	0.250 (6.3500)		1.25 (31.7500)	
NAS4005A5-4		0.312 (7.9248)		1.25 (31.7500)	
NAS4005A4-5	5	0.250 (6.3500)		1.25 (31.7500)	
NAS4005A5-5		0.312 (7.9248)		1.25 (31.7500)	
NAS4005A4-6	6	0.250 (6.3500)		1.25 (31.7500)	
NAS4005A5-6		0.312 (7.9248)		1.25 (31.7500)	
NAS4005A7-6		0.438 (11.1252)		1.25 (31.7500)	
NAS4005A4-7	7	0.250 (6.3500)		1.25 (31.7500)	
NAS4005A5-7		0.312 (7.9248)		1.25 (31.7500)	
NAS4005A7-7		0.438 (11.1252)		1.25 (31.7500)	
NAS4005A4-8	8	0.250 (6.3500)		1.25 (31.7500)	
NAS4005A5-8		0.312 (7.9248)		1.25 (31.7500)	
NAS4005A7-8		0.438 (11.1252)		1.25 (31.7500)	
NAS4005A7-9	9	0.438 (11.1252)		1.25 (31.7500)	
NAS4005A10-9		0.625 (15.8750)		1.25 (31.7500)	
NAS4005A10-10	10	0.625 (15.8750)		1.25 (31.7500)	
NAS4005A10-11	11	0.625 (15.8750)		1.25 (31.7500)	
NAS4005A10-12	12	0.625 (15.8750)		1.25 (31.7500)	
NAS4005A10-13	13	0.625 (15.8750)		2.50 (63.5000)	
NAS4005A12-14	14	0.750 (19.0500)		3.00 (76.2000)	
NAS4005A12-15	15	0.750 (19.0500)		3.00 (76.2000)	

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Type B Drivers						
Driver Number	Recess Number	Hex Size inch (mm)	Driver Length inch (mm)			
NAS4005B-0	0	0.250 (6.3500)	1.88 (47.752)	2.75 (69.8500)	3.50 (88.9000)	6.00 (152.4000)
NAS4005B-1	1	0.250 (6.3500)	1.88 (47.752)	2.75 (69.8500)	3.50 (88.9000)	6.00 (152.4000)
NAS4005B-2	2	0.250 (6.3500)	1.88 (47.752)	2.75 (69.8500)	3.50 (88.9000)	6.00 (152.4000)
NAS4005B-3	3	0.250 (6.3500)	1.88 (47.752)	2.75 (69.8500)	3.50 (88.9000)	6.00 (152.4000)
NAS4005B-4	4	0.250 (6.3500)	1.88 (47.752)	2.75 (69.8500)	3.50 (88.9000)	6.00 (152.4000)
NAS4005B-5	5	0.250 (6.3500)	1.88 (47.752)	2.75 (69.8500)	3.50 (88.9000)	6.00 (152.4000)
NAS4005B-6	6	0.438 (11.1252)	1.88 (47.752)	2.75 (69.8500)	3.50 (88.9000)	6.00 (152.4000)
NAS4005B-7	7	0.438 (11.1252)	1.88 (47.752)	2.75 (69.8500)	3.50 (88.9000)	6.00 (152.4000)
NAS4005B-8	8	0.438 (11.1252)	1.88 (47.752)	2.75 (69.8500)	3.50 (88.9000)	6.00 (152.4000)
NAS4005B-9	9 (15.8750)	0.625		2.75 (69.8500)	3.50 (88.9000)	6.00 (152.4000)
NAS4005B-10	10 (15.8750)	0.625		2.75 (69.8500)	3.50 (88.9000)	6.00 (152.4000)
NAS4005B-11	11 (15.8750)	0.625		2.75 (69.8500)	3.50 (88.9000)	6.00 (152.4000)

Type C Drivers					
Driver Number	Recess Number	Hex Size inch (mm)	Driver Length inch (mm)		
NAS4005C7	7				
NAS4005C8	8	0.750 (19.0500)		1.50 (38.1000)	
NAS4005C9	9				
NAS4005C10	10			1.75 (44.4500)	
NAS4005C11	11	0.875 (22.2250)			
NAS4005C12	12			2.00 (50.8000)	
NAS4005C13	13				
NAS4005C14	14	1.250 (31.7500)		2.25 (57.1500)	
NAS4005C15	15				

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Type D Drivers					
Driver Number	Recess Number	Hex Size inch (mm)	Driver Length inch (mm)		
NAS4005D4-0	0	0.250 (6.3500)		1 (25.4000)	
NAS4005D4-1	1	0.250 (6.3500)		1 (25.4000)	
NAS4005D4-2	2	0.250 (6.3500)		1 (25.4000)	
NAS4005D4-3	3	0.250 (6.3500)		1 (25.4000)	
NAS4005D4-4	4	0.250 (6.3500)		1 (25.4000)	
NAS4005D4-5	5	0.250 (7.9248)		1 (31.7500)	
NAS4005D5-4	4	0.312 (7.9248)		1.25 (31.7500)	
NAS4005D5-5	5	0.312 (7.9248)		1.25 (31.7500)	

4. Phillips Recessed Head Screws

A. For driver bits for phillips standard and posidriv recessed head screws reference Figure 203 and Figure 204.

5. Loosening of Tri-Wing Screws

A. Seized tri-wing and phillips screws can be removed using screw extractor kit DZZ7299-1. (Figure 201)

B. A tool for loosening seized tri-wing and phillips screws without stripping recess can be fabricated locally as follows.

(1) Make a tool from a regular 3/8-inch (9.53 mm) shank rivet set, a steel bar, and a standard 3/8-inch (9.53 mm) adapter as shown in Figure 202.

CAUTION: CARE MUST BE TAKEN TO USE PROCEDURE ONLY TO LOOSEN SCREW. DO NOT CONTINUE VIBRATION AND PRESSURE AFTER SCREW HAS STARTED TO TURN OR DAMAGE TO DOME NUTS WILL RESULT.

(2) Loosen screw by vibrating tool with rivet gun and by applying pressure against bar stock handle simultaneously.

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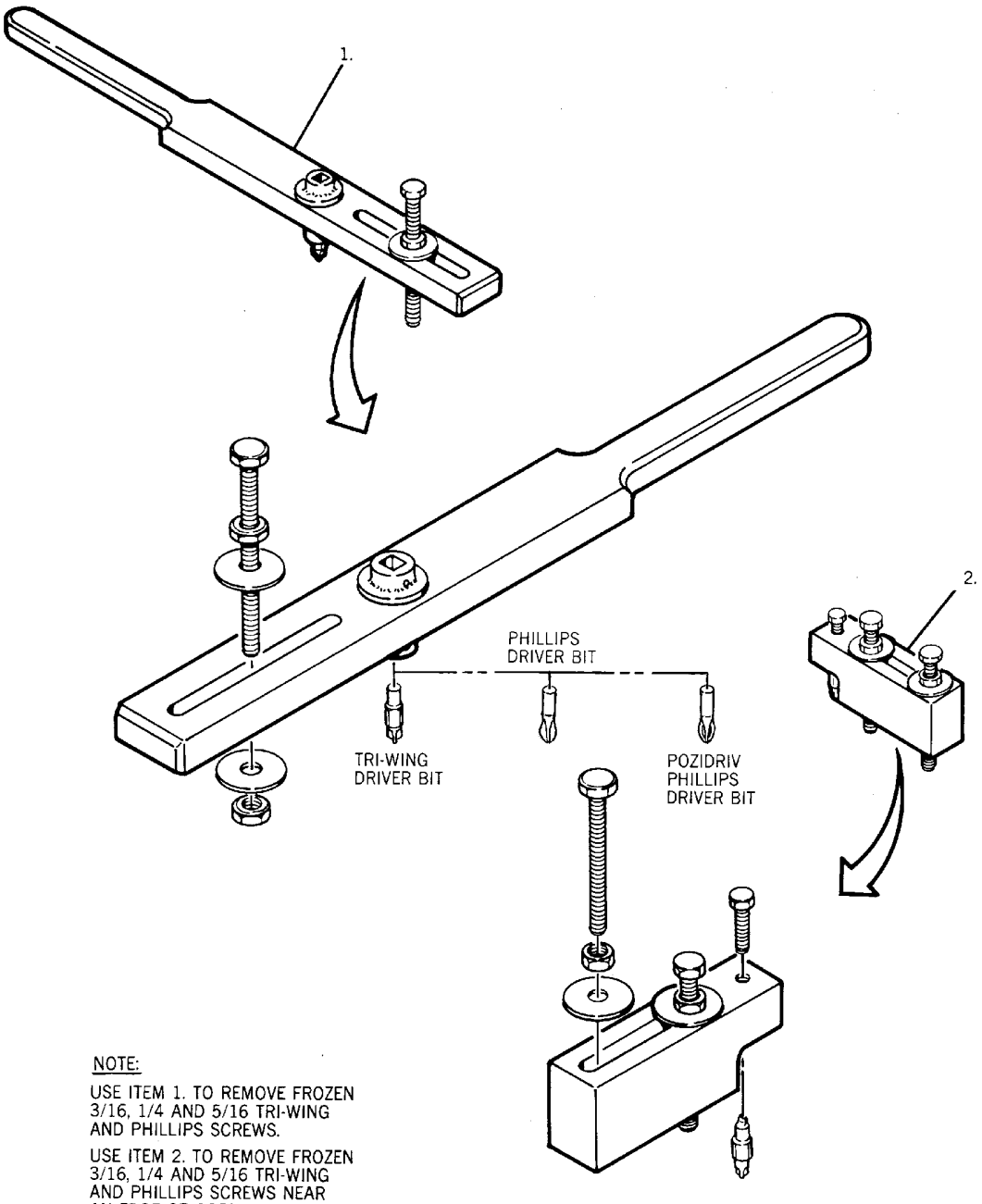

Screw Extractor Kit (DZZ7299-1)
Figure 201/20-10-12-990-801

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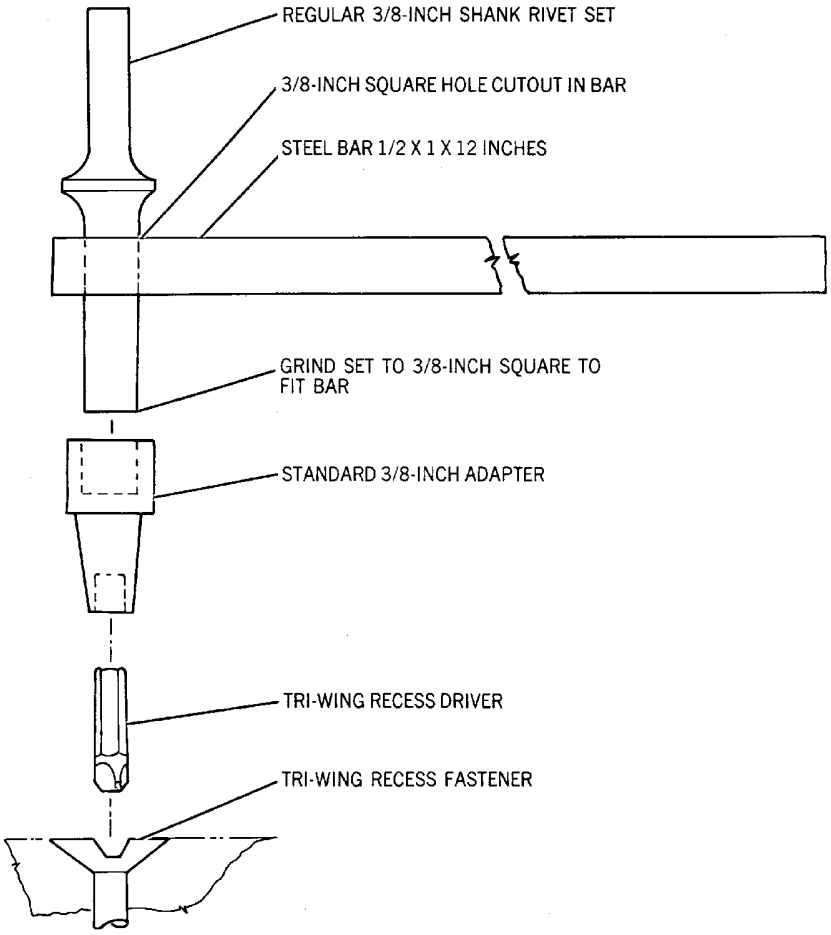

BBB2-20-92

Tool For Loosening Seized Tri-Wing Screw
Figure 202/20-10-12-990-802

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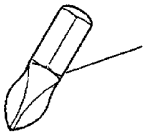

NOMINAL SCREW SIZE IN./MM	DRIVER SIZE	1-4 INCH HEX SHANK DRIVER BITS (6.35MM)			5/16 INCH HEX SHANK DRIVER BITS (7.94MM)		
		AIR INDUSTRIES	APEX	ZEPHYR	AIR INDUSTRIES	APEX	ZEPHYR
0.1380-32 (3.5052)	NO. 2	A1C440-2	440-2	D1222AA	A1C480-2	480-2	D1232AA
0.1640-32 (4.1656)	NO. 2	A1C440-2	440-2	D1222AA	A1C480-2	480-2	D1232AA
0.1900-32 (4.8260)	NO. 2	A1C440-2	440-2	D1222AA	A1C480-2	480-2	D1232AA
0.2500-28 (6.3500)	NO. 3	A1C440-3	440-3	D1223AA	A1C480-3	480-3	D1233AA
0.3125-24 (7.9375)	NO. 4	A1C440-4	440-4	-	A1C480-4	480-4	D1234AA
0.3750-24 (9.5250)	NO. 4	A1C440-4	440-4	-	A1C480-4	480-4	D1234AA
0.4375-20 (11.1125)	NO. 4	A1C440-4	440-4	-	A1C480-4	480-4	D1234AA
0.5000-20 (12.7000)	NO. 4	A1C440-4	440-4	-	A1C480-4	480-4	D1234AA
0.5625-18 (14.2875)	NO. 4	A1C440-4	440-4	-	A1C480-4	480-4	D1234AA

NOTE: Driver bit sizes for S-4619603-9608 Series screws (reduced head diameter) are specified as follows:

SCREW NO.	DRIVER SIZE
S-4619303	NO.2
S-4619304	NO.2
S-4619305	NO.3
S-4619306	NO.4
S-4619307	NO.4
S-4619308	NO.4

BBB2-20-117

Driver Bits For Installation of Screws with Standard (Phillips) Recess
Figure 203/20-10-12-990-803

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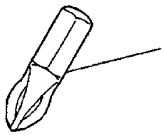

NOMINAL SCREW SIZE IN./MM	DRIVER SIZE	1/4 INCH HEX SHANK DRIVER BITS (6.35MM)			5/16 INCH HEX SHANK DRIVER BITS (7.94MM)	
		AIR INDUSTRIES	APEX	ZEPHYR	APEX	ZEPHYR
0.1380-32 (3.5052)	NO. 2	AIC470-4-2X	440-2PZD	PZ1222A	480-2PZD	PZ1232A
0.1640-32 (4.1656)	NO. 2	AIC470-4-2X	440-2PZD	PZ1222A	480-2PZD	PZ1232A
0.1900-32 (4.8260) (1)	NO. 2	AIC470-4-2X	440-2PZD	PZ1222A	480-2PZD	PZ1232A
0.2500-28 (6.3500) (1)	NO. 3	AIC470-4-3X	440-3PZD	PZ1223A	480-3PZD	PZ1233A
0.3125-24 (7.9375)	NO. 4	-	-	-	480-4PZD	PZ1234A
0.3750-24 (9.5250)	NO. 4	-	-	-	480-4PZD	PZ1234A
0.4375-20 (11.1125)	NO. 4	-	-	-	480-4PZD	PZ1234A
0.5000-20 (12.7000)	NO. 4	-	-	-	480-4PZD	PZ1234A

NOTE: (1) For Pozidriv screws manufactured to head dimensions of NAS1581 "Bolt-Shear, Reduced 100° Flush Head", use the NO.2 Pozidriv driver for 0.1900-32 inch (4.83MM) and 0.2500-28 inch (6.35MM) thread sizes.

BBB2-20-118

Driver Bits For Installation of Screws with Posidriv (Phillips) Recess
Figure 204/20-10-12-990-804

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FLUID LINE FITTINGS - MAINTENANCE PRACTICES

1. General

A. For the removal and installation of the AN and MS fittings. (AN and MS FITTING - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-03/201)

B. For the removal and installation of the tubing and hoses. (TUBING AND HOSE - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-01/201)

C. For the maintenance practices of the permanent piping. (PERMANENT PIPING - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-04/201 Config 1)

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PRELOAD INDICATING (PLI) WASHERS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides identification and installation instructions for the preload indicating (PLI) washers.

B. PLI washers are used in various installations throughout the aircraft. PLI washers are packaged in sets, each set consisting of two loose fitting concentric steel rings, inner and outer washers, positioned between two close tolerance flat washers, which are heat treated to 160,000 psi (1,104,000 kPa) minimum, 180,000 psi (1,242,000 kPa) minimum, or 220,000 psi (1,518,000 kPa) minimum, depending on strength requirements.

PLI washers are placed between the material and the nut, or under the bolt head, and becomes a permanent part of the installation. As the bolt or nut is tightened, the inner washer, which is thicker than the outer washer, is compressed until the outer washer cannot be moved, indicating the desired preload on the bolt.

CAUTION: UNDER NO CIRCUMSTANCES ARE WASHERS TO BE USED IN PLACE OF FLAT WASHERS IN PLI WASHER PACKAGED SETS.

C. On PLI washer installations where standard bolt lengths are used, additional washers might be required to keep the nut from bottoming on the bolt shank. In such cases, two additional washers are permitted. In special cases where bolt length increments are greater than 1/16-inch (1.59 mm), three washers are permissible.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of following items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Washers, preload indicating (PLI)	Standard Pressed Steel Co.
Wiggle tool, pre- load indicating (PLI) washer	Douglas Aircraft Co.

3. Removal/Installation PLI Washers

A. Install Washers Under Nuts

(1) Remove all chips and burrs from bolt hole.

(2) Place one PLI flat washer over end of bolt and against material. (Figure 201)

(3) Place inner and outer PLI washer over bolt and on top of flat washer.

(4) Place second PLI flat washer over bolt and on top of PLI washer.

NOTE: All inner PLI washers, 7/16 inch (11.1 mm) and larger, are wax coated to reduce the tightening force required to install the PLI washer. Do not remove wax coating.

(5) Insert PLI washer wiggle tool in one of three small holes of outer washer, and wiggle or rotate outer washer back and forth while tightening nut. (Paragraph 3.C.)

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Bolt head must be held stationary during operation. When outer washer comes in contact with flat washer and cannot be moved, bolt has reached desired preload and must not be tightened further. Check two of three holes whenever possible.

NOTE: Nut must not be overtightened. PLI washers are designed to preload at 80 percent of bolt strength, and additional tightening of nut after outer washer has bottomed might overload the bolt. When bolt has been tightened more than one-eighth turn (45 degrees) beyond point where indicating washer becomes immovable, installation is not acceptable and entire installation, including bolt and nut, must be replaced. Once a bolt or nut is tightened, using PLI washers, it must not be loosened. If a bolt or nut is loosened, PLI washers must be replaced. If a loose PLI washer is discovered, remove complete PLI washer set and replace with a new set. If this is not possible, nut should be tightened, and PLI washers replaced at earliest possible date.

(6) After installation, tapered gaps may exist between outer PLI washer and flat washer. Tapered gaps must not exceed limitations. (Figure 202)

B. Install Washers Under Bolt Head

NOTE: If PLI washers, intended for use under a nut, are installed under a bolt head, a 5 to 25 percent (depending on the bolt diameter) reduction of preload on the bolt will result.

(1) Remove all chips and burrs from bolt hole.

CAUTION: USE OF COUNTERSUNK WASHER IS MANDATORY WHEN PLI WASHERS ARE USED UNDER BOLT HEAD.

(2) Place countersunk washer over end of bolt with washer countersunk radius next to fillet radius under bolt head. (Figure 201)

NOTE: When using a countersunk washer under head of an oversize bolt, the countersunk radius must be large enough to avoid interference with fillet radius of bolt head.

(3) Place one PLI flat washer against countersunk washer.

(4) Place inner and outer PLI washers over bolt.

(5) Place second PLI flat washer over inner and outer PLI washers and insert bolt in hole.

(6) Place plain washer over end of bolt and install nut.

NOTE: Washer at nut end of bolt is omitted when bolt is installed into a stationary or fixed nut such as barrel nuts, nut plates, etc.

(7) Tighten bolt on nut until outer PLI washer can no longer be rotated. Bolt has reached desired preload and must not be tightened further.

C. PLI Washer Wiggle Tool

(1) Effective wiggle tools can be fabricated to rotate and/or wiggle outer PLI washer to determine required amount of tightening for proper bolt preloading. (Figure 203)

A tool wire diameter tolerance of +0.000, -0.002 inch (-0.051 mm) ensures that wire will not exceed outer PLI washer hole diameter.

(2) During tightening process, when outer PLI washer is being rotated, care should be taken to determine that initial stoppage of outer washer is not premature. In addition to resisting rotation, outer washer should have no side play and should show no tendency to rock about, such as might result if only spot binding occurs. Inserting wiggle tool in either of two additional holes may help in checking these possibilities.

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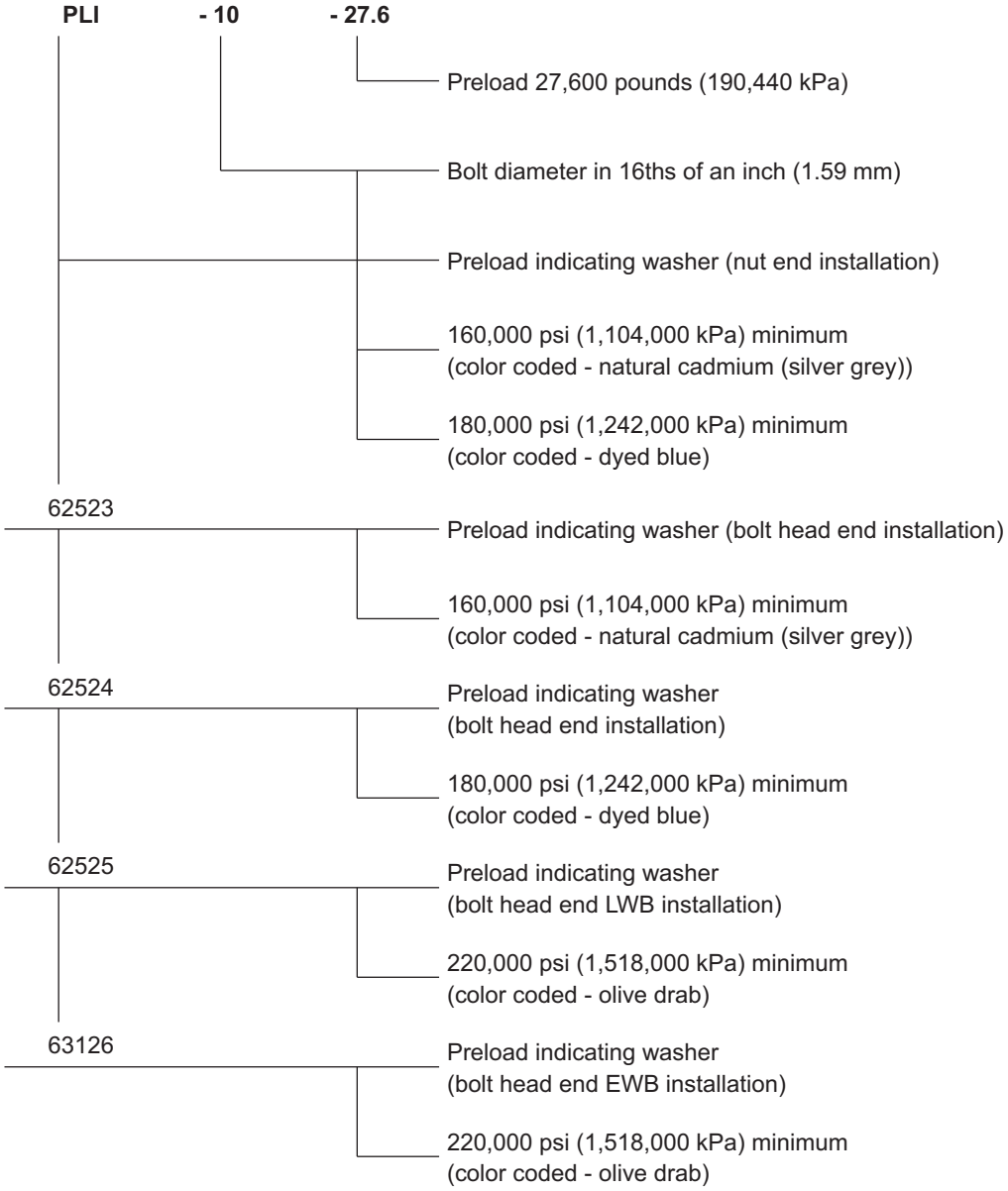
(3) Too much or too little force can be used on wiggle tool when checking outer washer for binding. By applying force on wiggle tool as closely as possible to washer, any excessive tendency for tool wire to bend or rotate about point X at washer check hole can be avoided. (Figure 203)

D. Standard PLI Washer Identification - Part Number Coding

(1) Standard four piece PLI washer sets are identified by part number coded to indicate specific use (nut or bolt end installation), bolt size, flat washer tensile strength, and bolt preload value. (Table 203)

Table 202 Example:



E. Oversize PLI Washer Identification - Part Number Coding

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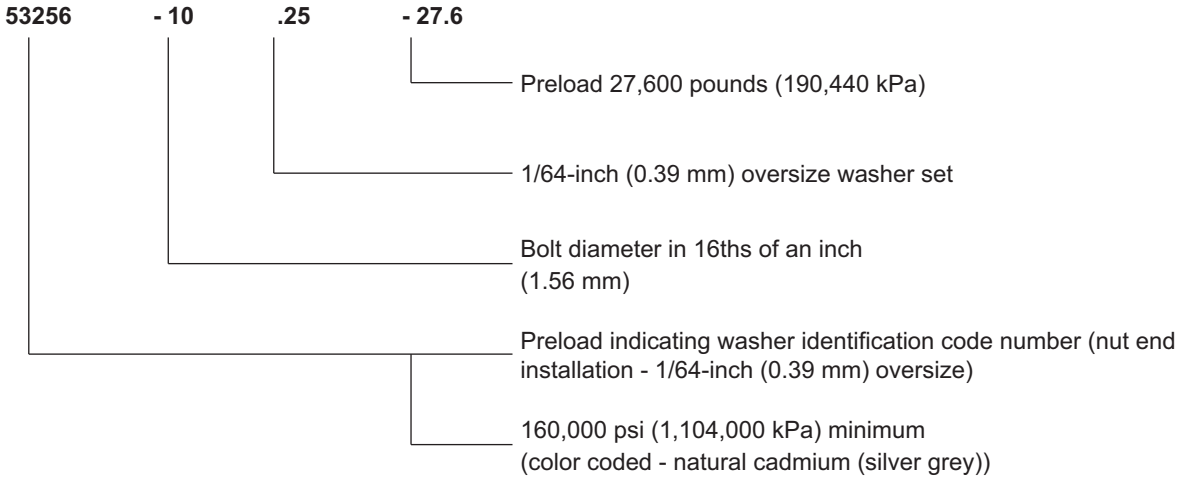
(1) PLI washers are supplied in 1/64- and 1/32-inch (0.39 and 79 mm) oversize dimensions for use with respective over-size bolt shanks. Standard oversize PLI washer sets are identified by one or two grooves around the periphery of the outer PLI washer, indicating 1/64- and 1/32-inch (0.39 and 0.79 mm) oversize washer sets respectively. (Table 203)

Example - 1/64-inch (0.39 mm) oversize PLI washer part number coding:



Example - 1/32-inch (0.79 mm) oversize PLI washer part number coding:

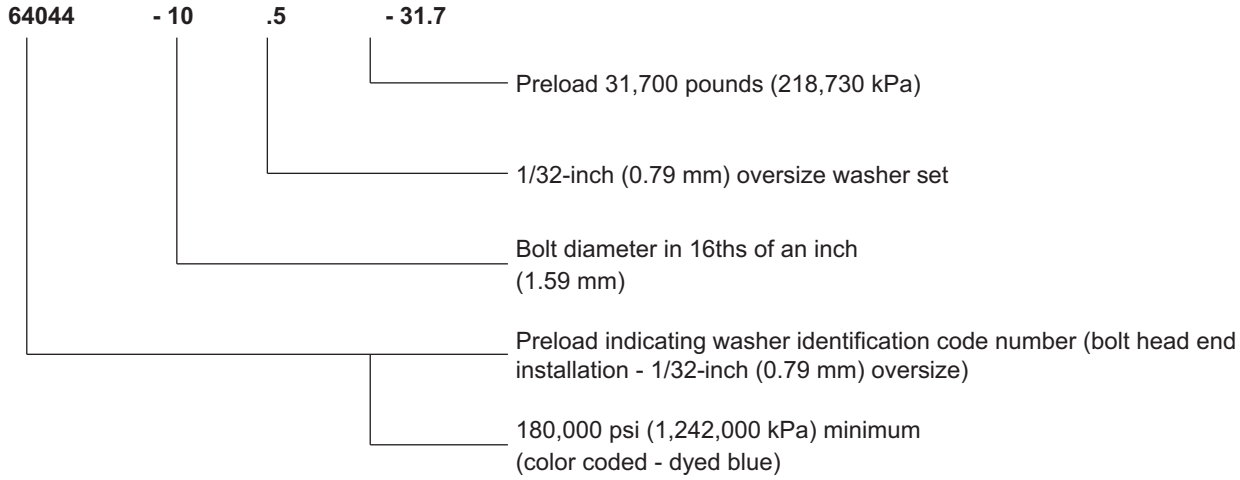


Table 203 Preload Indicating Washer List (Sheet 1)

Nut End – 160,000 psi (1,104,000 kPa) Minimum									
Bolt Size	**Standard PLI**			**1/64-inch(0.39 mm) Oversize**			**1/32-inch(0.79mm) Oversize**		
10-32	PLI	-3-	2.1	53256	-3.25-	2.1	64045	-3.5-	2.1
1/4-28		-4-	3.6		-4.25-	3.6		-4.5-	3.6
5/16-24		-5-	5.9		-5.25-	5.9		-5.5-	5.9
3/8-24		-6-	9.2		-6.25-	9.2		-6.5-	9.2
7/16-20		-7-	12.4		-7.25-	12.4		-7.5-	12.4

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Table 203 Preload Indicating Washer List (Sheet 1) (Continued)

Nut End – 160,000 psi (1,104,000 kPa) Minimum								
Bolt Size	Standard PLI			1/64-inch(0.39 mm) Oversize			1/32-inch(0.79mm) Oversize		
1/2-20	-8-	17.0		-8.25-	17.0		-8.5-	17.0
9/16-18	-9-	21.6		-9.25-	21.6		-9.5-	21.6
5/8-18	-10-	27.6		-10.25-	27.6		-10.5-	27.6
3/4-16	-12-	40.3		-12.25-	40.3		-12.5-	40.3
7/8-14	-14-	55.2		-14.25-	55.2		-14.5-	55.2
1 -12	-16-	74.3		-16.25-	74.3		-16.5-	74.3
1 1/8-12	-18-	93.4		-18.25-	93.4		-18.5-	93.4
1 1/4-12	-20-	117.8		-20.25-	117.8		-20.5-	117.8
1 3/8-12	-22-	145.1		-22.25-	145.1		-22.5-	145.1
1 1/2-12	-24-	175.3		-24.25-	175.3		-24.5-	175.3
NOTE: Color coded -- Natural cadmium (silver grey)								

Preload Indicating Washer List (Sheet 2)

Bolt Head End - 160,000 psi (1,104,000 kPa) Minimum									
Bolt Size	Standard PLI			1/64-inch(0.39 mm) Oversize			1/32-inch(0.79mm) Oversize		
10-32	62523	-3-	2.1	64046	-3.25-	2.1	64047	-3.5-	2.1
1/4-28		-4-	3.6		-4.25-	3.6		-4.5-	3.6
5/16-24		-5-	5.9		-5.25-	5.9		-5.5-	5.9
3/8-24		-6-	9.2		-6.25-	9.2		-6.5-	9.2
7/16-20		-7-	12.4		-7.25-	12.4		-7.5-	12.4
1/2-20		-8-	17.0		-8.25-	17.0		-8.5-	17.0
9/16-18		-9-	21.6		-9.25-	21.6		-9.5-	21.6
5/8-18		-10-	27.6		-10.25-	27.6		-10.5-	27.6
3/4-16		-12-	40.3		-12.25-	40.3		-12.5-	40.3
7/8-14		-14-	55.2		-14.25-	55.2		-14.5-	55.2
1 1-12		-16-	74.3		-16.25-	74.3		-16.5-	74.3
1 1/8-12		-18-	93.4		-18.25-	93.4		-18.5-	93.4
1 1/4-12		-20-	117.8		-20.25-	117.8		-20.5-	117.8
1 3/8-12		-22-	145.1		-22.25-	145.1		-22.5-	145.1
1 1/2-12		-24-	175.3		-24.25-	175.3		-24.5-	175.3
NOTE: Color coded -- Natural cadmium (silver grey)									

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Preload Indicating Washer List (Sheet 3)

Nut End - 180,000 psi (1,242,000 kPa) Minimum									
Bolt Size	Standard PLI			1/64-inch(0.39 mm) Oversize			1/32-inch(0.79mm) Oversize		
10-32	PLI	-3-	2.3	62614	-3.25-	2.3	62615	-3.5-	2.3
1/4-28		-4-	1.3		-4.25-	4.3		-4.5-	4.3
5/16-24		-5-	6.9		-5.25-	6.9		-5.5-	6.9
3/8-24		-6-	10.7		-6.25-	10.7		-6.5-	10.7
7/16-20		-7-	14.4		-7.25-	14.4		-7.5	14.4
1/2-20		-8-	19.6		-8.25-	19.6		-8.5-	19.6
9/16-18		-9-	24.9		-9.25-	24.9		-9.5-	24.9
5/8-18		-10-	31.7		-10.25-	31.7		-10.5-	31.7
3/4-16		-12-	46.5		-12.25-	46.5		-12.5-	46.5
7/8-14		-14-	63.5		-14.25-	63.5		-14.5-	63.5
1 -12		-16-	85.5		-16.25-	85.5		-16.5-	85.5
1 1/8-12		-18-	108.4		-18.25-	108.4		-18.5-	108.4
1 1/4-12		-20-	133.6		-20.25-	133.6		-20.5-	133.6
1 3/8-12		-22-	164.5		-22.25-	164.5		-22.5-	164.5
1 1/2-12		-24-	198.5		-24.25-	198.5		-24.5-	198.5

NOTE: Color coded -- Dyed blue

Preload Indicating Washer List (Sheet 4)

Bolt Head End - 180,000 psi (1,242,000 kPa) Minimum									
Bolt Size	Standard PLI			1/64-inch(0.39 mm) Oversize			1/32-inch(0.79mm) Oversize		
10-32	62524	-3-	2.3	64043	-3.25-	2.3	64044	-3.5-	2.3
1/4-28		-4-	4.3		-4.25-	4.3		-4.5-	4.3
5/16-24		-5-	6.9		-5.25-	6.9		-5.5-	6.9
3/8-24		-6-	10.7		-6.25-	10.7		-6.5-	10.7
7/16-20		-7-	14.4		-7.25-	14.4		-7.5-	14.4
1/2-20		-8-	19.6		-8.25-	19.6		-8.5-	19.6
9/16-18		-9-	24.9		-9.25-	24.9		-9.5-	24.9
5/8-18		-10-	31.7		-10.25-	31.7		-10.5-	31.7
3/4-16		-12-	46.5		-12.25-	46.5		-12.5-	46.5
7/8-14		-14-	63.5		-14.25-	63.5		-14.5-	63.5
1 -12		-16-	85.5		-16.25-	85.5		-16.5-	85.5
1 1/8-12		-18-	108.4		-18.25-	108.4		-18.5-	108.4
1 1/4-12		-20-	133.6		-20.25-	133.6		-20.5-	133.6

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Preload Indicating Washer List (Sheet 4) (Continued)

Bolt Head End - 180,000 psi (1,242,000 kPa) Minimum								
Bolt Size	Standard PLI			1/64-inch(0.39 mm) Oversize			1/32-inch(0.79mm) Oversize		
1 3/8-12		-22-	164.5		-22.25-	164.5		-22.5-	164.5
1 1/2-12		-24-	198.5		-24.25-	198.5		-24.5-	198.5

NOTE: Color coded -- Dyed blue

Preload Indicating Washer List (Sheet 5)

Nut End (LWB 22 and 71658 Bolts) 220,000 psi (1,518,000 kPa) Minimum									
Bolt Size	Standard PLI			1/64-inch(0.39 mm) Oversize			1/32-inch(0.79mm) Oversize		
1/4-28	PLI L22	-4-	5.0	66148	-4.25-	5.0	66149	-4.5-	5.0
5/16-24		-5-	8.1		-5.25-	8.1		-5.5-	8.1
3/8-24		-6-	12.4		-6.25-	12.4		-6.5-	12.4
7/16-20		-7-	16.7		-7.25-	16.7		-7.5-	16.7
1/2-20		-8-	22.7		-8.25-	22.7		-8.5-	22.7
9/16-18		-9-	28.7		-9.25-	28.7		-9.5-	28.7
5/8-18		-10-	36.4		-10.25-	36.4		-10.5-	36.4
3/4-16		-12-	53.3		-12.25-	53.3		-12.5-	53.3
7/8-14		-14-	72.9		-14.25-	72.9		-14.5-	72.9
1 -12		-16-	97.9		-16.25-	97.9		-16.5-	97.9
1 1/8-12		-18-	122.9		-18.25-	122.9		-18.5-	122.9
1 1/4-12		-20-	154.8		-20.25-	154.8		-20.5-	154.8
1 3/8-12		-22-	190.3		-22.25-	190.3		-22.5-	190.3
1 1/2-12		-24-	229.5		-24.25-	229.5		-24.5-	229.5

NOTE: Color coded -- Dyed olive drab

Preload Indicating Washer List (Sheet 6)

Bolt End (LWB 22 and 71658 Bolts) 220,000 psi (1,518,000 kPa) Minimum									
Bolt Size	Standard PLI			1/64-inch(0.39 mm) Oversize			1/32-inch(0.79mm) Oversize		
1/4-28	62525	-4-	5.0	66150	-4.25-	5.0	66151	-4.5-	5.0
5/16-24		-5-	8.1		-5.25-	8.1		-5.5-1	8.1
3/8-24		-6-	12.4		-6.25-	12.4		-6.5-	12.4
7/16-20		-7-	16.7		-7.25-	16.7		-7.5-	16.7
1/2-20		-8-	22.7		-8.25-	22.7		-8.5-	22.7
9/16-18		-9-	28.7		-9.25-	28.7		-9.5-	28.7

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Preload Indicating Washer List (Sheet 6) (Continued)

Bolt End (LWB 22 and 71658 Bolts) 220,000 psi (1,518,000 kPa) Minimum								
Bolt Size	Standard PLI			1/64-inch(0.39 mm) Oversize			1/32-inch(0.79mm) Oversize		
5/8-18		-10-	36.4		-10.25-	36.4		-10.5-	36.4
3/4-16		-12-	53.3		-12.25-	53.3		-12.5-	53.3
7/8-14		-14-	72.9		-14.25-	72.9		-14.5-	72.9
1 -12		-16-	97.9		-16.25-	97.9		-16.5-	97.9
1 1/8-12		-18-	122.9		-18.25-	122.9		-18.5-	122.9
1 1/4-12		-20-	154.8		-20.25-	154.8		-20.5-	154.8
1 3/8-12		-22-	190.3		-22.25-	190.3		-22.5-	190.3
1 1/2-12		-24-	229.5		-24.25-	229.5		-24.5-	229.5
NOTE: Color coded -- Olive drab									

Preload Indicating Washer List (Sheet 7)

Nut End (EWB 22 Bolts) - 220,000 psi (1,518,000 kPa) Minimum									
Bolt Size	Standard PLI			1/64-inch(0.39 mm) Oversize			1/32-inch(0.79mm) Oversize		
1/4-28	PLI 22	-4-	5.0	68478	-4.25-	5.0	68479	-4.5-	5.0
5/16-24		-5-	8.1		-5.25-	8.1		-5.5-	8.1
3/8-24		-6-	12.4		-6.25-	12.4		-6.5-	12.4
7/16-20		-7-	16.7		-7.25-	16.7		-7.5-	16.7
1/2-20		-8-	22.7		-8.25-	22.7		-8.5-	22.7
9/16-18		-9-	28.7		-9.25-	28.7		-9.5-	28.7
5/8-18		-10-	36.4		-10.25-	36.4		-10.5-	36.4
3/4-16		-12-	53.3		-12.25-	53.3		-12.5-	53.3
7/8-14		-14-	72.9		-14.25-	72.9		-14.5-	72.9
1 -12		-16-	97.9		-16.25-	97.9		-16.5-	97.9
1 1/8-12		-18-	122.9		-18.25-	122.9		-18.5-	122.9
1 1/4-12		-20-	154.8		-20.25-	154.8		-20.5-	154.8
1 3/8-12		-22-	190.3		-22.25-	190.3		-22.5-	190.3
1 1/2-12		-24-	229.5		-24.25-	229.5		-24.5-	229.5
NOTE: Color coded -- Dyed olive drab									

Preload Indicating Washer List (Sheet 8)

Bolt End (EWB 22 Bolts) - 220,000 psi (1,518,000 kPa) Minimum									
Bolt Size	Standard PLI			1/64-inch(0.39 mm) Oversize			1/32-inch(0.79mm) Oversize		
1/4-28	63126	-4-	5.0	68247	-4.25-	5.0	68248	-4.5-	5.0

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Preload Indicating Washer List (Sheet 8) (Continued)

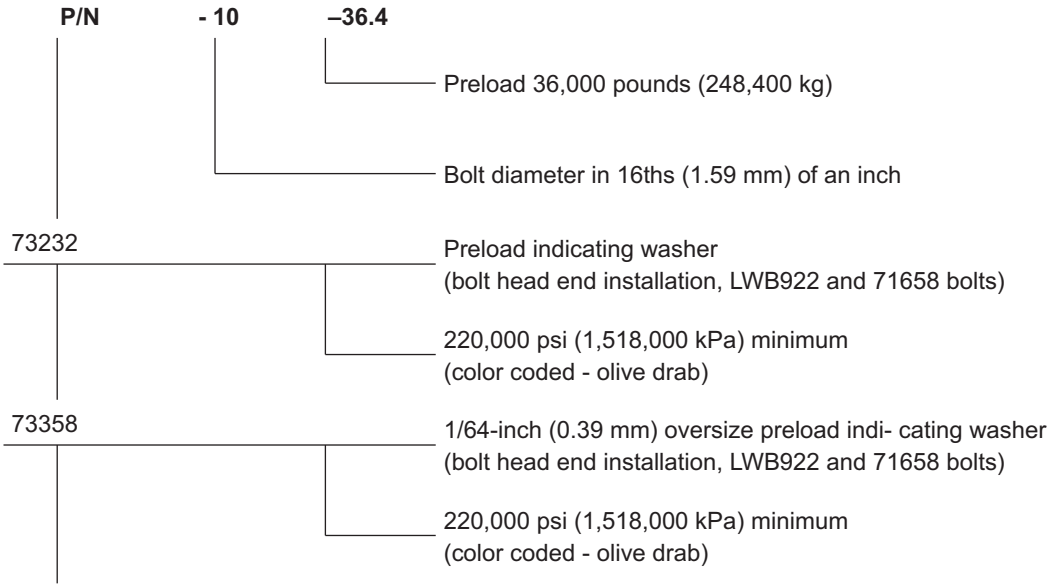
Bolt End (EWB 22 Bolts) - 220,000 psi (1,518,000 kPa) Minimum								
Bolt Size	Standard PLI			1/64-inch(0.39 mm) Oversize			1/32-inch(0.79mm) Oversize	
5/16-24	-5-	8.1		-5.25-	8.1		-5.5-	8.1
3/8-24	-6-	12.4		-6.25-	12.4		-6.5-	12.4
7/16-20	-7-	16.7		-7.25-	16.7		-7.5-	16.7
1/2-20	-8-	22.7		-8.25-	22.7		-8.5-	22.7
9/16-18	-9-	28.7		-9.25-	24.7		-9.5-	28.7
5/8-18	-10-	36.4		-10.25-	36.4		-10.5-	36.4
3/4-16	-12-	53.3		-12.25-	53.3		-12.5-	53.3
7/8-14	-14-	72.9		-14.25-	72.9		-14.5-	72.9
1 -12	-16-	97.9		-16.25-	97.9		-16.5-	97.9
1 1/8-12	-18-	122.9		-18.25-	122.9		-18.5-	122.9
1 1/4-12	-20-	154.8		-20.25-	154.8		-20.5-	154.8
1 3/8-12	-22-	190.3		-22.25-	190.3		-22.5-	190.3
1 1/2-12	-24-	229.5		-24.25-	229.5		-24.5-	229.5

NOTE: Color coded -- Olive drab

F. High Temperature PLI Washer Identification - Part Number Coding

(1) Four piece PLI washer sets for elevated temperatures up to 900°F (482°C) are identified by part number to indicate standard size, 1/64-inch (0.39 mm) oversize, and 1/32-inch (0.79 mm) oversize. (Table 204)

Example:



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Example: (Continued)

P/N	- 10	–36.4	
73359			1/32-inch (0.79 mm) oversize preload indi- cating washer (bolt head end installation, LWB922 and 71658 bolts)
			220,000 psi (1,518,000 kPa) minimum (color coded - olive drab)

(2) Spacer washers used with high temperature PLI washer sets are listed in Table 205 .

Table 204 High Temperature Preload Indicating Washer List

Bolt Head End (LWB922 & 71658 Bolts) 220,000 psi (1,518,000 kPa) Minimum, High Temperature Applications Up to 900°F (482°C)									
Bolt Size	**Standard PLI**			**1/64-inch(0.39 mm) Oversize**			**1/32-inch (0.79mm) Oversize**		
1/4-28	73232	-4-	5.0	73358	-4-	5.0	73359	-4-	5.0
5/16-24		-5-	8.1		-5-	8.1		-5-	8.1
3/8-24		-6-	12.4		-6-	12.4		-6-	12.4
7/16-20		-7-	16.7		-7-	16.7		-7-	16.7
1/2-20		-8-	22.7		-8-	22.7		-8-	22.7
9/16-18		-9-	28.7		-9-	28.7		-9-	28.7
5/8-18		-10-	36.4		-10-	36.4		-10-	36.4
3/4-16		-12-	53.3		-12-	53.3		-12-	53.3
7/8-14		-14-	72.9		-14-	72.9		-14-	72.9
1 -12		-16-	97.9		-16-	97.9		-16-	97.9
1 1/8-12		-18-	122.9		-18-	122.9		-18-	122.9
1 1/4-12		-20-	154.8		-20-	154.8		-20-	154.8
1 3/8-12		-22-	190.3		-22-	190.3		-22-	190.3
1 1/2-12		-24-	229.5		-24-	229.5		-24-	229.5

NOTE: Color Coded - Olive Drab

Table 205 High Temperature Spacer Washer List

Spacer Washers Used With High-Temperature PLI Washer Sets		
Standard	**1/64-inch (0.39 mm) Oversize**	**1/32-inch(0.79 mm) Oversize**
WCL22N	66470CN	66471CN
WPL22N	66470PN	66471PN

NOTE: CN Denotes countersunk washer

NOTE: PN Denotes plain washer

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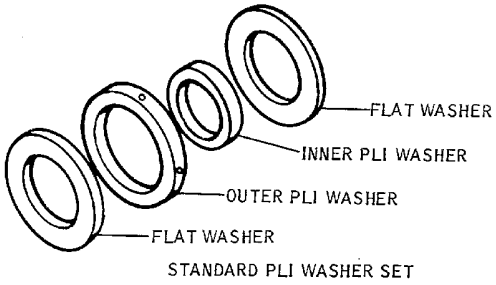
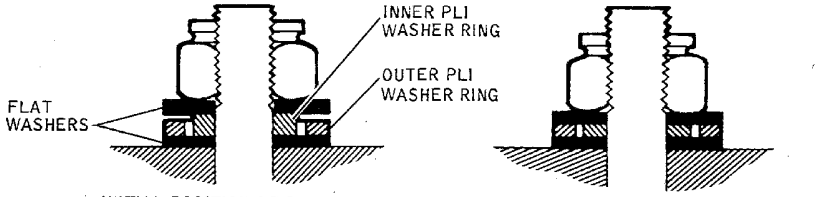
NOTE:
EACH PLI WASHER SET CONSISTS OF TWO LOOSE FITTING CONCENTRIC WASHERS (RINGS) POSITIONED BETWEEN TWO HIGH-STRENGTH, STEEL WASHERS.



STANDARD PLI WASHER SET

EXAMPLE A

NOTE:
AS BOLT IS TIGHTENED, INNER PLI WASHER IS COMPRESSED UNTIL OUTER PLI WASHER CAN NO LONGER BE MOVED, THUS INDICATING DESIRED PRELOAD ON BOLT.

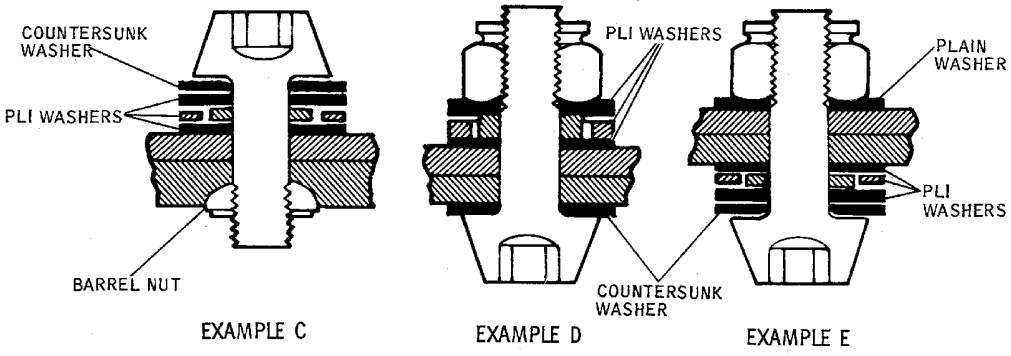


INITIAL POSITION OF PLI WASHER BEFORE TIGHTENING

POSITION OF PLI WASHERS AT DESIRED BOLT PRELOAD AFTER TIGHTENING

EXAMPLE B

NOTE:
TYPICAL BOLT INSTALLATIONS WITH POSITIONS OF PLI WASHERS, COUNTERSUNK WASHERS, AND PLAIN WASHERS, NOT COUNTERSUNK.



EXAMPLE C EXAMPLE D EXAMPLE E

BBB2-20-15

PLI Washers -- Removal/Installation
Figure 201/20-10-14-990-801 (Sheet 1 of 2)

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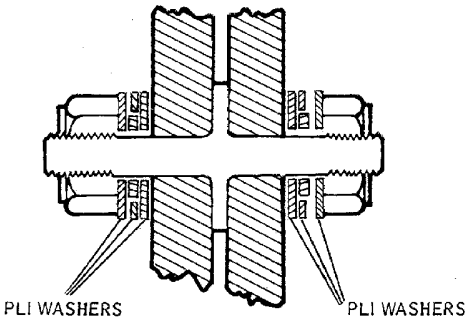
NOTE:

TYPICAL STUD INSTALLATION
WITH POSITIONS OF PLI WASHERS.



EXAMPLE F

BBB2-20-16

PLI Washers -- Removal/Installation
Figure 201/20-10-14-990-801 (Sheet 2 of 2)

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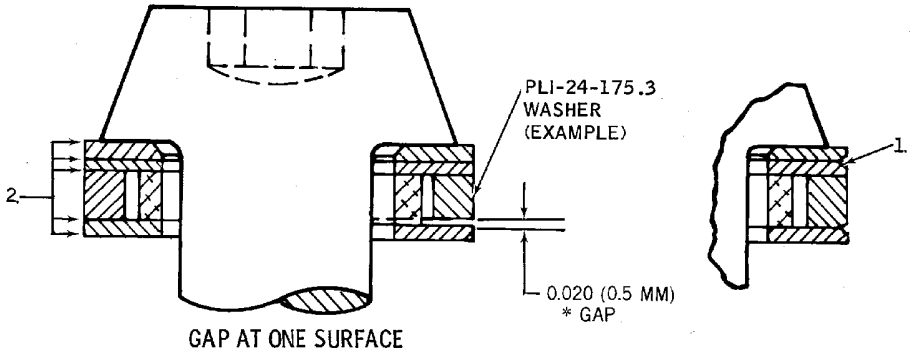
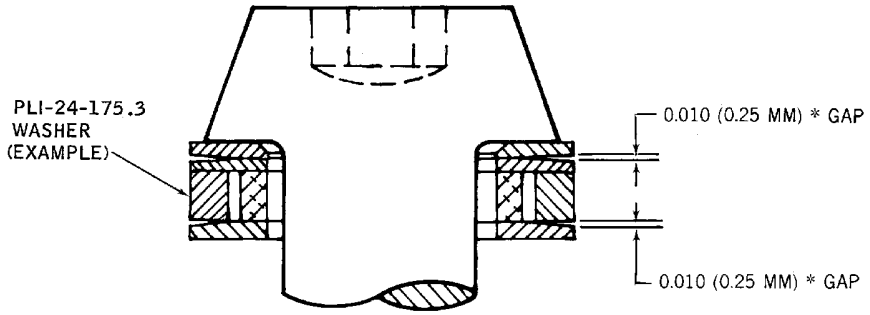
NOTE:
1. INDICATES NORMAL FABRICATION, EDGE CONDITION OF WASHERS.
2. INDICATES WHERE TAPERED GAPS MAY OCCUR, EITHER AT ONE OR ALL SURFACES.
3. DIMENSIONS NOTED ARE IN INCHES WITH METRIC EQUIVALENTS.



GAP AT ONE SURFACE



GAP AT MORE THAN ONE SURFACE

*TAPERED GAP LIMITATIONS				
WASHER SIZE	BOLT SIZE		GAP (INCH)	GAP (MM)
	INCHES	MM		
−3	0.1900	(4.8260)	0.007	0.175
−4	0.2500	(6.3500)	0.0075	0.1905
−5	0.3125	(7.9375)	0.0085	0.2159
−6	0.3750	(9.5250)	0.009	0.229
−7	0.4375	(11.1125)	0.0095	0.2413
−8	0.5000	(12.7000)	0.0105	0.2667
−9	0.5625	(14.2875)	0.011	0.279
−10	0.6250	(15.8750)	0.012	0.305
−12	0.7500	(19.0500)	0.013	0.330
−14	0.8750	(22.2250)	0.0145	0.3683
−16	1.0000	(25.4000)	0.016	0.406
−18	1.1250	(28.5750)	0.017	0.432
−20	1.2500	(31.7500)	0.0175	0.4445
−22	1.3750	(31.8750)	0.0185	0.4699
−24	1.5000	(38.1000)	0.020	0.508

BBB2-20-17B

PLI Washers -- Tapered Gap Limitations
Figure 202/20-10-14-990-802

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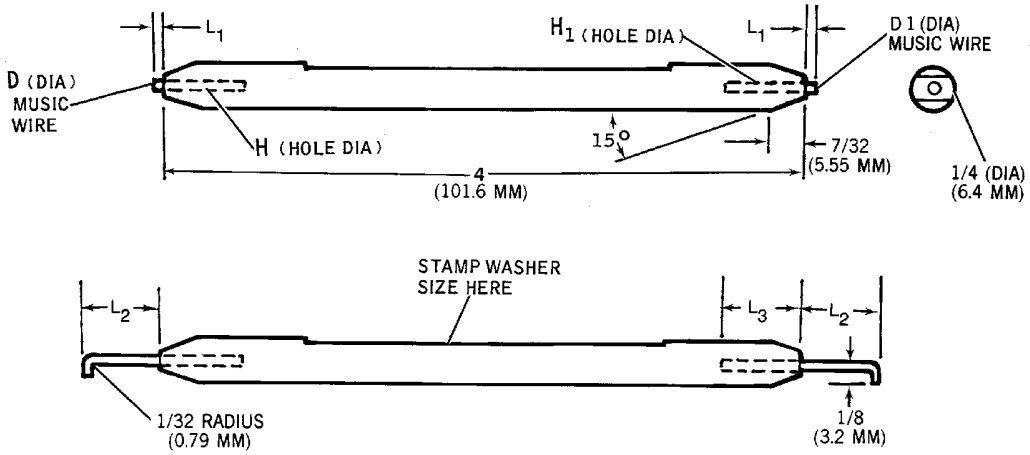


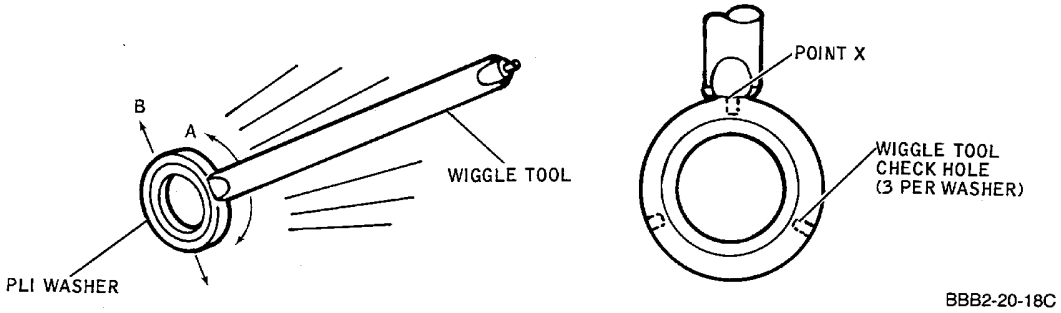
PLI WASHER WIGGLE TOOL

	PLI WASHER SIZE	D	D_1	H	H_1	L_1 STRAIGHT	L_2 HOOK	L_3 DEPTH
INCHES (MM)	3/16 AND 1/4 (4.8 AND 6.4)	0.043 (1.092)	0.047 (1.19)	0.042 (1.067)	0.046 (1.168)	1/16 (1.6)	1/2 (12.7)	1/2 (12.7)
INCHES (MM)	5/16 TO 5/8 (8.0 TO 15.9)	0.059 (1.498)	0.076 (1.930)	0.055 (1.397)	0.075 (1.905)	1/16 (1.6)	1 (25.4)	1/2 (12.7)
INCHES (MM)	34 TO 1 1/2 19.1 TO 38.1)	0.088 (2.235)	0.120 (3.048)	0.086 (2.184)	0.116 (2.946)	1/16 (1.6)	3/4 (19.1)	1/2 (12.7)

NOTES:

1. DIMENSIONS NOTED ARE IN INCHES WITH METRIC EQUIVALENTS
2. DIMENSIONS APPLY TO BOTH TOOLS, EXCEPT L AS NOTED
3. TOLERANCE = $^{+\ 0.000}_{-\ 0.002}$ EXCEPT L = ±1/64 ($^{+0.000\ MM}_{-0.051\ MM}$ EXCEPT L = ± 0.0156 MM)
4. BREAK ALL SHARP EDGES

A = ROTATIONAL MOTION
B = SIDE (LATERAL) MOTION



PLI Washer Wiggle Tool -- Fabrication and Use
Figure 203/20-10-14-990-803

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FASTENERS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides information on fasteners used in special applications on the airframe. Special procedures or special tools may be required to remove, install, or maintain the fasteners covered in this maintenance practice.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Ratchet wrench HLH101 modified	Hi-Shear Corp. 2600 Skypark Drive Torrance, Calif. 90509
Ratchet socket HLH102 modified	Hi-Shear Corp. 2600 Skypark Drive Torrance, Calif. 90509
Allen wrench	Commercially Available
Pliers, vise grips, or equivalent	Commercially Available
Nonmetallic hammer, or mallet	Commercially Available
Grease, MIL-G-81322 DPM 5348	

3. Camloc Stress Panel Fastener (SPF)

CAUTION: CAMLOC STRESS PANEL FASTENERS (SPF) ARE DESIGNED TO CARRY STRUCTURAL LOADS. PROPER LOCKING REQUIRES THAT FASTENERS BE RESET AFTER UNLOCKING, OR BEFORE RELOCK-ING IS ATTEMPTED. DO NOT USE POWER TOOLS FOR LOCKING OR UNLOCKING FASTENERS.

A. Unlock Fastener

(1) Turn stud counterclockwise with proper size phillips screw-driver. (One-fourth turn will unlock fastener, but will not reset it.)

(2) Hold stud in and continue turning counterclockwwise as far as possible to reset fastener. Do not exceed one full turn.

WARNING: GREASE LUBRICANT IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN GREASE LUBRICANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET GREASE LUBRICANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(3) Remove screwdriver and open panel after all fasteners are unlocked in this manner.

(4) Lubrication of Camloc stress panel fasteners, as required.

(a) Apply Grease (MIL-G-81322), or equivalent to receptacle assembly stud entrance with floating thread insert in the reset position. (Figure 201)

B. Lock Fastener

(1) Before attempting to lock fastener, ensure that stud has been reset as in Paragraph 3.A.(2).

(2) Push in on stud with phillips screwdriver until head of stud is flush with bushing.

(3) Turn stud clockwise until tight.

(4) Remove screwdriver and check that head of stud stays flush with bushing.

NOTE: For large panels equipped with a large number of fasteners, lock fasteners in staggered pattern first, then finally lock all fasteners.

4. Hi-Lok Fasteners

A. General

(1) The Hi-Lok fastener consists of a threaded pin and corresponding threaded collar similar in application to a nut and bolt. The threaded end of the pin has a hexagonal wrenching cavity to allow installation from one side. The collar wrenching device separates from the body of the collar at a predetermined wrenching torque by shearing the material in the torque-off groove (Figure 202).

5. Removal/Installation

A. Remove Fastener

(1) Insert allen wrench into pin wrenching cavity and hold to prevent pin from turning (Table 202 and Figure 203)

Table 202 Manual Installation Tooling

Dash No.	Nom. Dia.	Allen Wrench	Ratchet Wrench	Socket	Socket Hex Size
	Inches (mm)	Inches (mm)			Inches (mm)
-4	1/8 (3.175)	1/16 (1.588)	HLH101-21	HLH102-6	5/16(7.938)
-5	5/32(3.969)	5/64 (1.984)	HLH101-21	HLH102-6	5/16(7.938)
-6	3/16(4.763)	5/64 (1.984)	HLH101-21	HLH102-6	5/16(7.938)
-8	1/4 (6.350)	3/32 (2.381)	HLH101-21	HLH102-8	11/32(8.731)
-10	5/16(7.938)	1/8 (3.175)	HLH101-23	HLH102-10	7/16(11.113)
-12	3/8 (9.525)	5/32 (3.969)	HLH101-23	HLH102-12	1/2(12.700)

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Table 202 Manual Installation Tooling (Continued)

Dash No.	Nom. Dia.	Allen Wrench	Ratchet Wrench	Socket	Socket Hex Size
	Inches (mm)	Inches (mm)			Inches (mm)
NOTE: If ratchet type tools are not available, use allen wrench for the wrenching cavity and an open end wrench or equivalent for the collar.					

(2) Remove collar by turning counterclockwise with pliers, vise grips, or equivalent.

(3) Tap pin out of hole with nonmetallic faced mallet.

B. Install Fastener

(1) Prepare holes for fasteners as follows:

(a) Drill holes perpendicular 90(±1/2) degrees to surface of material unless otherwise specified.

(b) Remove burrs from all final hole edges.

(c) Break hole edges adjacent to head maximum of 0.030 inch

1) 76 mm) to allow full head seating for protruding head pins.

(2) Drive new pin into hole until head is seated using nonmetallic faced mallet or hammer.

NOTE: Observe dissimiliar metal protection.

(3) Measure total material thickness in which fastener is to be installed and if pin length is incorrect substitute as necessary.

(4) Screw new collar on pin, minimum of two threads.

NOTE: Collars should not be reused. Collar should be replaced with same part number as original. Pins may be reused providing that finish has not been marred and threads and wrenching cavity are in good condition.

(5) Use special ratchet and socket to screw on collar while holding pin with allen wrench. (Table 202)

(6) Continue turning collar clockwise until wrenching device shears from collar.

NOTE: The point at which device shears will provide proper torque for the Hi-Lok fastener installation.

(7) When self-locking nuts and flat washers are installed on Hi-Lok pins, drive into hole until head is seated and install washers as necessary to assure nut will not bottom on shank.

NOTE: Total number of washers on nut side must not exceed two .064 (.015 mm) washers.

(8) Minimum pin protrusion through self-locking nut shall be full chamfer of pin.

C. Combined Pin and Collar Designation

Table 203 EXAMPLE:

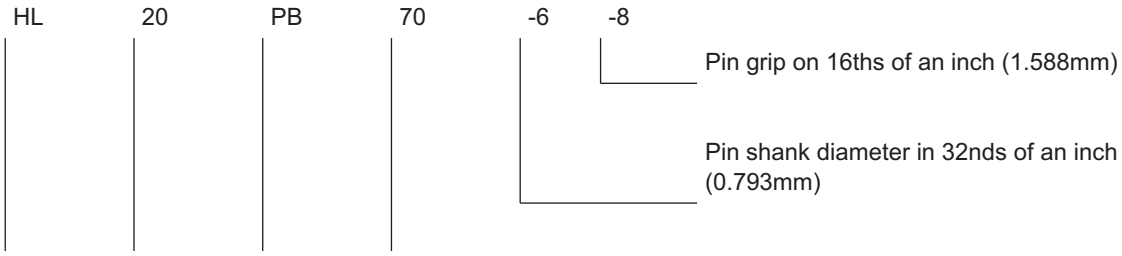

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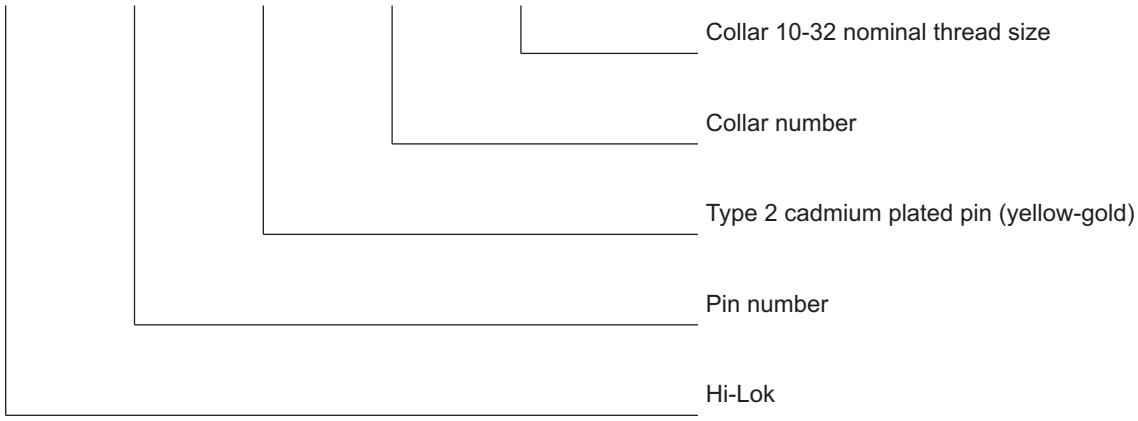
Table 203 EXAMPLE: (Continued)



NOTE: On protruding head Hi-Lok pins, to facilitate assembly of parts, Hi-Lok pins with collars or nuts may be reversed to eliminate interference with other parts. To further aid assembly, NAS 679A nuts with NAS 1252 washers may be substituted for Hi-Lok collars, except on tapered surfaces, window installations, assembly interference areas, or in special applications such as areas where temperatures exceed 232.2°C(450°F). tool clearances will not permit use of NAS 679A nut, an H16 or LH 3849 nut may be substituted.

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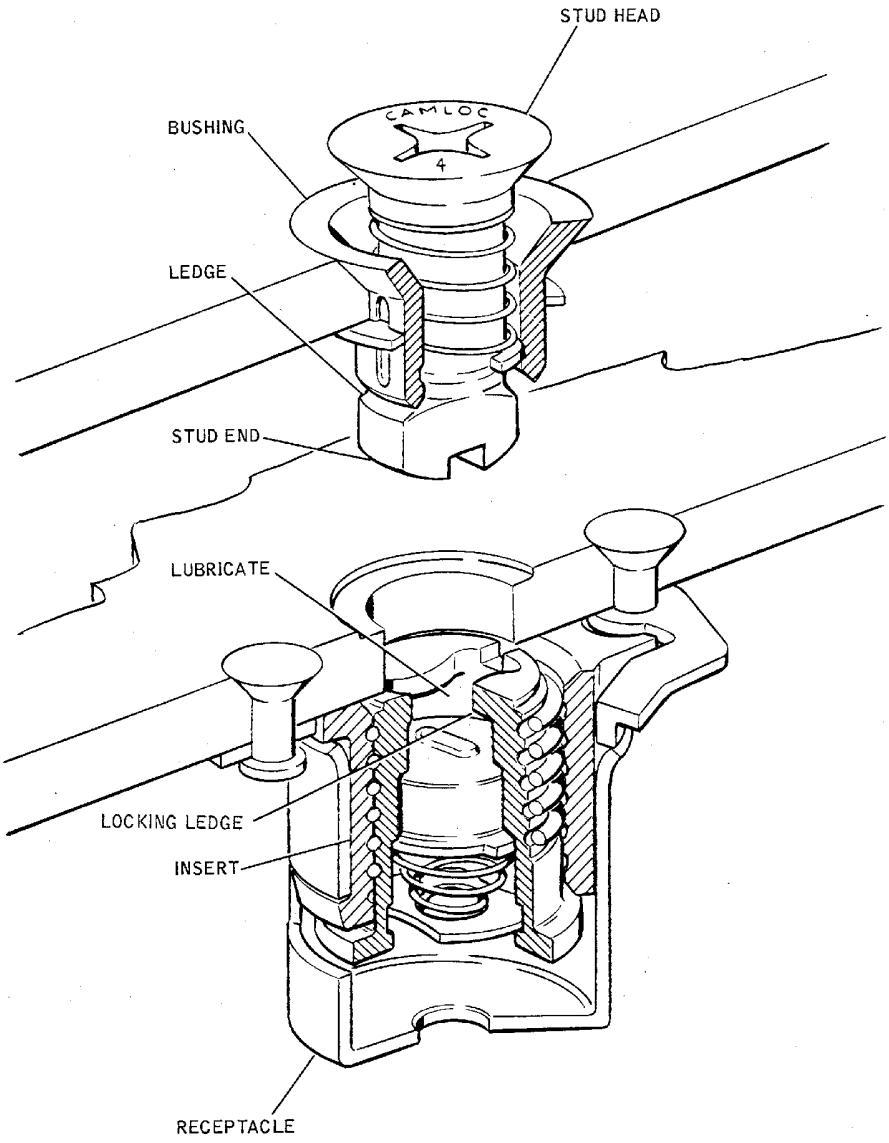

Camloc Stress Panel Fasteners
Figure 201/20-10-15-990-801

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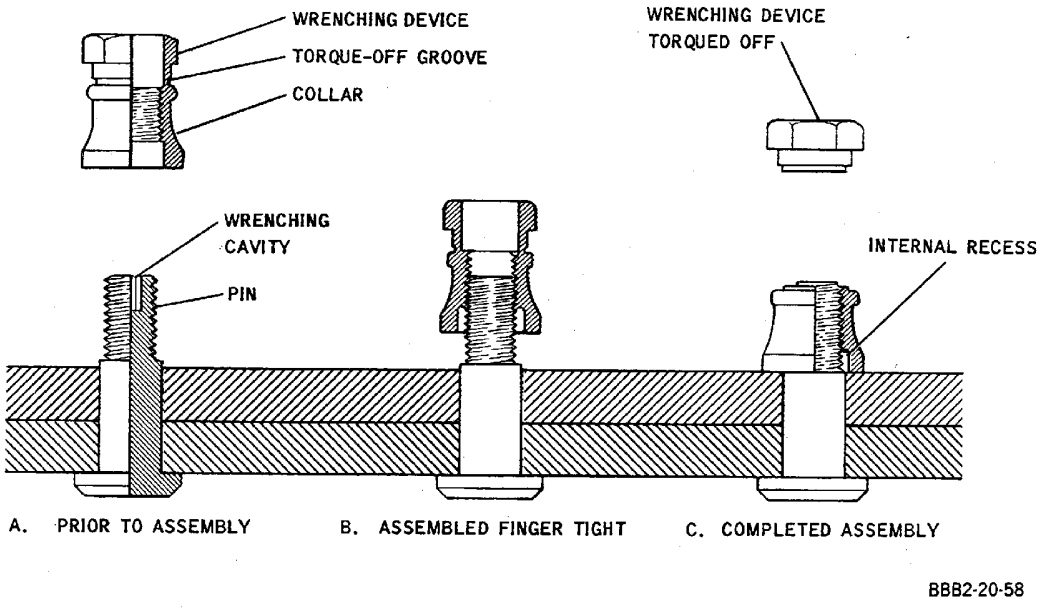

Hi-Lok Pin and Collar
Figure 202/20-10-15-990-802

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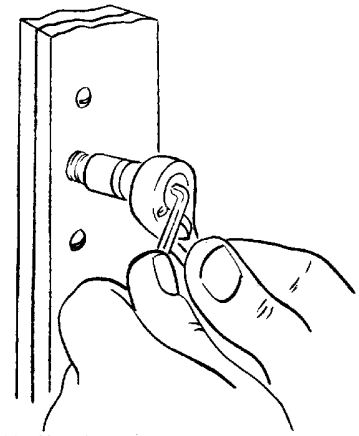
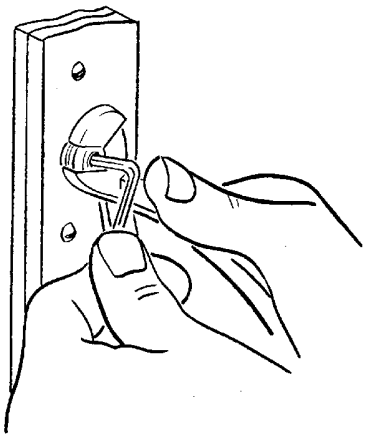
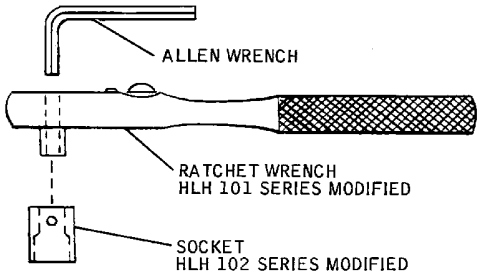


TYPICAL INSTALLATION PROCEDURE

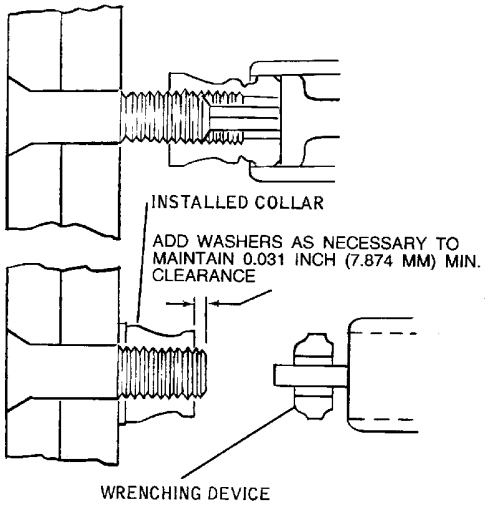


TYPICAL REMOVAL PROCEDURE



MANUAL INSTALLATION TOOL NO. HLH110-6

ALTERNATE REMOVAL TOOLS FOR HL586-6 COLLAR:
ALLEN WRENCH – 5/64 INCH (1.984 MM)
RATCHET – 1/4 INCH (6.350 MM) DRIVE (MODIFIED)
SOCKET – 9/32 INCH (7.144 MM) (MUST BE SLIGHTLY ELLIPTICAL TO BE EFFECTIVE)



TYPICAL INSTALLATION

BBB2-20-59B

Hi-Lok Fastener -- Removal/Installation
Figure 203/20-10-15-990-803

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HONEYCOMB PANEL - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides instructions for honeycomb panel check, sealing, and top coat protection.

B. It is difficult to completely seal a honeycomb bonded panel against environmental conditions experienced throughout the world. Even though the design and initial sealing of bonded panels does not allow for moisture or other contaminants to come in contact with the core, in actual service this is not generally true. Fabrication methods and initial installation practices may allow minute leak paths to be present in some panels. Also, completely sealed panels may develop leak paths due to imposed flight load flexing. This seal deterioration allows moisture to penetrate the adhesive bond line.

C. Progression of the moisture along the bond line causes a leak path into the core area which now allows the bonded panel to breathe or act as a vacuum pump. As the aircraft climbs to altitude and holds during cruise, the core inner chambers tend to equalize the pressure between outside altitude pressure and the inner panel pressure through the leak paths. During descent and landings, the induced lower pressure of altitude in the core area now becomes a vacuum chamber which pulls the denser air into the panel's inner chamber. When the panel is exposed to high humidity conditions on the ground, this moisture-laden air is sucked into the inner core area until water globules are formed within the manufacturing voids. Continuous operation of the aircraft with leak paths increases the amount of water until the water mass is capable of causing core damage from freezing. In some adhesive bond systems absorption of water can occur within the adhesive which allows loss of the original peel strength. Disintegration of the core from corrosion usually occurs when exposed to water for extended periods. Bonded panels using synthetic fabric core, such as the trade name "Nomex", do not corrode but have the capability of water absorption which may increase the weight of the unit as much as eight percent of the total core weight.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of following listed items.

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Brush, small	
Brush, stiff fiber or nylon	
Cleaner, Hand Wipe, Brulin MP 1793, DPM 6380-1	Brulin Company, Inc. Richmond, CA
Cleaner, Hand Wipe, EPA 2000, DPM 6380-2 or Cleaner/Solvent, handwipe, bulk, DPM 6380-4	DPM 6380-2 is superseded by DPM 6380-4, however the DPM 6380-2 can be used until supplies are depleted. Contec, Inc., Spartanburg, SC
Cleaner, Hand Wipe, PF Degreaser, DPM 6380-3	P-T Technologies, Inc. Safety Harbor, FL
Cloth, cotton	
Impact resistant primer, 515 x 336 with catalyst 710 x 458 DMS 2144	Courtaulds Aerospace Inc.

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Table 201 (Continued)

Name and Number	Manufacturer
Pad, abrasive nylon web, very fine grit, Scotch-Brite, aluminum oxide	
Paper, heavy	
Paper, poly ethylene coated	
Polyurethane top coat, impact resistant, gray No. 822-T-203 DMS 2143-1	Courtaulds Aerospace Inc.
Sandpaper, 400 grit abrasive	
Scraper, non metallic	
Sealant, aluminized, Pro-Seal 735 DMS 1819	
Sealant, PR 1422B-2 DMS 2082	
Sealant, PR 1431G DMS 2013	
Source of clean, dry compressed air	
Spatula	
Tac-rag	
Tape, poly ethylene coated	
Wipers, cotton, select white	

3. **Honeycomb Panel**

A. Check

(1) Maintaining sealing of bonded panels is probably best preventive measure available to preclude costly repairs or replacement. Following step-by-step procedure is recommended at normal maintenance checks to insure proper sealing of all bonded panels.

(a) At maintenance checks perform visual check of all honey-comb bonded panels, checking for butt and gap sealant condition along all exposed edges. Also, check condition of fillet sealant on all fittings attached to bonded panels.

NOTE: During this check, close observation of damage to the panels should be accomplished and any observed deformities should be marked and checked for delamination.

(b) If sealant is found missing or deteriorated, sealant should be replaced at the time of discovery.

B. Sealing

(1) Following should be accomplished any time check reveals missing sealant or any time panel is replaced.

(a) Protect area adjacent to defective sealant by covering with heavy paper.

(b) Remove sealant using non-metallic scraper and stiff brush.

(c) Taper both ends of existing good sealant to ensure minimum of 1/2 inch (12.7 mm) overlap of new sealant. Roughen overlap area to aid in adhesion of new sealant.

NOTE: If sealant is missing from over one-third the length of the bonded panel, remove sealant from complete length of the panel.

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(d) Before application of sealant, clean repair area with cleaner. Use stiff fiber or nylon brush in gap area between skin panels and wipe up excess cleaner immediately.

(e) Wipe area dry with clean cloth before cleaner dries.

(f) Continue cleaning process until area is clean.

WARNING: SOLVENT IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN SOLVENT IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: LOW VISCOSITY POLYSULFIDE SEALANT IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN LOW VISCOSITY POLYSULFIDE SEALANT IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET LOW VISCOSITY POLYSULFIDE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, A SENSITIZER, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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- DO NOT BREATHE THE GAS.

WARNING: HANDWIPE CLEANER/SOLVENT IS AN AGENT THAT IS FLAMMABLE AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER/SOLVENT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER/SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(g) If sealant is removed from complete edge of bonded panel, carefully apply FR primer to exposed edge with small brush, avoiding puddles. After primer has dried, clean area with cloth moistened with hand wipe cleaner.

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(h) Apply PR 1422B-2 sealant along seam in short increments. Work applied sealant with spatula to fill all voids and eliminate air bubbles.

NOTE: In areas that are not painted and appearance is a factor Pro-Seal 735 may be used in lieu of PR 1422B-2.

(i) If bonded panels have been removed for repair, apply PR 1422B-2/PR 1431G sealant to attachment countersink holes with brush before installing attachments. Wipe surface clean after installation.

NOTE: Care should be used not to over-drive rivets during installation. This may damage bond line or edge seal.

(j) Apply complete faying surface seal of PR 1422B-2/PR 1431G sealant between panel sills and any supporting structure.

C. Topcoat Protection

NOTE: The aircraft trailing edge units, spoilers, and flap vanes have been topcoated in many areas for corrosion protection. This corrosion protection has been deter-mined to have a secondary effect of protecting the adhesive bond line from moisture penetration. Therefore, operators should maintain the paint system now provided to assure an extended service life. Whenever honeycomb bonded panels are repaired, the polyurethane coating should be reconditioned or the repair area repainted.

(1) For previous top coated panel paint rejuvenation, proceed as follows:

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- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(a) Clean complete unit with hand wipe cleaner and wipe dry.

(b) Check complete unit for paint deterioration and depending upon area involved, completely repaint or touch up area.

(c) Tape area not to be painted using polyethylene masking tape and polyethylene coated paper.

(d) Scuff sand to remove all nibs, orange peel, etc., with 400 grit abrasive paper.

CAUTION: USE CARE AROUND RIVETS NOT TO REMOVE PRIMER.

(e) Cross sand entire area with nylon abrasive pad to achieve a matte surface.

(f) Remove sanding residue with oil free compressed air while lightly wiping surface with cotton cloth.

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WARNING: IMPACT RESISTANT PRIMER IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AN IRRITANT, AND AN ASPHYXIANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN IMPACT RESISTANT PRIMER IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET IMPACT RESISTANT PRIMER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: IMPACT RESISTANT TOPCOAT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN IMPACT RESISTANT TOPCOAT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET IMPACT RESISTANT TOPCOAT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

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- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(g) Just prior to painting, wipe entire area lightly with tac-rag and apply impact resistant primer, if removed by rework, and polyurethane topcoat, impact resistant, gray No. 822-T-203 available from Courtaulds Aerospace Inc.

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CONTROL CABLES, SEALS, PULLEYS, AND PULLEY GUARD PINS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides check, wear tolerance, cleaning, and application of corrosion preventive compound instructions for control cables. Rigging procedures and adjustments for specific systems, including identification of cables by segment number and function, are covered in the applicable chapter of the maintenance manual.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Cleaning solvent, P-D-680, Type 1 DPM 518	
Cleaner, Hand Wipe, Brulin MP 1793, DPM 6380-1	Brulin Company, Inc. Richmond, CA
Cleaner, Hand Wipe, EPA 2000, DPM 6380-2 or Cleaner/Solvent, handwipe, bulk, DPM 6380-4	DPM 6380-2 is superseded by DPM 6380-4, however the DPM 6380-2 can be used until supplies are depleted. Contec, Inc., Spartanburg, SC
Cleaner, Hand Wipe, PF Degreaser, DPM 6380-3	P-T Technologies, Inc. Safety Harbor, FL
Compound, corrosion preventive MIL-C-16173, Grade 4 DPM 667-1	Castrol, Inc. Bray Products Div. Irvine, CA
Compound, corrosion preventive, D-5035 DPM 5217	ZIP-Chem Products, North Hollywood, Calif.
Phenolic tubing MIL-P-79, Type FBM, Form TR	Commercially Available
Sandpaper 320 grit abrasive	Commercially Available
Sealant PR1422 DPM 6142	Products Research Co.
Varnish-Fungicide (MIL-V-173) DPM 499	Commercially Available
Compound, DC-33 DPM 348	Dow Corning Midland, MI
Nylon utility cord 3/32 inch diameter, DPM 5349-1 or equivalent	Commercially Available

3. Check Cable Pulleys, Guide Pins, Brackets, and Fairleads

A. Check Cable Pulleys, Guide Pins, Brackets, and Fairleads

NOTE: Occasionally, surface protective coating has to be removed from cables to perform a thorough check. Cables must be lubricated immediately after the check is completed.

(1) Check security and condition of all pulley brackets.

(2) Check that all pulley guard pins are in place. (Paragraph 10.)

(3) Check for broken or cracked pulleys and pulley flanges, and replace any that are damaged.

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(4) Check that all cotter pins are securely installed.

(5) Examine fairlead grommets and rubstrips, and replace any that are damaged or worn.

(6) Examine all firewall fairlead grommets and check for proper alignment and security to prevent cable wear. Grommets should be rigidly clamped in retainer after some cable tension is applied and should not be allowed to swivel or rotate.

(7) Check that all turnbuckles are properly safetied.

4. Cable Wear Tolerance

A. These procedures must be performed along the entire cable run in each system.

(1) To ensure verification of the portions of the cables that are in contact with pulleys and quadrants, the control cables must be moved by operation of the applicable system controls, to expose those portions of the cables.

B. Examine control cables for broken wires. Cable passing around pulley will weaken from fatigue caused by bending, internal friction, and wearing of wires passing over one another.

NOTE: A cloth should be run over cables suspected of fraying; cloth will snag on broken ends of wire. Visual inspection should also be performed to check for wires that may be fractured, but remain in the lay of the cable, and are not snagged by the cloth.

C. Check for fraying of cables in vicinity of pulleys and fairleads. Examine cable for broken wires by running cloth over cable. Cloth is used to prevent injury to hands. Rust, dust, or dirt at point of operation tends to shorten life of cable. When cables are dry, treat with corrosion preventive compound (Paragraph 6.). Before installing new cable, place cable in hydraulic jack, preloaded to 60 percent of rated strength, three times, and hold for 15 seconds at this tension each time to prevent excessive cable stretching and proof loading of end fittings.

NOTE: Cables supplied by Douglas Aircraft Company have been pre-stretched and this operation will not be necessary.

(1) Any 7 x 19, 6 x 31, or 7 x 31 control cable that has three broken wires or less per inch per strand, provided that not more than six broken wires exist in one inch (25.4 mm) running length shall be considered serviceable. Any 7 x 7 control cable that has two broken wires or less per strand per inch (25.4 mm) provided that not more than three broken wires exist in one inch (25.4 mm) running length shall be considered serviceable. Maximum number of broken wires shall not occur in any two consecutive inches (50.8 mm) of cable. If maximum number of wires in one inch (25.4 mm) of cable, as noted above are broken; none would be allowed in next consecutive inch (25.4 mm).

(2) Assemblies shall be examined, and those with frayed or severely kinked strands shall be unacceptable. A kink in the cable which can be worked out with finger manipulation, with no resultant broken or separated strands, however, is acceptable.

(3) Only 1/16 and 3/32 inch diameter terminals which become inadvertently bent to an angle not greater than 30 degrees may be straightened. Straightening shall be by finger manipulation.

(4) Critical fatigue area is working length of cable, therefore, when broken wire appears in this area tension should be released and cable checked for defects. Any cable not within above limits is unserviceable and must be replaced.

(5) Replace cable which is worn to point that material reduction at any cross section is in excess of, area of six wires for 7 x 19, 6 x 31, or 7 x 31 cable per inch (25.4 mm), or three wires for 7 x 7 per inch (25.4 mm).

NOTE: Cross section wear halfway through 12 wires per inch is equivalent to 6 broken wires in 7 x 19, 6 x 31, or 7 x 31 cable; and half-way through 6 wires is equivalent to 3 broken wires in 7 x 7 cables.

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Example: A 7 x 19, 6 x 31, or 7 x 31 cable is worn to the point where material reduction of a cross section is equivalent to six wires in one inch (25.4 mm) and not more than the equivalent of 3 broken wires in one strand, and one wire is broken in the worn area. The cable should be replaced since the total area of worn wires and the broken wire are in excess of six wires. Any wire worn more than half through is considered a broken wire.

(6) Any 1 x 19 non-flexible cable that has more than one broken wire within a length of 10 ft (3.048 m) or having a broken wire in an area that goes through a fairlead, should be replaced. Single wire worn more than 60 percent of diameter is classed as broken wire.

5. Cleaning Cables

A. Clean Cable

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- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, A REDUCER, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: HANDWIPE CLEANER/SOLVENT IS AN AGENT THAT IS FLAMMABLE AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER/SOLVENT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER/SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: MIL-PRF-680 TYPE 1 SOLVENT IS AN AGENT THAT IS FLAMMABLE AND POISONOUS. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN MIL-PRF-680 TYPE 1 SOLVENT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET MIL-PRF-680 TYPE 1 SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: CORROSION PREVENTATIVE IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN CORROSION PREVENTATIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION PREVENTATIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

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(WARNING PRECEDES)

CAUTION: DO NOT SATURATE CONTROL CABLES WITH CLEANING SOLVENT, SOLVENT PENETRATION TO CABLE CORE DESTROYS CABLE LUBRICANT PERMITTING CORROSION AND RAPID WEAR.

(1) Check surface of control cable for evidence of rust, corrosion, or lack of protective coating. Clean such areas with a clean cloth moisten with handwipe cleaner, Federal Specification P-D-680, Type 1. Do not saturate cloth or cables with solvent since solvent penetration to cable core washes out lubricant and permits rapid wear and corrosion. Wipe cable dry, and touch up by brushing on corrosion preventive compound, Braycote 194, Grade 4 or spray with D-5035 (Aerosol Can). Do not apply to quick disconnect fittings. (Paragraph 6.)

(a) To remind operators of unfavorable results that occur with misuse of cleaning solvents, glycol, detergents, and high water pressure during maintenance of aircraft.

1) Corrosion preventive compound (MIL-C-16173, Grade 4 or D-5035) should be used on flight control cables for prevention of corrosion. Corrosion preventive compound is not an everlasting product; therefore, it must be applied periodically for best results. (Paragraph 6.)

CAUTION: USE CLEANING SOLVENT SPARINGLY WHEN CLEANING CABLES. SOLVENT PENETRATION TO CABLE CORE DESTROYS CABLE LUBRICANT PERMITTING CORROSION AND RAPID WEAR. ALLOW SOLVENT TO DRY THOROUGHLY BEFORE APPLYING CORROSION PREVENTIVE COMPOUND TO CABLES.

2) Corrosion preventive compound will dissolve in solvent and deteriorate in glycol or detergents. When these compounds are used heavily or under pressure, cables should be covered. Once lubrication compound is washed from core of cable, it cannot be replaced. Corrosion preventive compound is applied only to outside surface and can be replaced. Lubrication compound is applied at time of wire rope manufacture and cannot be replaced by dipping.

6. Application of Corrosion Preventive Compound

A. Apply Compound

(1) Areas of treated cable which require further fabrication or cleaning before, during, or after installation, shall have protective coating reapplied as follows:

(a) Wipe portion of cable to be coated with clean dry cloth to obtain clean, tack-free surface.

WARNING: MIL-PRF-680 TYPE 1 SOLVENT IS AN AGENT THAT IS FLAMMABLE AND POISONOUS. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN MIL-PRF-680 TYPE 1 SOLVENT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET MIL-PRF-680 TYPE 1 SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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WARNING: CORROSION PREVENTATIVE IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN CORROSION PREVENTATIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION PREVENTATIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

CAUTION: DO NOT APPLY PROTECTIVE COMPOUND TO CABLE QUICK-DISCONNECT FITTINGS.

(b) Apply thin drip-free film of corrosion preventive compound, Braycote 194 (MIL-C-16173, Grade 4) using clean brush, or spray with corrosion preventive compound D-5035.

(c) To ensure proper treatment of cables in pulley area, actuate system from one extreme position to other and recoat cables at pulley contact points if necessary.

(d) Corrosion preventive compound coating shall have following visual characteristics:

1) Valleys between strands shall have a dark line at base of valley.

2) All other surfaces shall have pronounced amber color. Metallic sheen of uncoated cable shall have been dulled by coating.

3) Buildup of coating thickness, dripping, or sagging of coating to extent that cable construction form cannot be seen is not acceptable.

4) Within pressurized fuselage area(s), installed cables may be checked for coating coverage utilizing ultraviolet light, in which case cables shall have uniform green fluorescent color.

(e) Avoid excessive buildup of corrosion preventive compound at fairleads, grommets, and pressure seals, as this increases cable friction forces.

7. Approved Repairs Control Cable Nylon Coating

A. Remove Damaged Nylon Coating Segment

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CAUTION: FOLLOWING PROCEDURE IS USED FOR REPAIR OF DAMAGED NYLON COATING ON NYLON COATED CABLES.

(1) Remove damaged nylon coating from nylon coated flap bus or nosewheel steering cables as follows:

NOTE: This procedure is applicable only to nylon coated cables in the flap bus system and nosewheel steering system. There are other applications of nylon coated cable in which operation with bare cable may involve significant risk of unsatisfactory consequences.

CAUTION: EXTREME CARE MUST BE EXERCISED WHEN CUTTING NYLON COAT TO PREVENT CUTTING OR NICKING CABLE.

(a) Using sharp instrument, carefully cut groove in nylon coating sufficient distance each side of damaged area to preclude transition between bare and nylon coated cable over pulleys, through fairleads, through pressure seals, and cable guides.

(b) Carefully cut slit along length of nylon coating, between grooves cut in Paragraph 7.A.(1)(a), to be removed and strip damaged nylon coat from cable.

(c) Clean exposed cable with clean dry cloth.

(d) Check cable for wear. (Paragraph 4.)

(e) Apply corrosion preventive compound to exposed cable. (Paragraph 6.)

NOTE: If the nylon coating is removed, use the tensiometer riser and tensiometer calibration card corresponding to the outside diameter of the cable where tension reading is taken.

Example - Nylon coating installed - A 3/16 inch diameter cable with a 1/32 inch nylon coating equals 1/4 inch. Use tensiometer riser and tensiometer calibration card for a 1/4 inch cable. The tension table corresponds to the correct tension for the actual diameter of the steel cable.

Example - Nylon coating removed - A 3/16 inch diameter cable with a 1/32 inch nylon coating removed, use tensiometer riser and tensiometer calibration card for a 3/16 inch cable. The tension table corresponds to the correct tension for the actual diameter of the steel cable.

(f) Check cable tension after repair, (PAGEBLOCK 27-50-00/501) if nylon coated flap bus cable was repaired, (PAGEBLOCK 32-51-00/201) if nylon coated nosewheel steering cable was repaired.

(g) Operate nosewheel steering system (PAGEBLOCK 32-51-00/201) or flap system (PAGEBLOCK 27-50-00/501), as applicable, through complete cycle several times and check that remaining nylon coat on cable does not snag and bunch up on pulleys, through fairleads, pressure seals, or on cable guides.

8. Application of Ice Preventative Compound to Control Cables

CAUTION: THE LUBRICANT APPLIED HERE IS A SILICONE BASED COMPOUND, THEREFORE CARE MUST BE TAKEN TO PREVENT CONTAMINATION OF A PAINTED AREA TO BE BONDED.

A. Apply Compound

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WARNING: SILICONE GREASE LUBRICANT IS AN AGENT THAT IS A LOW HAZARD. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN SILICONE GREASE LUBRICANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE GREASE LUBRICANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.

WARNING: CORROSION PREVENTATIVE IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN CORROSION PREVENTATIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION PREVENTATIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Remove as much corrosion preventive compound as possible from area to be coated, with a clean dry cloth. Solvents must not be used because solvents penetrate into strands and disperse internal lubricant.

(2) Apply compound sparingly, with a small brush such as an acid brush, through pressure seal and/or grommets along the wing rear spar and wheel well areas. Brush compound a distance of four inches (101.6mm) on each side of pressure seals and/or grommets.

NOTE: DC-33 compound is used to prevent ice from adhering to cables.

(3) Cycle applicable control systems full travel five times and wipe off any excess compound from cables and grommets.

B. Remove Compound

(1) Remove compound from painted surfaces or surfaces to be bonded, as follows:

(a) Remove as much compound as possible by dry wiping.

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- USE IN AN AREA OPEN TO THE AIR.
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- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

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- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(b) Clean with an approved hand wipe cleaner and clean cotton cloth.

(c) Wet sand with 320 abrasive paper to a dull matte finish.

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- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
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(d) Clean with an approved hand wipe cleaner and clean cotton cloth.

(e) Thoroughly rinse area with tap water and dry at room temperature.

(f) Check for a water-break free surface during the final rinse. If a water-break free surface is not produced the first time, do the cleaning operation starting with the wet sanding again then check for water-break free surface.

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9. Removal/Installation - Control Cable Pressure Seals

NOTE: Control cable pressure seals are used where control cables route from a pressurized to a nonpressurized area. The seals are molded of synthetic or silicone rubber. The silicone rubber seals are less susceptible to damage caused by bushing popout, cleaning abuse, and aging. When replacement is necessary, the damaged seal should be replaced with a silicone rubber seal. The control cable pressure seal bushings do not require lubrication. The bushings are made of nylon impregnated with molybdenum disulfide.

A. Remove Seal

(1) Gain access to control cable turnbuckles nearest control cable pressure seal to be replaced.

(2) Make certain that all affected controls systems are in position as prescribed in Chapter 26, 27, 71, 76, as applicable.

(3) Disconnect cables that route through seals to be replaced.

(4) Pull cable from seals. Bushings will come out as cable is removed. Identify each cable as it is pulled from seal, and carefully coil cable and set aside.

(5) Remove bolts, nuts, and washers that secure cover, seal, and plate to aircraft structure. (Figure 201)

NOTE: Bolts and face of cover should be cleaned of all sealant before installation.

B. Install Seal

(1) Check cables for damage.

(2) Install plate, silicone rubber seal, and cover. (Figure 201)

CAUTION: ALL TEMPORARY CABLE MARKERS MUST BE REMOVED.

(3) Route cables through correct seal nipples and join cable turnbuckles.

(4) Place bushing halves on cable and press bushing into seal nipple. Make certain bushing is properly seated in seal nipple.

(5) Adjust cable turnbuckles to obtain standard rig. (FIRE PROTECTION, CHAPTER 26) (FLIGHT CONTROLS, CHAPTER 27) (POWER PLANT, CHAPTER 71) (ENGINE CONTROLS, CHAPTER 76)

NOTE: Cable must slide freely and be centered in bushing.

(6) Tighten pressure seal attaching bolts only until silicone rubber seal shows signs of compression.

(7) Check cable systems for fairlead alignment, excessive pulloff at pulleys, seized bearings, and cables rubbing at cutouts.

WARNING: SEALING COMPOUND (POLYSULFIDE SEALANT B1/2 AND B2) IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN SEALING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SEALING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(8) Seal bolts with PR1422 (Products Research Co.) sealant.

(9) Perform system checks.

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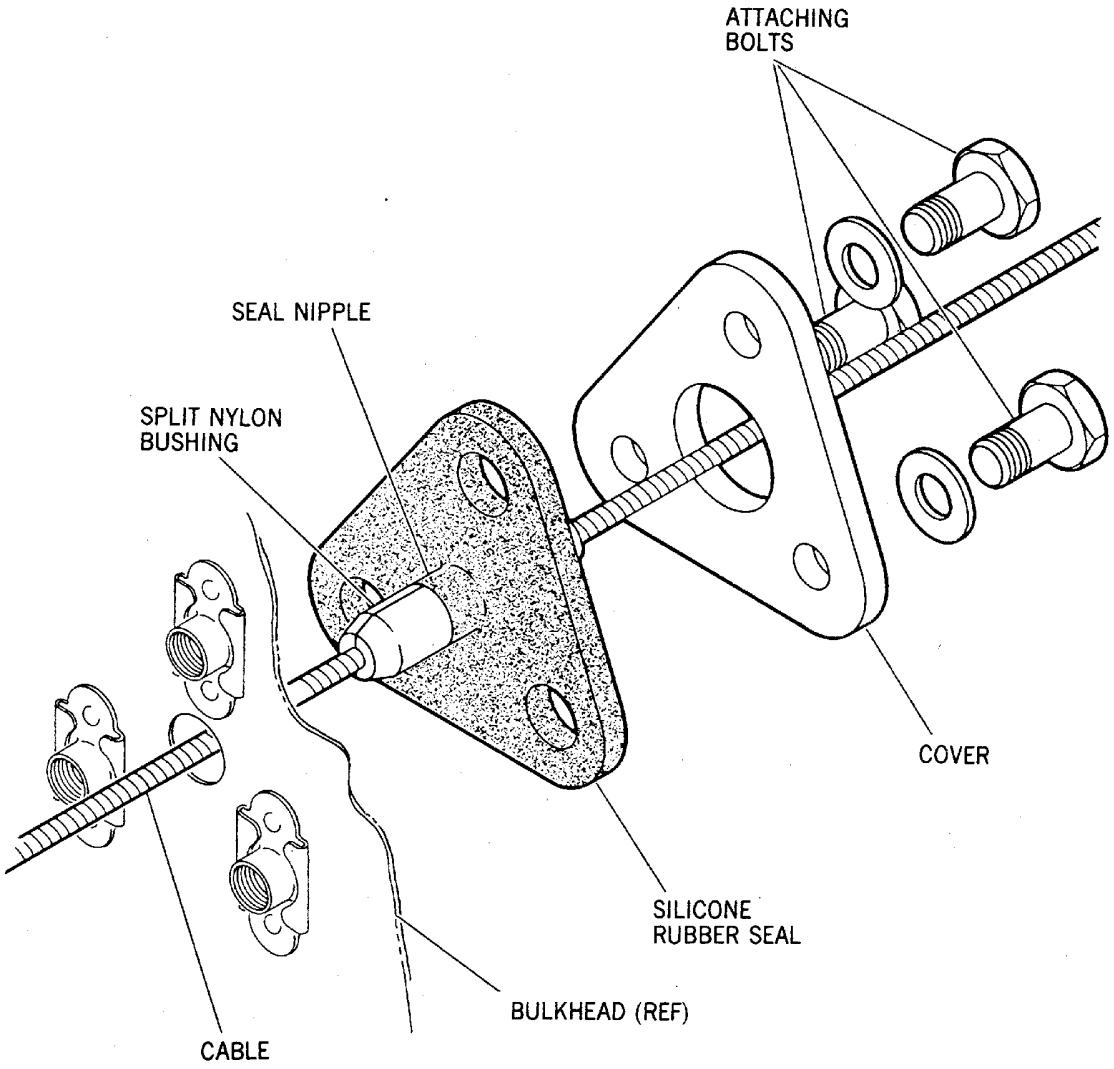

Control Cable Pressure Seals -- Removal/Installation
Figure 201/20-10-17-990-801

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10. Pulley Guard Pin

A. Using Pulley Guard Pins

(1) Pulley guard pins one grip length longer or shorter can be substituted when grip length called out will not permit full engagement of pin tongue for "K" and "T" type pins, or when a shorter pin would permit correct pin tongue engagement. Correct pin tongue engagement occurs when 0.032 inch (0.79 mm) radius between tongue and pin body is completely clear of pulley bracket face. (Figure 202)

(2) For "W" type pulley guard pin, grip length substitution per Paragraph 10.A.(1) is acceptable if guard pin is too short to install cotter pin or when shorter guard pin would permit correct cotter pin installation. When shortage of "W" type guard pin exists, it is permissible to cut off longer "W" type guard pin, chamfer end and drill cotter pin hole to required dimension. (Figure 202)

B. Rework of Pulley Guard Pins

(1) Prepare bushing using 3/16 inch (4.76 mm) ID laminated varnished phenolic tubing (MIL-P-79, Type FBM, Form TR).

NOTE: Tubing OD will vary with clearance requirements. Tubing wall thickness shall not be less than 0.020 inch (0.51 mm).

NOTE: Rework is to be accomplished only on installed brackets.

WARNING: FUNGICIDE VARNISH IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN FUNGICIDE VARNISH IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET FUNGICIDE VARNISH IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(2) Bushing can be installed stock size or turned to wall thickness that will allow gap between pulley/sector/drum and guard pin within tolerances. (Paragraph 10.B.(4)) If bushing is turned or cut, treat bushing with moisture and fungus resistant varnish (MIL-V-173).

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WARNING: SEALING COMPOUND (POLYSULFIDE SEALANT B1/2 AND B2) IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN SEALING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SEALING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(3) Cement bushing to guard pin with PR-1422 sealant.

(4) After installation of bushing, gap between guard pin/bushing and flange of pulley/sector/drum should be minimum 0.010 inch (0.254 mm), maximum 1/2 cable diameter.

C. Removal of Reworked Pulley Guard Pins

(1) Guard pins with bushings cemented in place per Paragraph 10.B. may be removed by cutting or sawing pin from bracket. Method of removal will depend on access to guard pin.

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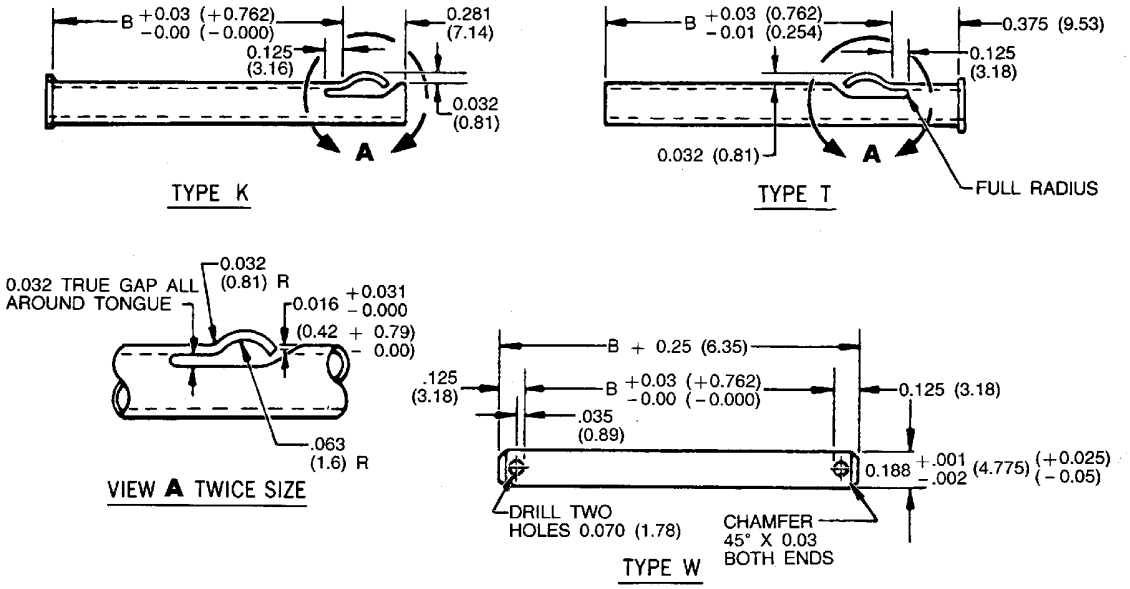

DASH NO.	LENGTH "B" IN.	(MM)	DASH NO.	LENGTH "B" IN.	(MM)	DASH NO.	LENGTH "B" IN.	(MM)	DASH NO.	LENGTH "B" IN.	(MM)	DASH NO.	LENGTH "B" IN.	(MM)
-6	0.38	(9.652)	-16	1.00	(25.400)	-26	1.62	(41.148)	-40	2.50	(63.500)	-60	3.75	(95.250)
-7	0.44	(11.176)	-17	1.06	(26.924)	-27	1.69	(46.926)	-42	2.62	(66.548)	-62	3.88	(98.552)
-8	0.50	(12.700)	-18	1.12	(28.448)	-28	1.75	(44.450)	-44	2.75	(69.850)	-64	4.00	(101.600)
-9	0.56	(14.224)	-19	1.19	(30.226)	-29	1.81	(45.974)	-46	2.88	(73.152)	-66	4.12	(104.648)
-10	0.62	(15.748)	-20	1.25	(31.750)	-30	1.88	(47.752)	-48	3.00	(76.200)	-68	4.25	(107.950)
-11	0.69	(17.526)	-21	1.31	(33.274)	-31	1.94	(49.276)	-50	3.12	(79.248)	-70	4.38	(111.252)
-12	0.75	(19.050)	-22	1.38	(35.052)	-32	2.00	(50.800)	-52	3.25	(82.550)	-72	4.50	(114.300)
-13	0.81	(20.574)	-23	1.44	(36.576)	-34	2.12	(53.848)	-54	3.38	(85.852)	-74	4.62	(117.348)
-14	0.88	(22.352)	-24	1.50	(38.100)	-36	2.25	(57.150)	-56	3.50	(88.900)	-76	4.75	(120.650)
-15	0.94	(23.876)	-25	1.56	(39.624)	-38	2.38	(60.452)	-58	3.62	(91.948)	-78	4.88	(123.952)
												-80	5.00	(127.000)

NOTE:

1. TYPE K AND T 0.016 1095 SHEET SPRING STEEL, TEMPERED SPEC. MIL-S-7947.
2. TYPE W 2024-T4 ALUMINUM ALLOY WIRE SPEC. QQ-A-268.
3. ADD "K", "T" OR "W" BEFORE DASH NUMBER TO INDICATE TYPE PIN DASH NUMBER INDICATES LENGTH "B" IN 1/16 INCH (1.59 MM) INCREMENTS (PER NAS 427).
4. NAS427K18-PIN TYPE K WITH GRIP LENGTH "B" OF 1.12 INCHES (28.45 MM)
5. DIMENSIONS ARE IN INCHES WITH MILLIMETERS IN PARENTHESIS.

BBB2-20-90B

Pulley Guard Pins
Figure 202/20-10-17-990-802

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11. Inspection of the Control Cable Pulleys

A. Check Pulleys. (Figure 203)

(1) Check pulleys for maximum allowable wear limits. (Table 202)

NOTE: Grooves in pulley tire from wire rope are allowed providing that the pulley meets the wear tolerances specified in Table 201.

Table 202 Maximum Allowable Pulley Wear Limits

Pulley Part Number	Maximum Groove Depth		Minimum Flange Thickness	
	Inch	(mm)	Inch	(mm)
APA 3-5-106	0.351	8.915	0.046	1.168
APA 3-5-77	0.289	7.341	0.046	1.168
APA 4-5-98	0.351	8.915	0.075	1.905
APA 4-6-106	0.351	8.915	0.075	1.905
APA 4-6-159	0.445	11.303	0.075	1.905
APA 5-6-132	0.414	10.516	0.070	1.778
APA 6-8-152	0.476	12.090	0.075	1.905
APM 2-5-54	0.226	5.740	0.109	2.769
APM 2-5-50	0.226	5.740	0.109	2.769
APM 3-10-68	0.289	7.341	0.112	2.845
APS 3-8-90	0.351	8.915	0.064	1.626
D4-250B	0.291	7.391	0.066	1.676
1969-130	0.411	10.439	0.067	1.702
1969-132	0.564	14.326	0.075	1.905
1969-134	0.406	10.312	0.070	1.778
1969-135/-139	0.437	11.100	0.070	1.778
1969-137	0.475	12.065	0.070	1.778
1969-143	0.563	14.300	0.075	1.905
1969-164	0.509	12.929	0.055	1.397
1969-231	0.475	12.065	0.070	1.778
D4-25TB	0.265	6.731	0.090	2.286
D7-50TA	0.395	10.033	0.090	2.286
MS20220-3	0.265	6.731	0.060	1.524
MS20221-3	0.327	8.306	0.060	1.524

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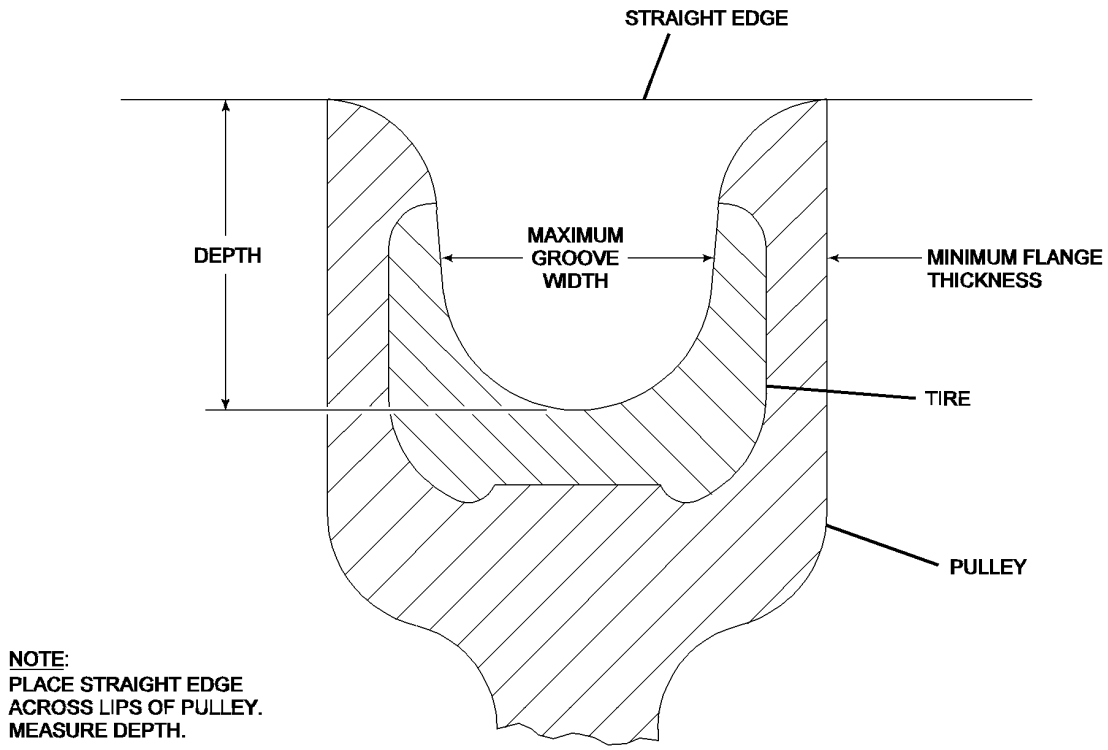

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Pulleys -- Wear Limits
Figure 203/20-10-17-990-803

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12. Removal/Installation - Control Cables

A. Removal/Installation

(1) Cable being removed can typically be used as guide for replacement cable.

(2) Gain access as required along length of cable being removed so that any items such as cable guards, fairlead grommets, and pressure seals that would prevent passage of cable fittings can be removed.

(3) Replacement cable can then be attached to cable being removed, which is used as it is extracted to pull replacement cable into place.

(4) If removed cable will not immediately be replaced, do following:

(a) Appropriate length of cord can be attached to cable and pulled into place as cable is extracted.

(b) Cord will assist in proper installation of replacement cable.

NOTE: A slight tension should be maintained on the cable or cord being installed to help prevent misrouting or snagging on adjacent components or structure.

(5) After installing replacement cable, rig and test affected system per applicable chapter procedures.

(6) Check affected cable run for following:

- Misrouting
- Interference conditions
- Freedom of travel throughout entire range of travel
- Foreign objects.

(7) Close or install removed cable access panels or covers.

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CONTROL CABLES - INSPECTION/CHECK

1. General

A. This procedure contains MSG-3 task card data.

TASK 20-10-17-211-801

2. Detailed Inspection of the Control Cables

NOTE: This procedure is a scheduled maintenance task.

A. Consumable Materials

NOTE: Equivalent replacements are permitted for the items that follow.

NOTE: It is possible that some materials in the Consumable Materials chart cannot be used for some or all of the necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Reference	Description	Specification
G60085	Cloth - Low Lint	MIL-C-24671

B. Detailed Inspection of the Control Cables

SUBTASK 20-10-17-211-001

(1) Inspect the control cables as follows:

NOTE: Occasionally, surface protective coating has to be removed from cables to perform a thorough check. Cables must be lubricated immediately after the check is completed.

(a) Check security and condition of all pulley brackets.

(b) Check that all pulley guard pins are in place.

(c) Check the control cable pulleys for broken or cracked pulleys and pulley flanges, and replace any that are damaged.

(d) Check that all cotter pins are securely installed.

(e) Examine fairlead grommets and rubstrips, and replace any that are damaged or worn.

(f) Examine all firewall fairlead grommets and check for proper alignment and security to prevent cable wear. Grommets should be rigidly clamped in retainer after some cable tension is applied and should not be allowed to swivel or rotate.

(g) Check that all turnbuckles are properly safetied.

SUBTASK 20-10-17-220-001

(2) Check the cable wear tolerances as follows:

(a) Inspect control cables for broken wires. Cable passing around pulley will weaken from fatigue caused by bending, internal friction, and wearing of wires passing over one another.

NOTE: A low lint cloth, G60085 should be run over cables suspected of fraying; cloth will snag on broken ends of wire. Visual inspection should also be performed to check for wires that may be fractured, but remain in the lay of the cable, and are not snagged by the cloth.

(b) Check for fraying of cables in vicinity of pulleys and fairleads. Examine cable for broken wires by running cloth over cable. Rust, dust, or dirt at point of operation tends to shorten life of cable.

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(c) If cables are dry, treat with corrosion preventive compound.

1) Any 7x19, 6x31, or 7x31 control cable that has 3 broken wires or less per in. per strand, provided that not more than 6 broken wires exist in 1 in. (25.4 mm) running length shall be considered serviceable. Any 7x7 control cable that has 2 broken wires or less per strand per in. (25.4 mm) provided that not more than 3 broken wires exist in 1 in. (25.4 mm) running length shall be considered serviceable. Maximum number of broken wires shall not occur in any 2 consecutive in. (50.8 mm) of cable. If maximum number of wires in 1 in. (25.4 mm) of cable, as noted above are broken; none would be allowed in next consecutive in. (25.4 mm).

2) Critical fatigue area is working length of cable, therefore, when broken wire appears in this area tension should be released and cable checked for defects. Any cable not within above limits is unserviceable and must be replaced.

3) Replace cable which is worn to point that material reduction at any cross section is in excess of, area of 6 wires for 7x19, 6x31, or 7x31 cable per in. (25.4 mm), or 3 wires for 7x7 per in. (25.4 mm).

NOTE: Cross section wear half-way through 12 wires per in. is equivalent to 6 broken wires in 7x19, 6x31, or 7x31 cable; and half-way through 6 wires is equivalent to 3 broken wires in 7x7 cables.

Example: A 7x19, 6x31, or 7x31 cable is worn to the point where material reduction of a cross section is equivalent to 6 wires in 1 in. (25.4 mm) and not more than the equivalent of 3 broken wires in 1 strand, and 1 wire is broken in the worn area. The cable should be replaced since the total area of worn wires and the broken wire are in excess of 6 wires. Any wire worn more than half through is considered a broken wire.

4) Any 1x19 non-flexible cable that has more than 1 broken wire within a length of 10 ft (3.047 m), or having a broken wire in an area that goes through a fairlead, should be replaced. Single wire worn more than 60 percent of diameter is classed as broken wire.

END OF TASK

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LOCKWIRE SAFETYING - MAINTENANCE PRACTICES

1. General

A. Lockwire is used to secure parts that have a tendency to loosen when subjected to continuous motion or vibration. Lockwire is inserted through holes in the parts, either as a single strand or twisted; then the wire ends are twisted into a pigtail. On emergency equipment, the lockwire size is such that the wire can be easily broken when it is necessary to use the equipment.

B. This section covers materials and procedures to be used when safetying with lockwire. These procedures describe safetying of nuts, bolts, turnbuckles, draincocks, electrical connectors, and lead or aluminum seals.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Lead seals, 3/8-inch (9.53 mm) diameter	Sylvester and Co. Cleveland, Ohio
Aluminum seals, 3/8-inch (9.53 mm) diameter	Sylvester and Co. Cleveland, Ohio
Parker-O-Lube DPM 5367	Parker Seal Co.
Compound, corrosion protection, MIL-C-11796B, Class 3, DPM 672	Not specified

3. Removal/Installation Lockwire

A. Lockwire - Alternate Materials

(1) An alternate lockwire material is permitted only as follows:

(a) The NASM20995C (CRES Lockwire) cannot be installed as an alternate to NASM20995N (Inconel Lockwire) in the areas that follow:

1) All uses in and on the Engine, Engine Nacelle and Pylon.

2) All uses in and on the engine to pylon, pylon to wing or pylon to fuselage areas.

3) All uses in APU compartment.

4) All uses in and on the Landing gear brakes.

(b) The NASM20995C (CRES Lockwire) can be installed as an alternate to NASM20995N (Inconel Lockwire) in all areas, systems, or components not listed in the above step.

Standard Lockwire Sizes

STANDARD LOCKWIRE SIZES	
DPM 684 INCONEL (NASM20995N) (INCHES)	**DPM 5865 *[1] CORROSION RESISTANT STEEL (NASM20995C) (INCHES)**
0.020	0.020
0.032	0.032

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Standard Lockwire Sizes (Continued)

STANDARD LOCKWIRE SIZES	
DPM 684 INCONEL (NASM20995N) (INCHES)	**DPM 5865 *[1] CORROSION RESISTANT STEEL (NASM20995C) (INCHES)**
0.040	0.041
0.051	0.047
0.091	0.091

*[1] Use Corrosion Resistant Steel (CRES) safety wire only where specified above.

B. Remove Lockwire

(1) Cut lockwire near ends with diagonal cutters.

CAUTION: NEVER ALLOW PIECES OF LOCKWIRE TO LIE ADRIFT INSIDE AIRPLANE OR IN ANY AREA WHERE WORK HAS BEEN PERFORMED. IF NECESSARY, USE VACUUM CLEANER OR MAGNET TO REMOVE PIECES.

(2) Remove lockwire. Make certain all pieces have been removed.

C. Install Lockwire

WARNING: DO NOT USE LOCKWIRE, SAFETY CABLES OR COTTER PINS IN THE FUEL TANKS OR FOR HARDWARE RETENTION OF COMPONENTS OR EQUIPMENT INSTALLED IN FUEL TANKS. STATIC DISCHARGES FROM THE LOCKWIRE, SAFETY CABLES OR COTTER PINS CAN CAUSE FIRES OR EXPLOSIONS. LOCKWIRE, SAFETY CABLES AND COTTER PINS CAN BE USED IF THEY ARE CONTAINED INSIDE THE HOUSING OF AN EXPLOSION PROOF, TANK MOUNTED COMPONENT, AND MUST BE INSTALLED ACCORDING TO THE APPLICABLE BOEING DESIGN, REPAIR AND MAINTENANCE DOCUMENTATION. THIS WILL HELP PREVENT INJURY TO PERSONS AND DAMAGE TO THE AIRCRAFT.

(1) The above warning is a Critical Design Configuration Control Limitation (CDCCL) procedure. For important information on CDCCLs, refer to Airworthiness Limitation Precautions (GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 28-00-00/201).

(2) Use only new wire of specified type, temper, and diameter. (Table 202)

(3) Handle lockwire during installation so that strands do not become kinked, nicked, scraped, or flattened. Avoid pulling wire around sharp corners, twisting wire excessively, or gripping wire too tightly with tools.

(4) Determine in which direction parts tighten. Install lockwire so that wire tends to tighten parts.

(5) Check that lockwire holes are exposed and that parts are properly tightened before safetying. Do not loosen parts or tighten beyond specified values to improve location of holes. Do not use or drill unspecified holes.

(6) Install lockwire and twist till tight. This will help prevent failure due to rubbing or vibrating. Do not over-stress lockwire.

(7) Cut off ends of lockwire with diagonal cutters, leaving 3 to 6 complete turns after loop. Never twist lockwire ends off with pliers. Do not allow cutoff ends to fall into parts being safetied.

(8) Bend pigtail in toward object being safetied, and in direction that will prevent possible injury to hands.

(9) Never reuse lockwire.

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Table 202 Soft Copper Lockwire Applications

Use	Wire Material	Wire Diameter Inches (mm)
Emergency Parts		
Exits, fire extinguisher, life raft, and release	Soft Copper	0.020 (0.508)
Emergency Switches		
Switches which may have to be operated by flight crews during abnormal operation	Soft Copper	0.020 (0.508)

4. Removal/Installation Single-wire Safetying

A. Install Single-wire Safetying

WARNING: SAFETYING OF CONTROLS WHICH OPERATE EMERGENCY EQUIPMENT WILL BE ACCOMPLISHED WHERE INADVERTENT OPERATION COULD CREATE A HAZARDOUS CONDITION. CARE SHALL BE EXERCISED TO ASSURE THAT SAFETYING THESE CONTROLS WILL NOT PREVENT EMERGENCY OPERATION OF EQUIPMENT. DO NOT USE SAFETY WIRE OF LARGER SIZE OR HIGHER TENSILE STRENGTH THAN SPECIFIED.

CAUTION: THE MAXIMUM AMOUNT OF UNITS IN A SERIES TO BE SAFETIED SHALL BE LIMITED TO THE NUMBER OF UNITS WHICH CAN BE SAFETIED BY A 24-INCH (609.6 MM) LENGTH OF WIRE.

(1) Install single-wire safetying as shown in Figure 201.

NOTE: Single-wire safetying is used on emergency equipment such as emergency exits, emergency brake levers, fire extinguisher actuating mechanisms, snap slides, and oxygen regulators. The wire is strong enough to safety parts, yet thin enough to be easily broken during an emergency. Single-wire safetying is also used when a series of three or more parts are safetied as a group and the configuration is a small geometrical pattern (triangle, square, rectangle, circle) or in places difficult to reach where double-wire safetying is not practical, and single-wire safetying is approved.

5. Double-wire Safetying

A. General Instructions

(1) For double-wire safetying procedure, refer to Figure 202.

(2) Use double-wire safetying as common method of safetying unless single-wire method is specified. Double-wire safetying procedure can be adapted for use with angular-drilled bolt heads or studs, bolt heads and nuts safetied to stationary parts (direction of twist optional), oil caps, drain plugs and draincocks.

(3) When safetying widely spaced multiple groups by this method, three units shall be the maximum number in one series. When safetying closely spaced multiple groups, the number of units that can be safetied by a 24-inch (609.6 mm) length of wire shall be the maximum number in a series.

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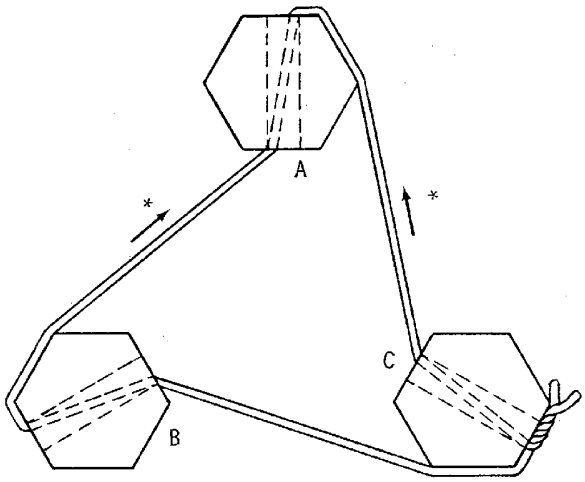

NOTES:

1. RIGHT HAND THREADED PARTS SHOWN. REVERSE DIRECTIONS FOR LEFT HAND THREADS.

*2. WHEN BOLT A TENDS TO LOOSEN, A PULL IS EXERTED IN DIRECTION OF ARROWS. BOLTS B AND C TIGHTEN TO MAXIMUM. TENDENCY OF BOLT A TO LOOSEN IS STOPPED.

BBB2-20-19

Single-wire Safetying
Figure 201/20-10-18-990-801

6. Safetying Castellated Nuts

A. General Procedures

(1) On castellated nuts, pass lockwire loop along side of stud or around nut. If this is not possible, pass lockwire loop over top of stud.

(2) When safetying castellated nuts, tighten nut to low side of specified torque range and, if necessary, continue tightening until slot aligns with safety hole.

7. Safetying Engine Section Parts

A. General Procedures

(1) Safety all engine section parts, using double-wire safetying procedure. For inaccessible parts, use single-wire safetying procedure when approved (Paragraph 4.). For an alternate method using safety cable see Paragraph 7.B..

B. Safety Cable Installation (Alternate Method)

(1) Safety cable is permitted at limited locations as an alternate to lockwire. Safety cable is permitted at all external and fan stream locations where the lockwire hole is sufficiently large for the cable, except as specified below. Use safety cable PN AS3510-0218C 0.032 inch (0.813 mm) diameter and safety cable ferrule PN AS3510-02F.

(2) Do not use safety cable at these locations:

(a) Locations where the lockwire hole is more than 0.100 inch (2.54 mm) diameter (the safety cable ferrule will pull through a hole larger than this).

(b) Internal engine, gearbox and accessory areas.

(c) Heat shields (as lacing).

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(d) Vendor-controlled (Category 1) components.

(3) Basic rules when using and installing safety cable are as follow:

(a) The maximum span of safety cable between two end points is 6 inches (152.4 mm), unless specified differently by the assembly illustration.

(b) Any cable defect (such as a nick, fray, kink or any damage to the safety cable) found before, during or subsequent to installation, at or between end points, is not permissible.

(c) Always install safety cable through the safety cable holes given on the part.

CAUTION: DO NOT USE SAFETY CABLE IF THE HOLES ARE MORE THAN 0.100 INCH (2.54 MM) DIAMETER. THE FERRULES ON THE END OF THE CABLE ARE 0.106 - 0.108 INCH (2.692 - 2.743 MM) DIAMETER AND WILL FALL THROUGH HOLES LARGER THAN THIS.

(d) The safety cable and its ferrule must be new for each application. It is not permissible to use the safety cable and ferrule again.

(4) Installation methods of safety cable are as follow:

(a) Various examples of safety cable methods are shown in Figure 202. Other methods are possible.

(b) Unless specified differently in the assembly procedure, install safety cable in two-or three-bolt patterns. The two-bolt pattern is preferred when you apply safety cable to an even number of fasteners.

(c) Although every possible combination is not shown in Figure 202, every combination must follow the basic rules for safety cable.

(d) The pull-off load is the force necessary to pull the cable out of either the ferrule or the cable end fitting.

(e) Crimp the ferrule (pull-off load) to the cable with a crimper (such as, Bergen Mechanical Crimper Model M303, M305 or M307, or equivalent).

(f) The safety cable must meet the minimum crimp requirements of Table 203.

Table 203 Safety Cable Minimum Crimp Requirements (Pull-off Load)

Nominal Cable Diameter	Minimum Pull-off Load
0.020 Inch (0.508 mm)	30 Inch-Pounds (3.390 N·m)
0.032 Inch (0.813 mm)	70 Inch-Pounds (7.909 N·m)

(g) Do not decrease or increase the torque on the parts to correctly align the holes for the cable.

(h) Install safety cable so that any tendency for a fastener to loosen is counteracted by more tension on the cable.

(i) Pratt & Whitney recommends that there be no sharp turns more than 90°, if possible, when cable goes through the fasteners. The result is the installation of safety cable with either a positive or neutral pull.

(j) Cable installation tools (such as, Bergen Mechanical Crimper Model M303, M305 or M307, or equivalent) will give the flex limits specified in Figure 203. These values are the maximum flex limits between the end points when light finger pressure of approximately 2 pounds (8.9 N) is applied at midspan.

(k) After installation of safety cable, cut off excess cable from the crimped ferrule.

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(l) The maximum length of unwanted cable that is permissible to extend past the crimped ferrule is 0.031 inch (0.787 mm).

(m) Where specified by the assembly drawing, apply and crimp lead seals to the safety cable.

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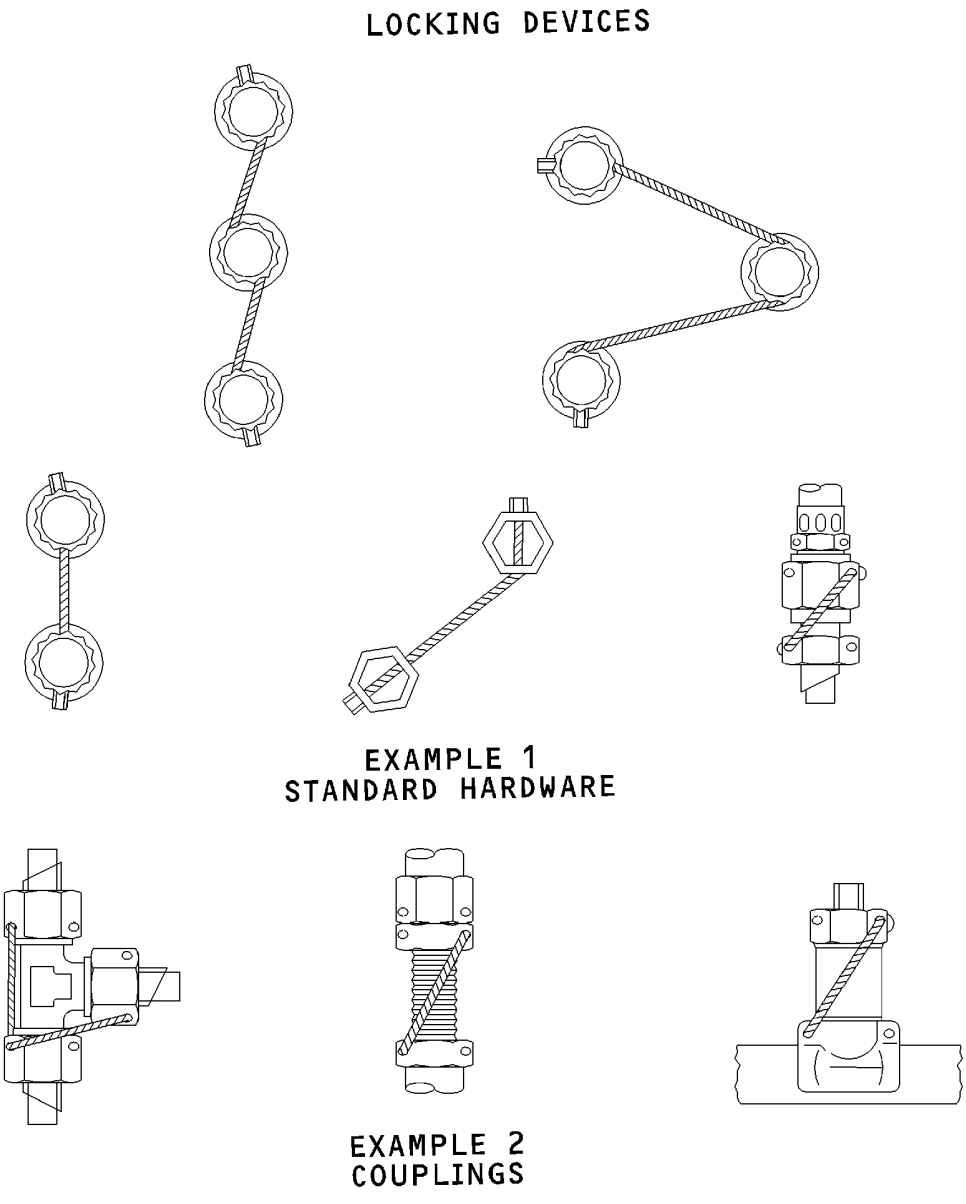

Examples of Safety Cable Methods
Figure 202/20-10-18-990-802 (Sheet 1 of 2)

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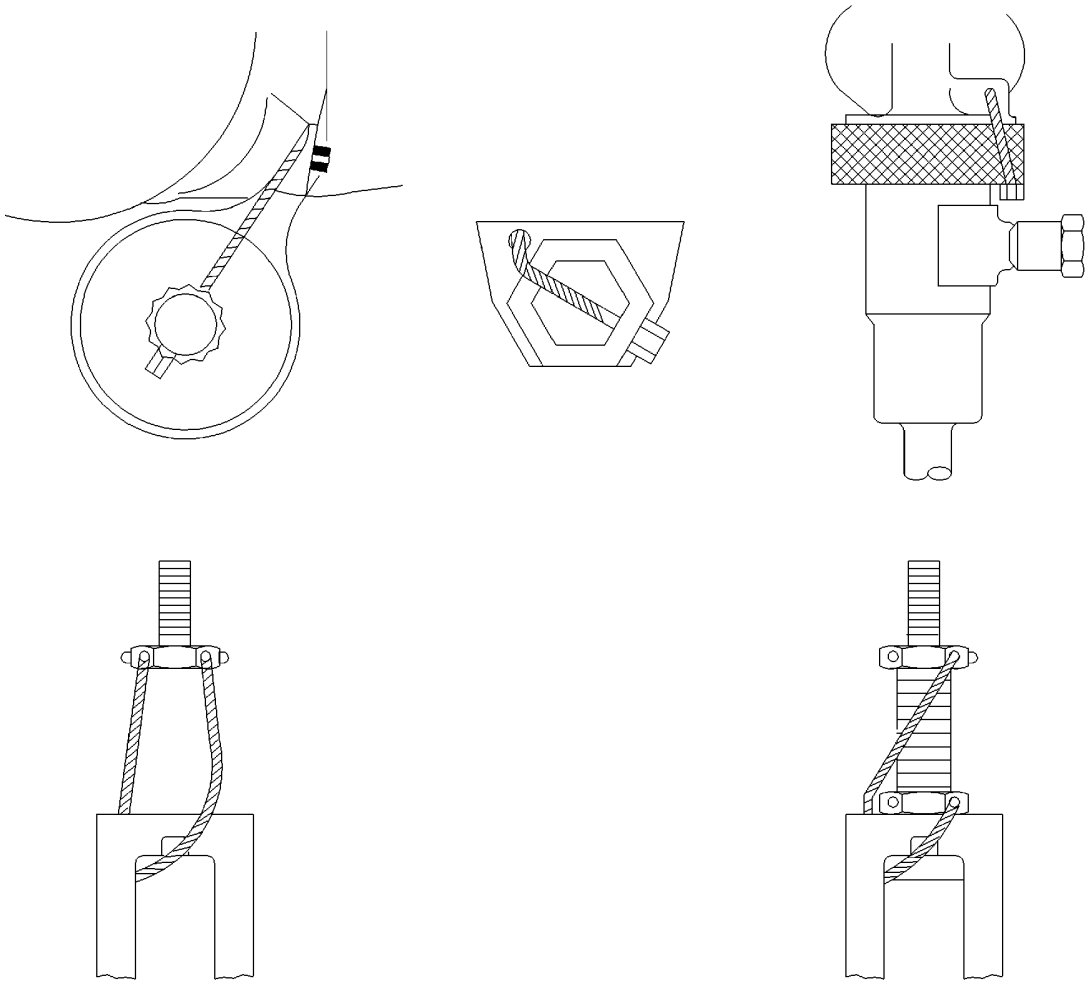

Examples of Safety Cable Methods
Figure 202/20-10-18-990-802 (Sheet 2 of 2)

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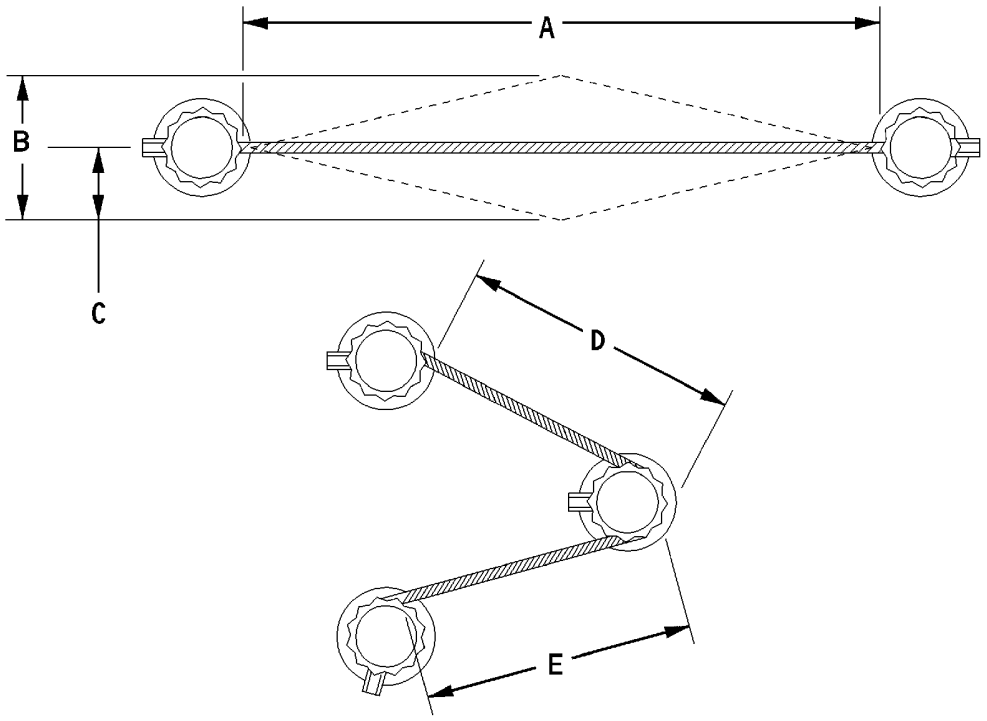
LOCKING DEVICES



FOR THREE BOLT PATTERNS

$A = D + E$

FLEX LIMITS, DIMENSIONS		
A INCH	B INCH	C INCH
0.5	0.125	0.620
1.0	0.250	0.125
2.0	0.375	0.188
3.0	0.375	0.188
4.0	0.500	0.250
5.0	0.500	0.250
6.0	0.625	0.312

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Safety Cable Flex Limits
Figure 203/20-10-18-990-803

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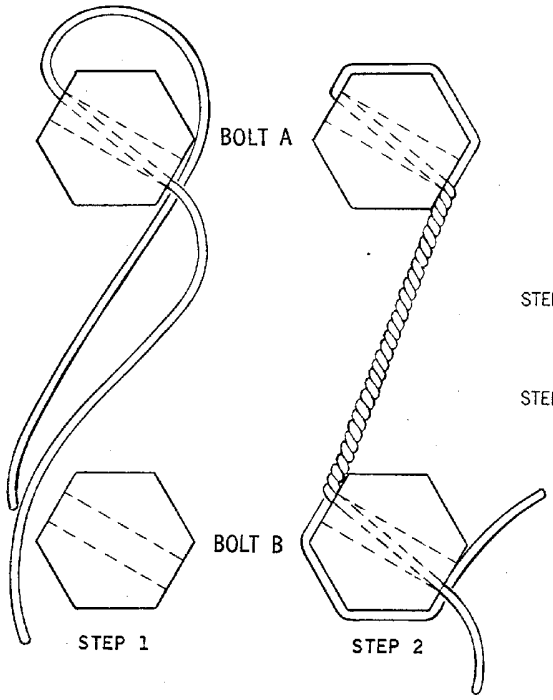


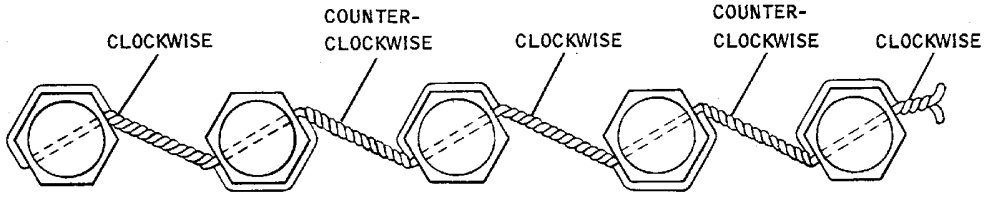
STEP 1 INSERT WIRE THROUGH BOLT A AND BEND AROUND BOLT (IF NECESSARY, BEND WIRE BACK ACROSS HEAD OF BOLT). TWIST WIRES CLOCKWISE UNTIL THEY REACH BOLT B.

STEP 2 INSERT ONE END OF WIRE THROUGH BOLT B. BEND OTHER END AROUND BOLT. (IF NECESSARY BEND WIRE ACROSS HEAD OF BOLT). TWIST WIRES COUNTER CLOCKWISE 1/2 INCH (12.7 MM) OR 6 TWISTS. CLIP ENDS. BEND PIGTAIL BACK AGAINST PART.

NOTES:

1. RIGHT HAND THREADED PARTS SHOWN; REVERSE DIRECTIONS FOR LEFT HAND THREADS.
2. IN SAFE TIED POSITION, WHEN BOLT A TENDS TO LOOSEN, BOLT B TIGHTENS TO MAXIMUM AND TENDENCY OF BOLT A TO LOOSEN IS STOPPED

DOUBLE-WIRE SAFETYING



DOUBLE-WIRE SAFETYING -- MULTIPLE GROUPS

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Double-wire Safetying
Figure 204/20-10-18-990-804

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8. Safetying with Lead Seals and Aluminum Seals

A. General Procedures

(1) When these seals are specified, provide sufficient length of wire to allow for extra length of pigtail required for seal.

(2) After completing safetying and making at least three turns of pigtail, thread both wires through seal, twist ends of wires three more times, and clip excess wire.

(3) Impression stamp seal.

(4) Check that pigtail, including seal, is short enough and positioned so as not to interfere with operation of any mechanism.

9. Safetying Electrical Connectors

A. General Procedures

(1) For typical safetying of electrical connectors, refer to Figure 205.

NOTE: AN500A screws are used for safetying connectors.

(2) Safety only following electrical connectors.

(a) Connectors specifically required to be safetied.

(b) Connectors located in engine and pylon area except self-locking type.

(3) Safety each connector separately. Do not safety one connector to another.

10. Safetying Turnbuckles

A. Single-wrap Procedure

(1) Prior to safetying turnbuckles perform following:

WARNING: LUBRICANT IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN LUBRICANT IS USED.

- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET LUBRICANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(a) Visually check both cable terminals and turnbuckles for evidence of mismachining, burrs or damage. Apply Parker-O-Lube to both cable terminals. During turnbuckle installation or retensioning of cables, check for evidence of thread damage resulting in excessive turning torque, misalignment of cable terminals and brass chips in locking grooves. Any evidence of thread damage will require replacement of part.

(2) Safety 1/16- (1.6 mm) and 3/32-inch (2.38 mm) cables as shown in Figure 206.

NOTE: Use 0.040-inch (1.02 mm) inconel lockwire (Fed. Spec. QQ-W-390, Cond. A) for single wrap method. In case of critical shortage, steel wire (Fed. Spec. QQ-W-423, Cond. A, Type 302) may be used in lieu of the same size inconel lockwire. Do not use zinc-coated carbon steel wire.

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(3) Check that not more than three threads of turnbuckle end fittings are exposed. End fitting shanks may be threaded into barrel to any depth (no threads visible), provided enough room is left on shanks for wrapping lockwire.

(4) Cut length of lockwire four times length of turnbuckle.

(5) Line up hole through barrel with holes in end fitting, or with cable eye, fork yoke, or swaged terminal holes, and draw half of wire through barrel hole.

(6) Bend one end of wire 90 degrees toward end fitting, making 1/2-turn around shank in direction that will cause pull on wire to tighten barrel and shank. Insert this end of wire through hole in end fitting, or through cable eye, fork yoke, or swaged terminal hole. Pull tight.

(7) Bend wire back toward center of turnbuckle and wrap wire five to seven turns tightly around shank close to end. Clip excess wire.

(8) Repeat Paragraph 10.A.(6) and Paragraph 10.A.(7) opposite end of turnbuckle.

B. Double-wrap Procedure Cable Eye or Forkend Fitting Turnbuckles

(1) Safety cables with cable eye or forkend fittings as shown in Figure 206.

(2) Double-wrap turnbuckles using lockwire of material and applicable diameter specified in Table 204.

(3) Check that not more than three threads of turnbuckle end fittings are exposed. End fitting shanks may be threaded into barrel to any depth, with no threads visible, provided enough room is left on shanks for wrapping lockwire.

(4) Cut two lengths of specified wire, each equal to four times length of turnbuckle.

(5) Insert wires through barrel hole and bend ends 90 degrees toward ends of turnbuckle. Check that two wires form x inside barrel hole.

(6) At one end of turnbuckle, in opposite directions, pass ends of wires through end fitting cable eye or fork yoke. If wires passing through cable eye are exposed to chafing, insert wires through cable thimble.

(7) Bend one wire back toward center of turnbuckle. Wrap other wire four turns around shank. Clip excess wire. Wrap remaining wire four turns around shank in opposite direction. Clip excess wire.

(8) Repeat Paragraph 10.B.(6) and Paragraph 10.B.(7) at opposite end of turnbuckle.

C. Double-wrap Procedure Swaged or Soldered End Fitting Turnbuckles

(1) Safety cables with swaged or soldered end fittings as shown in Figure 206.

(2) Double-wrap turnbuckles using lockwire of material and applicable diameter specified in Table 204.

(3) Perform Paragraph 10.B.(3), Paragraph 10.B.(4), and Paragraph 10.B.(5) of Paragraph 10.B..

(4) At one end of turnbuckle, insert one wire through hole in end fitting and bend wire back toward center of turnbuckle.

(5) Halfway between barrel end and end fitting hole, bend two wires against one another to form linked L's. Wrap wires four turns around shank in opposite directions. Clip excess wire.

(6) Repeat Paragraph 10.C.(4) and Paragraph 10.C.(5) at opposite end of turnbuckle.

D. Single-wire Double Wrap

(1) Double wrap turnbuckles using lockwire of material and applicable diameter specified. (Figure 207) ((Table 204))

(2) Cut two lengths of wire, each long enough to wrap at least four times around shank after lockwiring.

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(3) Insert wire through hole in turnbuckle, then pass both ends through hole in cable fitting.

(4) Bend both ends of wire back toward turnbuckle, wrap one end of wire over shank and other end four times.

(5) Wrap second end of wire four times around shank in opposite direction. Clip excess wire.

E. Lock Clip Turnbuckle Assemblies

NOTE: Possible obstructions in the turnbuckle and terminal grooves should be removed with a wire brush.

CAUTION: CHECK TURNBUCKLE AND TERMINAL GROOVES, BEFORE ASSEMBLY, FOR POSSIBLE OBSTRUCTIONS WHICH MAY PREVENT PROPER INSERTION OF LOCKING CLIP.

(1) Adjust turnbuckle barrel for correct cable tension observing thread adjustment limitations.

(2) Align slot in barrel with slot(s) in cable terminal(s).

(3) Insert straight end of lock clip into aligned slots and slide into place until hook loop is over hole in center of turnbuckle. (Figure 208, detail 4)

(4) Apply pressure to hook shoulder forcing hook loop into hole until hook lip is engaged inside barrel.

(5) Both lock clips may be inserted in same barrel hole or may be inserted in opposite holes. (Figure 208, detail 3)

(6) Verify proper engagement of hook lip in barrel by applying slight pressure in disengaging direction. (Figure 208, detail 4)

CAUTION: DO NOT REUSE LOCK CLIPS AFTER REMOVAL.

(7) Remove clips by pulling hook loop out of turnbuckle barrel hole with pliers and sliding straight end out of slots.

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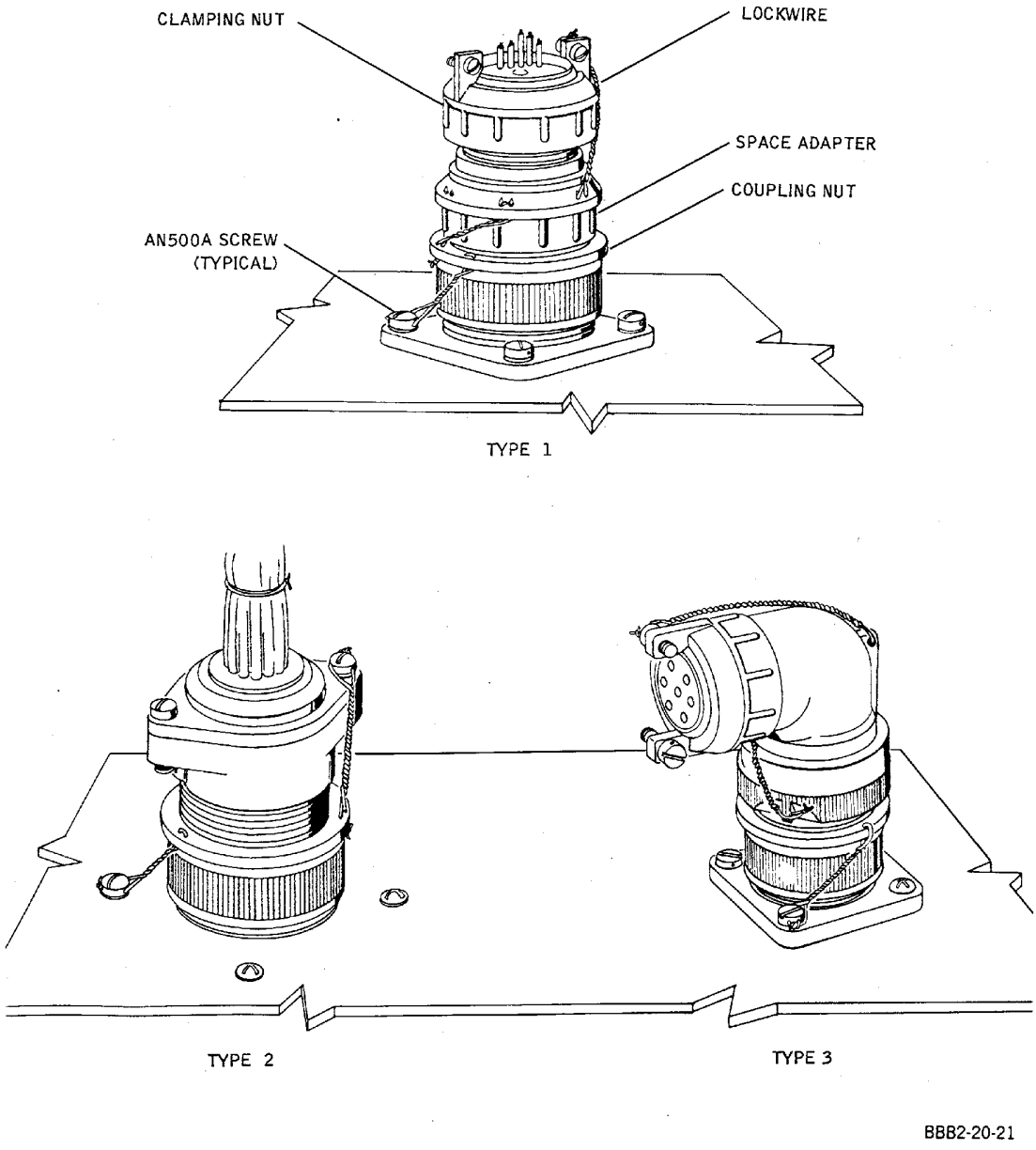

Safetying Electrical Connectors -- Typical
Figure 205/20-10-18-990-805

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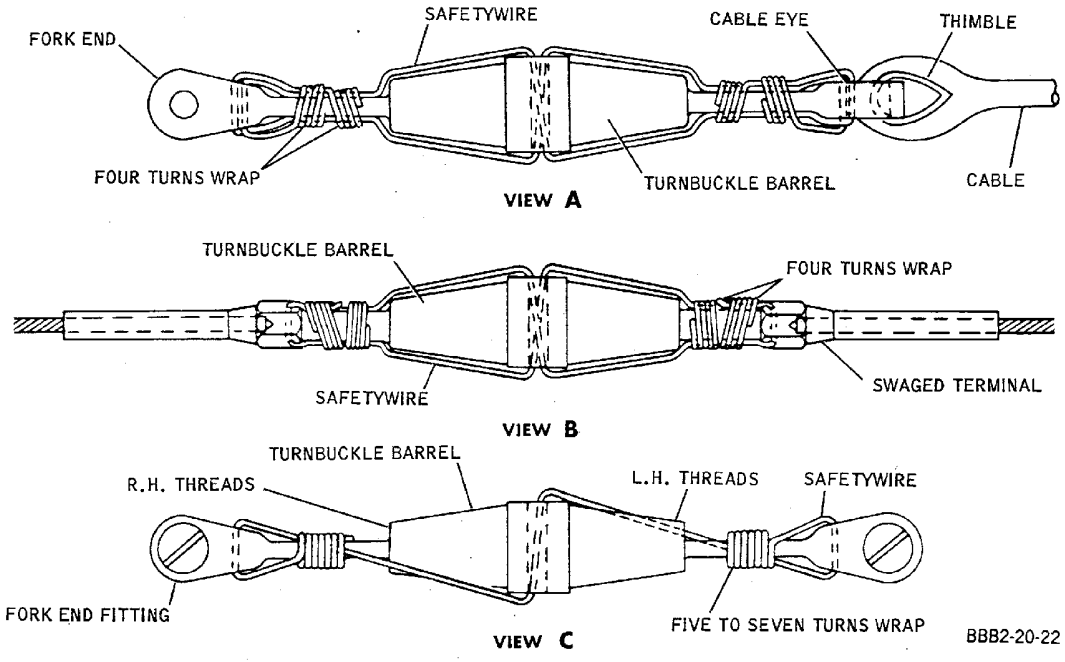
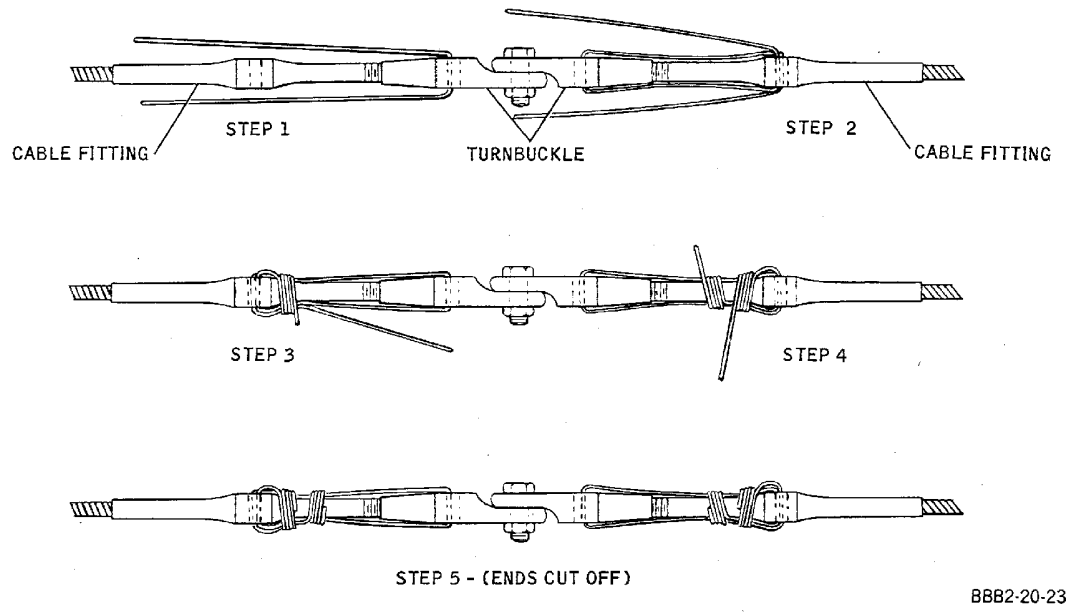


Turnbuckle Safetying Procedures
Figure 206/20-10-18-990-806



Turnbuckle Safetying Procedures
Figure 207/20-10-18-990-808

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11. Safetying B-nuts and Jamnuts

A. General Procedures

(1) Where safety wiring of B-nuts and jamnuts is required, apply correct torque and safety with Inconel 0.032 inch (0.813 mm) diameter wire. If safety hole is too small to accommodate 0.032 inch (0.813 mm) wire, 0.020 inch (0.508 mm) wire may be substituted.

(2) Use double-wire method of safetying. Pull wire so any movement will tend to tighten connection.

(3) Safety B-nuts on union connectors, elbows, and tee fittings to adjacent B-nuts. (Figure 209)

(4) Safety B-nuts on bulkhead fittings to B-nuts on adjacent fittings or to bulkhead fitting. (Figure 210)

CAUTION: DO NOT SAFETY B-NUTS AND JAMNUTS TO EACH OTHER SINCE BOTH NUTS TIGHTEN IN THE SAME DIRECTION OF ROTATION. DO NOT SAFETY ANY FITTING TO TUBING.

(5) Safety jamnuts, and B-nuts on same side of fitting as jamnut, to adjacent fittings or to suitable safety wire lugs on structure.

(6) Do not loosen or tighten nuts beyond specified torque setting in order to position safety holes. If hole can not be positioned as desired, back off nut and tighten; check position of hole when minimum torque value is reached. Continue tightening to position hole but do not exceed maximum torque.

Table 204 Turnbuckle Safety Wire Applications

Cable Size			Lockwire	Lockwire Diameter	
Inch	(mm)	Type of Wrap	Material	Inch	(mm)
1/16	(1.588)	Double	Inconel	0.032	(0.813)
3/32	(2.38)	Double	Inconel	0.032	(0.813)
1/8	(3.175)	Double	Inconel	0.032	(0.813)
5/32	*(3.969)	Double	Inconel	0.040	(1.016)
*And Larger					

NOTE: In case of critical shortage, steel wire (Fed. Spec. QQ-W-423, Cond. A, Type 302, Type 304, Type 305 or Type 316) may be used in lieu of the same size inconel lockwire.

12. Safetying Quick-disconnect Control Rods

A. General Procedure

(1) Use double wire safetying. (Figure 211)

(2) Wrap wire snugly around male barrel and against furthest rivet head.

(3) Twist wire until sufficient length has been obtained to reach across full length of movable female disconnect.

(4) Pull wire tight and wrap around and against far side of movable female disconnect; twist wire six times and cut off excess.

13. Pulleys and Stops

A. General Procedure

(1) Cut appropriate length of specified wire.

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(2) Insert wire through holes, make approximately six twists, and cut off excess wire.

CAUTION: TWISTED ENDS OF SAFETY WIRE MUST CLEAR PULLEY BRACKET, ADJACENT MECHANISM, AND GUARD PINS, THROUGHOUT NORMAL TRAVEL OF PULLEY.

(3) Bend twisted end flat along side of pulley. (Figure 212)

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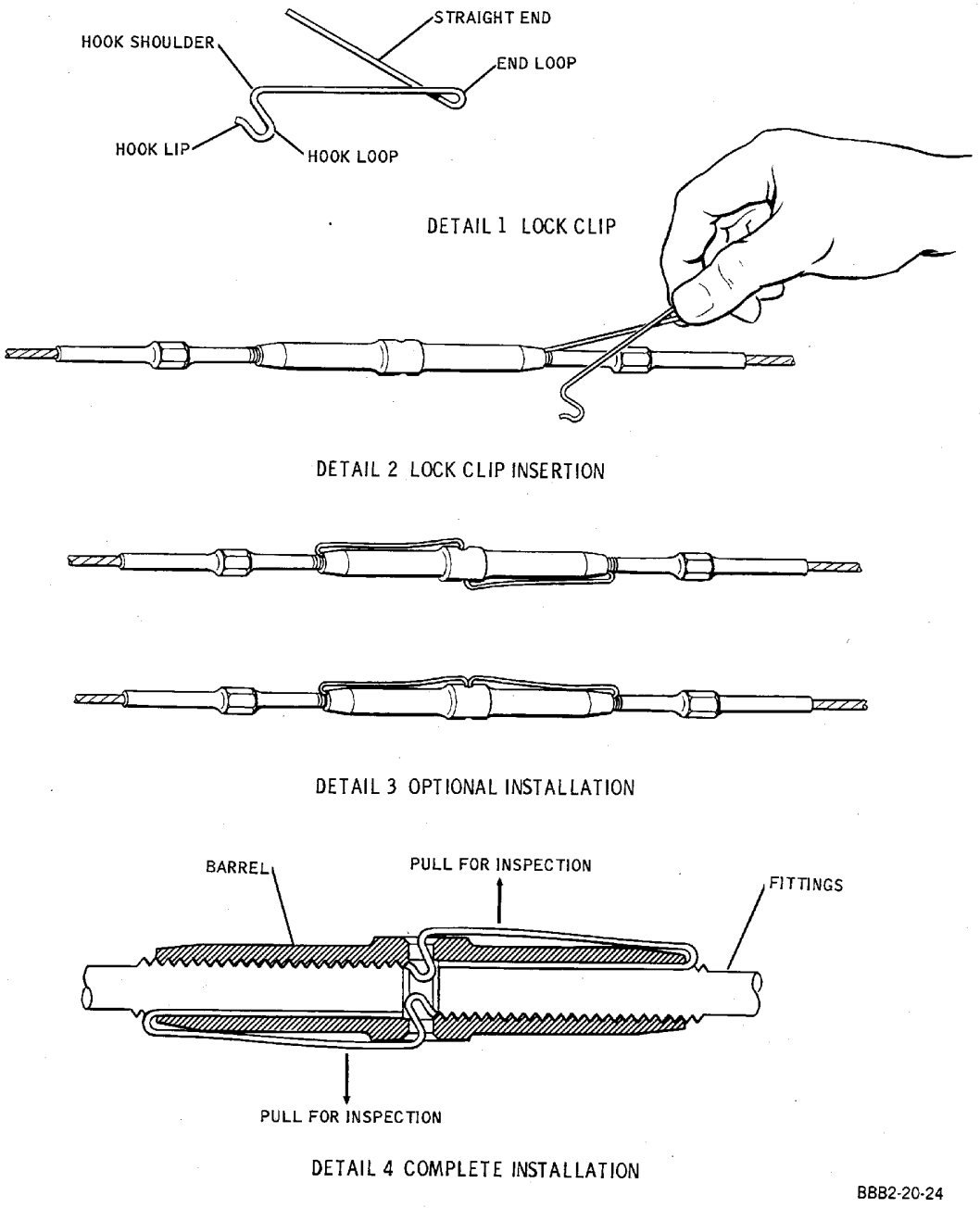

Clip Locking Turnbuckle Assemblies
Figure 208/20-10-18-990-809

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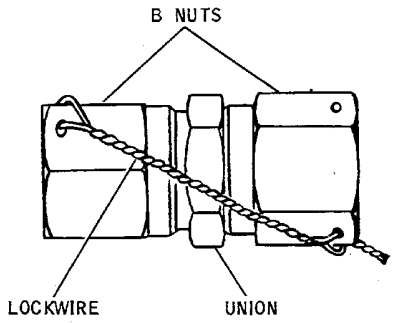
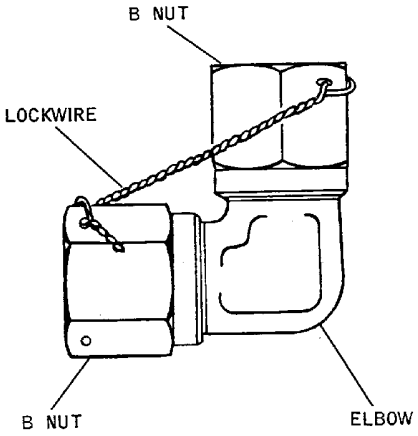
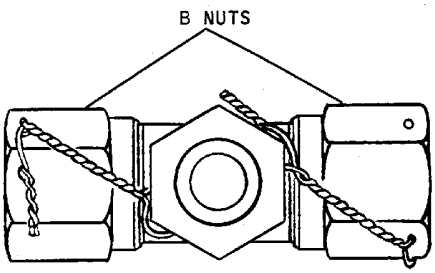


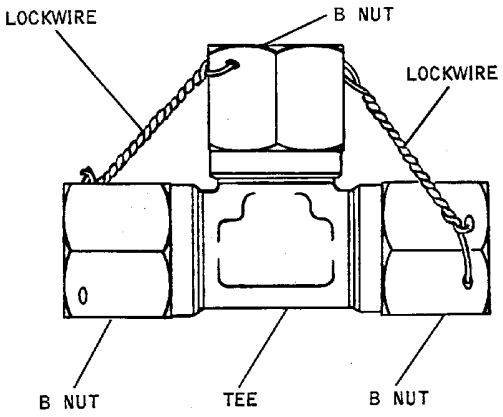
UNION FITTING



ELBOW FITTING



TOP VIEW



SIDE VIEW

TEE FITTING

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Safetying B-nuts -- Typical
Figure 209/20-10-18-990-810

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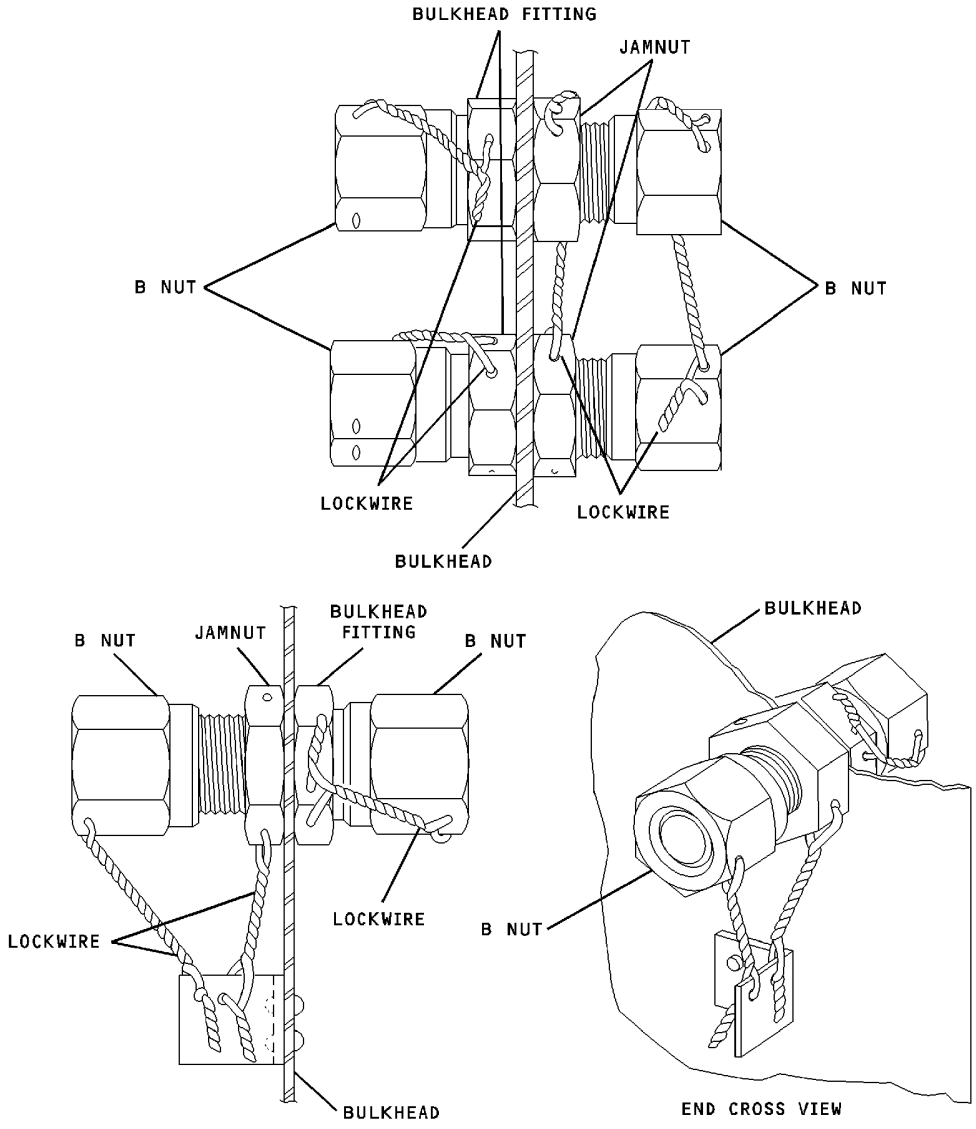

BULKHEAD FITTINGS

CAG(IGDS)

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Safetying B-nuts and Jamnuts -- Typical
Figure 210/20-10-18-990-811

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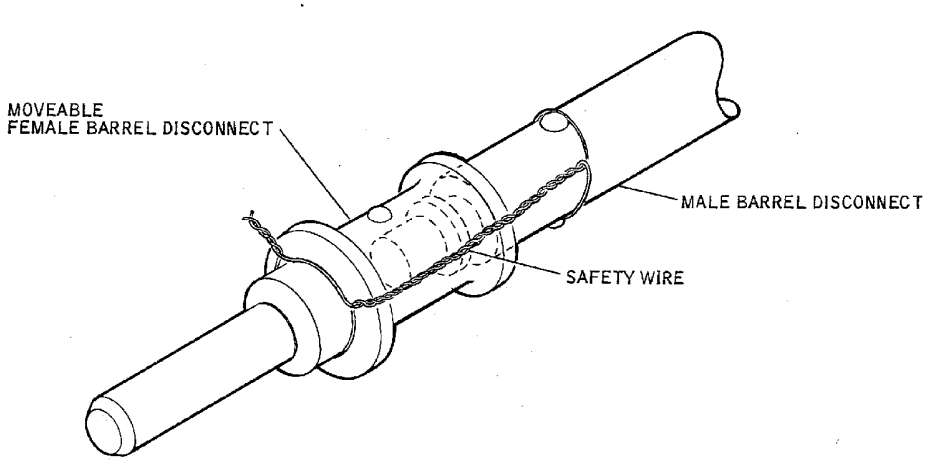
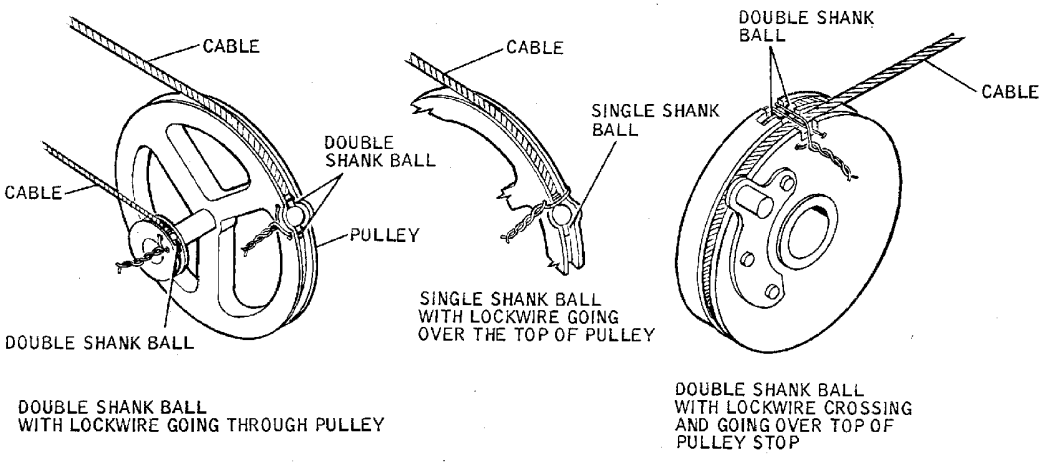


Safetying Quick-disconnect Control Rods
Figure 211/20-10-18-990-812



Safetying Pulleys and Stops
Figure 212/20-10-18-990-813

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14. Safetying Conduit Clips

A. General Procedure

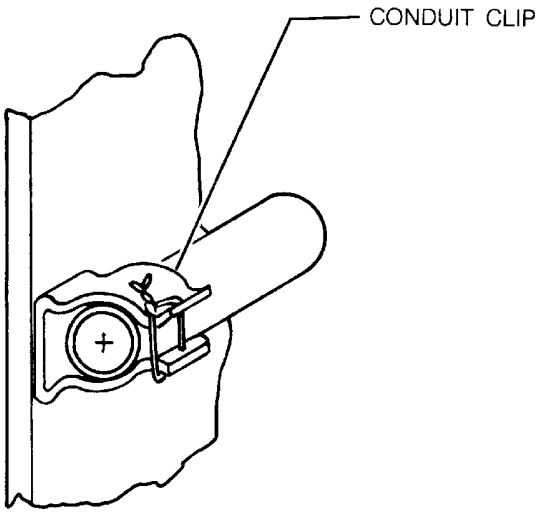
(1) Cut appropriate length of specified wire.

(2) Insert safety wire through holes in clip after conduit is installed. (Figure 213)

(3) Twist ends of wire together at least three turns.

(4) Make additional turns as necessary to take up slack in safety wire to prevent opening of clip.

(5) Bend twisted end towards clip.



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Safetying Conduit Clips
Figure 213/20-10-18-990-814

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HONEYCOMB PANEL INSERTS AND ATTACHMENTS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides instructions for installing inserts or attachments to honeycomb panels.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
SLE 3006 A/B, SLE 3009 A/B, or SLE 3012 A/B DPM 5429	Fiber-Resin Corp. Burbank, CA
Dapcotac 3003 DMS 1880	D. Aircraft Products Anaheim, CA
Sealant pressure applicator Model 250-06	Semco Research Inc. Inglewood, CA
Inserts and attachments	Shur-Loc Corp. Santa Ana, CA
	Delron Co., Inc. Santa Ana, CA
Sandpaper, light grit	Commercially available

3. Preparation of Casting Material

A. Prepare Material

NOTE: Unless preweighed kits are available, use following mixing instructions.

(1) Mix equal parts A and B by weight or volume, of casting material.

(2) Stir mixture thoroughly until uniform consistency is obtained.

NOTE: The pot life of Utilipast casting material is approximately 45 minutes at 75°F (23.9°C).

4. Seal Through-panel Attachment Holes

A. Seal Through-panel Hole

(1) Locate and drill through one skin and honeycomb a hole 1/4(±1/32) inch (6.4(±0.79) mm) larger than outside diameter of the attachment hole.

(2) Fill drilled hole completely with casting material prepared per Paragraph 3.A.(1) . Use sealant pressure gun, or other applicable method.

(3) Remove excess casting material with sharp knife immediately after material has reached a gel stage (approximately 1 to 2 hours).

(4) Allow casting material to cure (harden) at room temperature for a minimum of 2 hours; sand surface smooth with light-grit sandpaper.

(5) Drill required size attachment hole through casting material and panel.

5. Two-stage Installation of Blind Inserts

A. Install Blind Insert

(1) Locate and drill through one skin and honeycomb a hole 1/4(±1/32) inch (6.4(±0.79) mm) larger than outside diameter of the insert.

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(2) Fill drilled hole completely with casting material prepared per Paragraph 3.A.(1) . Use sealant pressure gun, or other applicable method.

(3) Allow casting material to cure (harden) at room temperature for a minimum of two hours.

(4) Drill hole in casting material plug to outside diameter size and depth of insert -0.000, +0.010 inch (-0.00, +0.254 mm) tolerance.

(5) Prime insert and hole in plug with fresh mix of casting material; locate insert as required.

(6) Remove excess casting material with sharp knife after mate-rial has gelled rigid (approximately 1 to 2 hours).

(7) After casting material has cured (harden) sand surface, smooth with light-grit sandpaper.

6. Single Step Installation of Blind Inserts with Potting Holes

A. Install Blind Insert

(1) Drill hole to insert outside diameter through one skin and honeycomb. (Figure 201)

NOTE: A closely controlled installation hole diameter is mandatory to obtain easy insert installation. Insert will not fit in undersize hole and will fall through an oversize hole during casting material filling operation.

(2) Clean loose fragments from drilled hole.

(3) Fill insert hole to approximately 1/2 depth with casting material prepared per Paragraph 3.A.(1). Use pressure sealant gun.

(4) Install insert flush with surface of panel. (Figure 201)

NOTE: A polyethylene plug, metal tap, or other fixture may be used to assist in holding insert parallel and flush with skin surface.

(5) Inject casting material through one potting hole in insert with pressure sealant gun equipped with small tip, until material, free of air bubbles, extrudes from opposite potting hole.

NOTE: When installing inserts without aid of potting assist fixture, remove a portion of the casting material and check that insert end is parallel and flush with panel skin surface.

(6) Allow casting material to cure (harden) at room temperature for approximately two hours before handling part.

(7) Remove assist fixture if applied.

(8) Remove excess casting material with sharp knife after mate-rial has gelled rigid (approximtely 1 to 2 hours).

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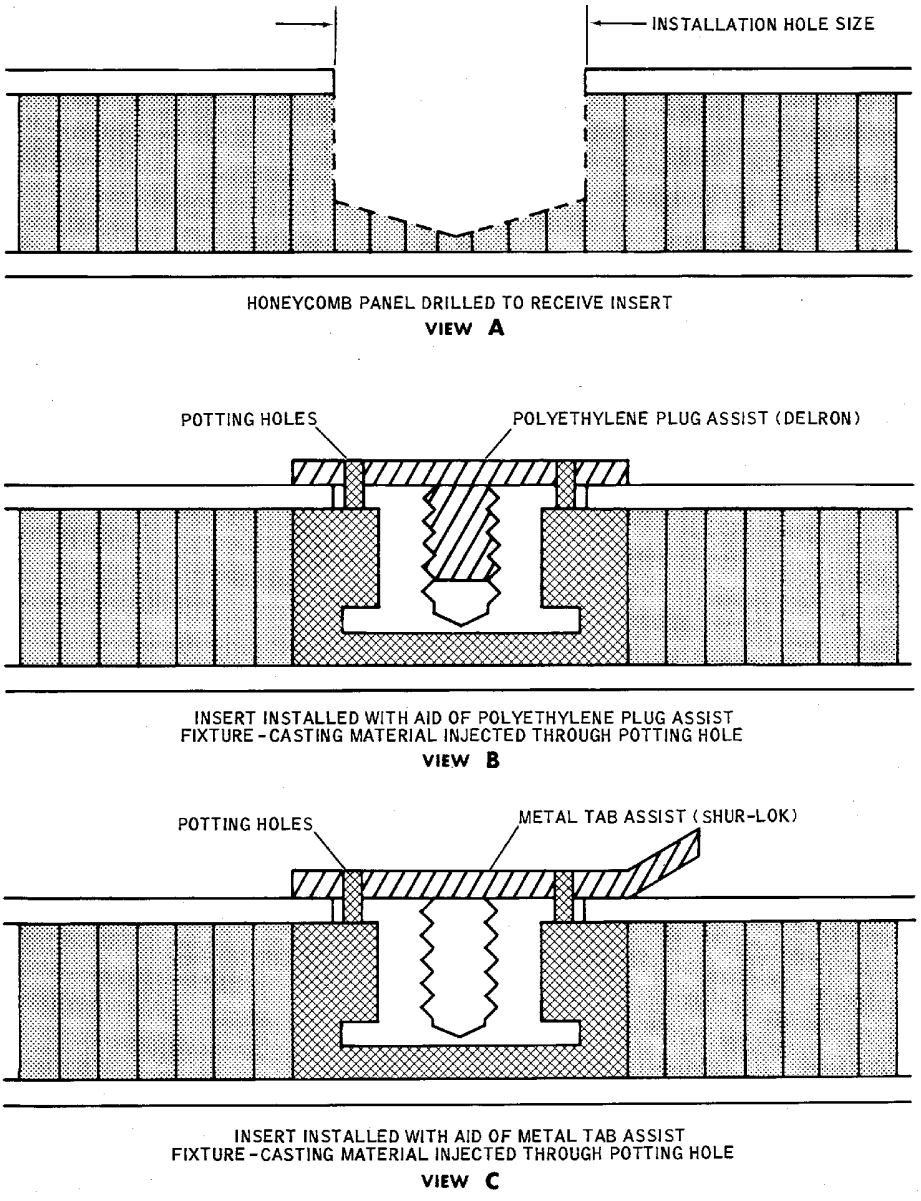

Honeycomb Panel -- Installation of Blind Inserts with Potting Holes
Figure 201/20-10-19-990-801

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7. Through-type Inserts Installation with Potting Holes

A. Install Through-type Insert

(1) Drill predimpled size hole through both skin surfaces and honeycomb core as specified in Figure 202.

(2) Counterbore installation hole through back side skin, doubler, and core, opposite dimple skin, to size specified in Figure 202; counterbore to include removal of bonding adhesive from inside surface of outer skin to be dimpled. (Figure 203)

(3) Hot dimple outer skin and doubler.

(4) Ream bolt and Camloc insert holes to final diameter as shown in Figure 202.

NOTE: Rivet insert holes do not require final reaming.

(5) Clean loose chips, burrs, and honeycomb material fragments from holes.

(6) Install insert into hole by squeeze procedure where possible until insert contacts and seats in dimpled skin.

NOTE: In all cases, this type of insert will protrude above surface of back skin.

(7) Inject casting material prepared per Paragraph 3.A.(1), through one potting hole in insert with pressure seal-ant gun equippped with small tip, until material, free of air bubbles extrudes from opposite potting hole.

(8) Remove excess casting material with sharp knife after mate-rail has gelled rigid (approximately 1 to 2 hours).

(9) Shave protruding insert from flush to 0.002 inch (0.051 mm) of surrounding surface.

8. Installation Two-piece Through-bolt Spacer

A. Install Through-bolt Spacer

(1) Drill hole to spacer outside diameter through both skin surfaces and honeycomb core.

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	INSERT IDENTIFICATION	MANUFACTURER	TYPE	FASTENER SIZE (INCH) (mm)	COUNTERBORE HOLE SIZE (INCH) (mm)	PREDIMPLE HOLE SIZE (INCH) (mm)	FINAL DIMPLE HOLE SIZE (INCH) (mm)
1	1806T-4	Deltron	Through-Bolt	1/4 6.4	0.625/0.630 15.88/16.00	NO DIMPLE REQUIRED	0.250/0.254 6.4/6.45
	SL-2094T	Shur-Lok					
2	1806-B12-3	Deltron		3/16 4.8	0.500/0.510 12.7/12.9	0.120/0.135 3.05/3.43	0.191/0.199 4.85/5.05
	SL-2094BF-3	Shur-Lok					
3	1806-B12-4	Deltron		1/4 6.4	0.625/0.635 15.88/16.13	0.166/0.173 4.22/4.39	0.250/0.254 6.4/6.45
	SL-2094BF-4	Shur-Lok					
4	1806-B25-3	Deltron		3/16* 4.8	0.500/0.510 12.7/12.9	0.129/0.135 3.28/3.43	0.191/0.199 4.85/5.05
	SL-2094BG-3	Shur-Lok					
1	1806-R12-1	Deltron	Through-Rivet	1/8 3.2	0.437/0.447 11.09/11.35	0.1285/0.134 3.26/3.40	0.1285/0.134 3.26/3.40
	SL-2094RF-4	Shur-Lok					
2	1806-R12-2	Deltron		5/32 7.9	0.500/0.510 12.7/12.9	0.161/0.166 4.09/4.22	0.161/0.166 4.09/4.22
	SL-2094RF-5	Shur-Lok					
3	1806-R12-3	Deltron		3/16 4.8	0.562/0.572 14.27/14.53	0.192/0.198 4.88/5.03	0.192/0.198 4.88/5.03
	SL-2094RF-6	Shur-Lok					
4	1806-R18-1	Deltron		1/8 3.2	0.375/0.385 9.53/9.78	0.1285/0.134 3.26/3.40	0.1285/0.134 3.26/3.40
	SL-2094R-4-26	Shur-Lok					
5	1806-R25-1	Deltron		1/8* 3.2	0.437/0.447 11.09/11.35	0.1285/0.134 3.26/3.40	0.1285/0.134 3.26/3.40
	SL-2094RG-4	Shur-Lok					
6	1806-R25-2	Deltron		5/32* 7.9	0.500/0.510 12.7/12.9	0.161/0.166 4.09/4.22	0.161/0.166 4.09/4.22
	SL-2094RG-5	Shur-Lok					
7	1806-R25-3	Deltron		3/16 4.8	0.562/0.572 14.27/14.53	0.192/0.198 4.88/5.03	0.192/0.198 4.88/5.03
	SL-2094RG-6	Shur-Lok					
1	1806-C25-6	Deltron	4F Camloc	3/8 9.5	0.750/0.760 19.1/19.3	0.166/0.173 4.22/4.39	0.386/0.390 9.80/9.91
	SL-2094C-4-1	Shur-Lok					

NOTE: * Inserts for wedge shaped panels. All others for constant thickness panels.
Callouts shown are only one size of many available interchangeable sizes for each style of attachment. Contact manufacturer for proper identification of other sizes of noted styles of inserts.

BBB2-20-29A

Honeycomb Panel -- Data for Dimpled-skin Type Insert with Potting Holes
Figure 202/20-10-19-990-802

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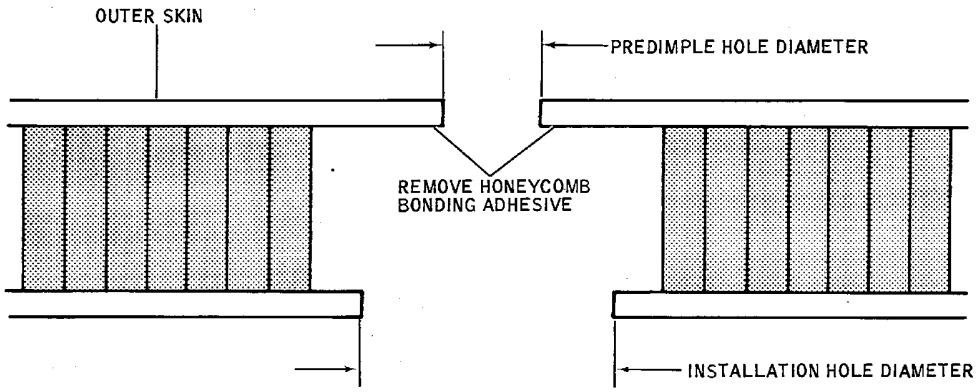
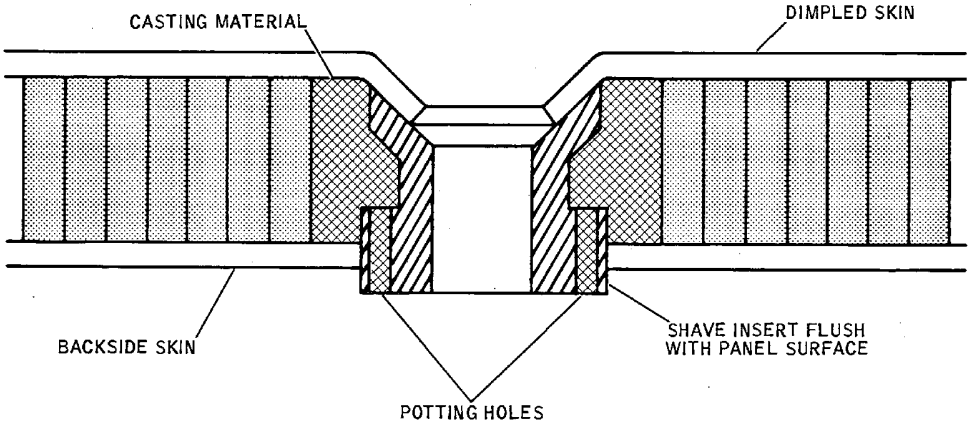


HONEYCOMB PANEL DRILLED AND COUNTERBORED TO RECEIVE INSERT

VIEW A



INSERT INSTALLED IN PREPARED PREDIMPLED HOLE - CASTING
MATERIAL INJECTED THROUGH POTTING HOLE

VIEW B

BBB2-20-30

Honeycomb Panel -- Installation of Through Type Inserts with Potting Holes
Figure 203/20-10-19-990-803

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SWAGED CABLES - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides instructions for the swaging, proof-loading and prestretching, length calculation, cutting, coiling, end fitting installation, identification and protective treatment of control cables.

B. Cables shall be cut to the calculated length ±0.100 inch (±2.54 mm). (Paragraph 6.)

C. Plating shall not be removed from cable fittings prior to assembly and swaging.

D. Depth witness marks shall not be removed from cable until swaging, proof-loading and prestretching and check are completed.

E. Corrosion protection of nylon coated cable assemblies shall be accomplished per Paragraph 8..

F. Prior to assembly, wire rope must not exhibit any waviness or spiraling which causes it to stand off from a flat surface by more than 1/8 inch (3.175 mm).

G. Nylon coating should only be stripped from areas as specified on engineering drawing.

H. Nicks and cuts in the cable as a result of stripping are not acceptable. A magnification of 5X minimum shall be used to check the area.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Cable stripper, WS20	Utility Tool Corp. East Haddom, CT
Cleaning solvent, MIL-PRF-680, Type 1(DPM-518)	
Aerosol Cor-Ban 35 DMS 2150	
Corrosion preventive, transparent, Bray Products Div. MIL-PRF-16173, Grade 4	Castrol Inc. Irvine, CA
Corrosion Shield, D-5035NS	Zip Chem Products,
Crayon, marking, soap base, small 43 mm	
Ink, raw stock marking, black	
Paper, greaseproof, waterproof, MIL-B-121, Type 1	
Tubing, heat shrinkable, dual wall, irradiated, rigid selectively cross-linked polyolefin, colored AMS 3634	
Wire stripper, Speedex -Trigomatic Model 200	Speedex Wire Stripper Co. Rockford, IL
Terminal End Cable Tester AT520CTK	ATI Tool, Snap On, Inc. Escondido, CA
Portable Cable Swager Kit AT520JK	ATI Tool, Snap On, Inc. Escondido, CA

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3. **Swaged Terminals**

A. General

(1) Cable assemblies can be fabricated off aircraft or a two stage assembly method can be used to replace cables where a terminal end cannot be routed through fairleads and over pulleys without disassembly of multiple components.

(a) The two stage method can be used on 1/16, 3/32, 1/8 and 3/16 inch cable sizes only. This method must not be confused with cable assemblies that have intermediate terminals swaged between the end terminals. A two stage assembly can also have an intermediate terminal.

1) The first stage consists of swaging all except one end terminal and proof-loading the assembly off the aircraft. There must be sufficient extra length to permit the removal of the temporary end terminal with a minimum of 5 in. (127 mm) extra length for grip purposes for the last end terminal.

2) The second stage consists of swaging and proof-loading the other end terminal as an installed operation, using the portable cable swager kit, SPL-1583 and the terminal end cable tester, SPL-4837 on the aircraft. The proof-loading of the last terminal end must be applied one time only.

B. Swaging requirements are as follows:

(1) With shop equipment do the single stage assembly method, or all except the last terminal end for the two stage assembly method, to swage the cable terminals according to the manufacturer's instructions. Use the portable cable swager kit to swage the last terminal for the two stage assembly method.

(2) Operate swager using swager manufacturer's instructions.

(3) Terminals shall be checked dimensionally for conformance to Figure 201, Figure 202, Figure 203 and Figure 205, or engineering drawing as applicable.

(4) Terminals shall not be reswaged nor shall they be cracked.

(5) Bent, nonconcentric, out of round, or tapered terminals over 0.005 inch (0.127 mm) or in excess of engineering tolerances, whichever is greater, are not acceptable.

(6) Swaged outside surface shall be examined for defects with unaided eye. Surface shall not be filed or ground except as allowed in Paragraph 3.B.(9).

(7) Laps and seams on which fingernail can be caught, depressions whose estimated depth is greater than 10 percent of wall thickness, and ridges which are greater than required dimensional tolerances are unacceptable.

(8) Indentations in surface of terminal which result from manufacturer's identification mark are acceptable.

(9) Localized exploratory abrasive polishing with hand-held coated abrasive paper or cloth and light filing is permissible to determine nature of questionable surface irregularities, provided that dimensionable requirements of Figure 201, Figure 202, Figure 203 and Figure 205 are satisfied prior to and after exploration.

(10) Surface irregularities other than those covered in Paragraph 3.B.(7) and Paragraph 3.B.(8) shall meet 63RHR surface finish unless otherwise specified by drawing.

(11) Broken, frayed, or kinked cable strands are unacceptable. One broken wire per assembly is permissible providing broken ends are trimmed flush with cable and present smooth surface. No broken wires are permitted on 1 x 19 cable.

(12) Swaged terminals shall not have internal cracks exceeding following limits:

(a) No cracks shall have length in excess of 30 percent of minimum terminal wall thickness.

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(b) Total length of cracks in any one cross section shall not exceed 60 percent of minimum terminal wall thickness.

(c) Crack length is defined as actual length of crack and not depth of penetration through terminal wall. However, cracks which do not extend more than 0.003 inch (0.076 mm) radially into terminal wall are considered of no consequence and are not to be included in computing total crack length.

(13) Excess cable protrusion shall be trimmed. (Figure 203) On cable fittings and configurations not represented in Figure 203, cable protrusion shall be trimmed to 0.062 inch (1.58 mm) maximum.

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DASH NO. INCH (MM)	CABLE DIAMETER INCH (MM)	As (1) DIAMETER INCH (MM)	X MINIMUM INCH (MM)	TERMINAL NUMBERS		
				MS21260 AN666, AN669	MS20667 AN667	MS20658
				Z MINIMUM		
				INCH (MM)	INCH (MM)	INCH (MM)
-2	1/16 (1.59)	$0.138^{+.000}_{-.005}$ $\left(3.51^{+.000}_{-.127}\right)$	.700 (17.78)	0.030 (0.762)		
-3	3/32 (2.38)	$0.190^{+.000}_{-.005}$ $\left(4.83^{+.000}_{-.127}\right)$	.800 (20.32)	0.030 (0.762)		1.344 (34.14)
-4	1/8 (3.18)	$0.219^{+.000}_{-.005}$ $\left(5.57^{+.000}_{-.127}\right)$	1.050 (26.67)	0.030 (0.762)	0.914 (23.22)	
-6	3/16 (4.76)	$0.313^{+.000}_{-.005}$ $\left(7.95^{+.000}_{-.127}\right)$	1.310 (33.27)	0.030 (0.762)		
-8	1/4 (6.35)	$0.438^{+.000}_{-.007}$ $\left(11.13^{+.000}_{-.179}\right)$	1.700 (43.18)	0.030 (0.762)		
-10	5/16 (7.94)	$0.563^{+.000}_{-.008}$ $\left(14.3^{+.000}_{-.203}\right)$	2.060 (52.32)	0.030 (0.762)		
-12	3/8 (9.53)	$0.625^{+.000}_{-.008}$ $\left(15.88^{+.000}_{-.203}\right)$	3.120 (79.25)	0.030 (0.762)		

NOTES: (1) THE TOLERANCE SHALL BE DOUBLED ON THE END PORTION OF THE TERMINAL CORRESPONDING TO THE LENGTH OF THE CHAMFER ON THE UNSWAGED TERMINAL.

CAG(IGDS) BBB2-20-97A

Shank Type Terminal Dimensions After Swaging
Figure 201/20-10-20-990-801

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TERMINAL PART NUMBER	CABLE DIAMETER INCH	CABLE DIAMETER (MM)	AS DIAMETER INCH	AS DIAMETER (MM)	X MINIMUM INCH	X MINIMUM (MM)	Z MINIMUM INCH	Z MINIMUM (MM)
S2339423	3/32	(2.38)	$.190^{+.000}_{-.005}$	$(4.83^{+.000}_{-.127})$	0.800	(20.32)	0.816	(20.73)
S2704321	1/16	(1.59)	$.138^{+.000}_{-.005}$	$(3.51^{+.000}_{-.127})$	0.700	(17.78)	0.634	(16.10)
S4922849	1/8	(3.18)	$.219^{+.000}_{-.005}$	$(5.56^{+.000}_{-.127})$	1.050	(26.67)	1.000	(25.4)
S4922921	1/8	(3.18)	$.219^{+.000}_{-.005}$	$(5.56^{+.000}_{-.127})$	1.125	(28.58)	0.900	(22.86)
S4932014	3/32	(2.38)	$.190^{+.000}_{-.005}$	$(4.83^{+.000}_{-.127})$	0.800	(20.32)	0.030	(0.76)
APH7284-501	1/16	(1.59)	$.138^{+.000}_{-.005}$	$(3.50^{+.000}_{-.127})$	0.400	(10.16)	0.250	(6.35)
4932597-2	1/16	(1.59)	$.138^{+.000}_{-.005}$	$(3.50^{+.000}_{-.127})$	0.800	(20.32)	1.000	(25.4)
4929482	1/16	(1.59)	$.138^{+.000}_{-.005}$	$(3.50^{+.000}_{-.127})$	0.900	(22.86)	1.000	(25.4)
AHR0555-1	5/16	(7.94)	$.563^{+.000}_{-.008}$	$(14.30^{+.000}_{-.203})$	2.06	(52.324)	0.50	(12.7)
AHR0555-1	3/8	(9.53)	$.625^{+.000}_{-.008}$	$(15.88^{+.000}_{-.203})$	3.12	(79.25)	0.50	(12.7)
2704322	1/16	(1.59)	$.138^{+.000}_{-.005}$	$(3.50^{+.000}_{-.127})$	0.700	(17.78)	0.823	(20.90)
2344315	3/32-1/16	(2.38-1.59)	$.195^{+.000}_{-.010}$	$(4.95^{+.000}_{-.254})$	FULL LENGTH			
4920389	3/16	(4.76)	$.313^{+.000}_{-.005}$	$(7.96^{+.000}_{-.127})$	1.31	(33.27)	1.133	(28.78)
2653961	3/32	(2.38)	$.190^{+.000}_{-.005}$	$(4.83^{+.000}_{-.127})$	0.800	(20.32)	0.500	(12.7)
2701439	1/16	(1.59)	$.138^{+.000}_{-.005}$	$(3.50^{+.000}_{-.127})$	0.750	(19.05)	0.562	(14.27)
4911148	1/8	(3.18)	$.219^{+.000}_{-.005}$	$(5.56^{+.000}_{-.127})$	1.050	(26.67)	0.030	(0.76)
2716710	1/16	(1.59)	$.138^{+.000}_{-.005}$	$(3.50^{+.000}_{-.127})$	0.700	(17.78)	0.700	(17.78)

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Special Shank Type Dimensions After Swaging
Figure 202/20-10-20-990-802

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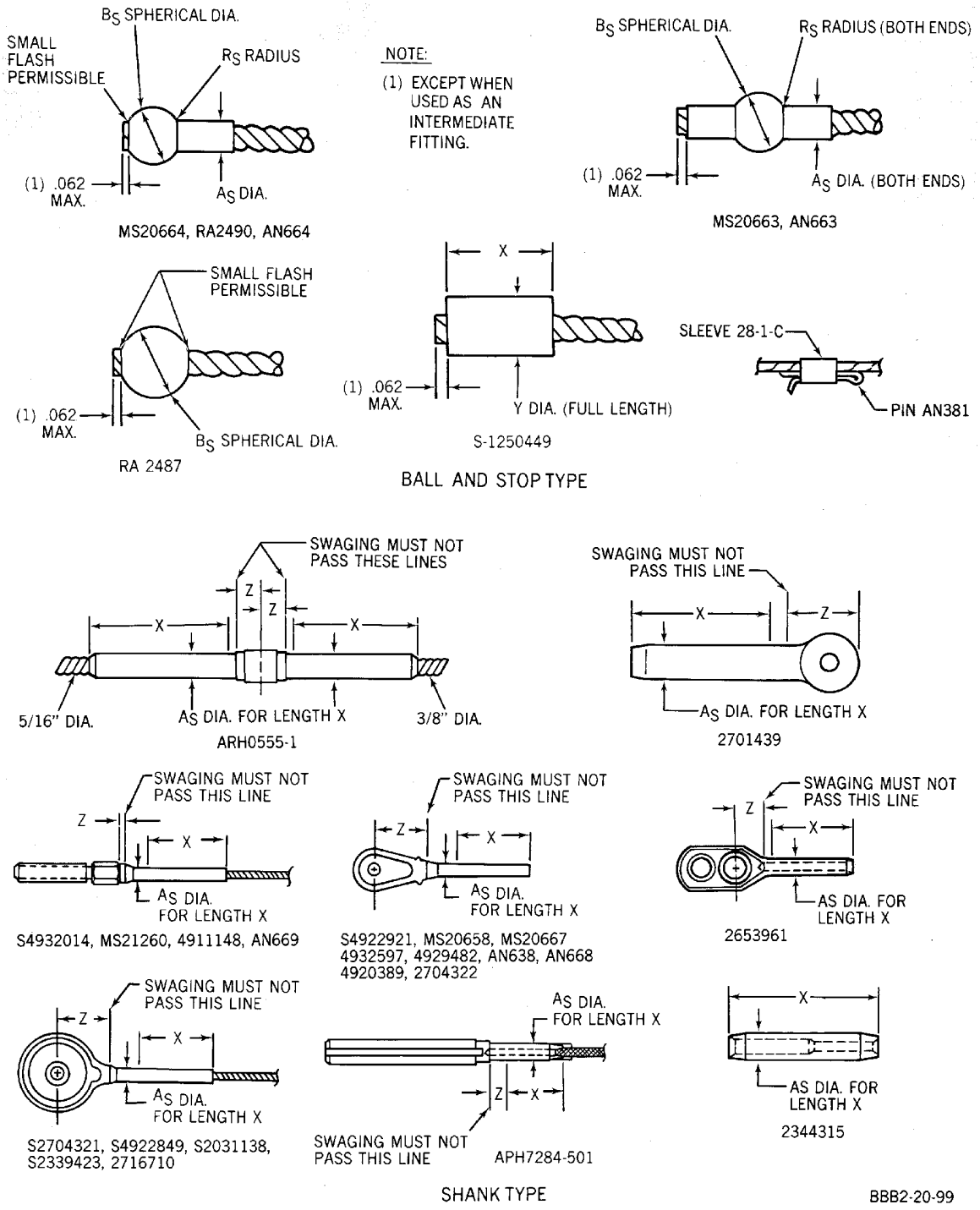

Ball, Shank and Stop Type Terminal Dimensions After Swaging
Figure 203/20-10-20-990-803

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4. Proof-Loading and Prestretching

A. All cable assemblies shall be prestretched, and all terminals and intermediate fittings (except RA2487) shall be proof loaded to values shown in Figure 205. Proof-loaded values for RA2487 fittings are shown in Table 202. For proof-load of the last terminal when you use the two stage assembly method, use the terminal end cable tester.

(1) Proof-loading and pre-stretching shall be accomplished with cable assembly in straight line. Proof-loading and prestretching are done simultaneously.

(2) Intermediate fittings shall be proof-loaded in one direction only.

(3) Hold all terminals with jaws (grips) per Figure 206 while applying load, unless otherwise specified on engineering drawing.

(4) Gradually, over an interval of at least 3 seconds, apply load until required value is obtained (Figure 205) (Table 202). Hold load for 15 seconds minimum.

(5) For the two stage assembly method, proof load of the last terminal end, must be applied one time only.

(6) Release load and repeat procedure as in Paragraph 4.A.(4). Apply load a total of 3 times.

(7) Assemblies with two different wire rope (cable) sizes shall be proof-loaded and prestretched from intermediate fitting to end fitting for larger size wire rope and between both end fittings for smaller size wire rope. Proof-loads shall be those specified in Figure 205 and Table 202for corresponding wire rope size.

(8) Proof loads shall be applied with either a calibrated testing machine or dead weight. Loads shall be released evenly and gradually.

(9) Proof-loaded and prestretched assemblies shall be identified per Paragraph 9. as verification of acceptability.

(10) Assemblies on which terminal depth mark on cable has moved out more than 1/32 inch (0.79 mm), and those on which mark is missing, are not acceptable.

NOTE: Swaged open-end fittings are acceptable if it can be verified that the terminal has not moved, by the cable still being full depth in the terminal and all quality requirements are met.

Table 202 RA2487 Ball-Cable Proof-Load Values

CABLE DIAMETER		NO. OF STRANDS X	PROOF-LOAD POUNDS ZINC COATED CARBON STEEL DMS 2220, TYPE 1, COMP A DMS 1989, TYPE 1	
INCH	(MM)	WIRES PER STRAND	MIN.	MAX.
1/16	1.59	7 x 7	230	250

Table 203 Coil Diameter Minimums

CABLE DIAMETER		NO. OF STRANDS X	MINIMUM COIL DIAMETER	
INCH	(MM)	WIRES PER STRAND	INCH	(MM)
1/16	(1.59)	7 x 7	10	(254.0)
3/32	(2.38)	7 x 7	12	(304.8)
1/8	(3.18)	7 x 19	12	(304.8)
3/16	(4.76)	7 x 19	15	(381.0)

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Table 203 Coil Diameter Minimums (Continued)

CABLE DIAMETER		NO. OF STRANDS X	MINIMUM COIL DIAMETER	
INCH	(MM)	WIRES PER STRAND	INCH	(MM)
1/4	(6.35)	7 x 19	18	(457.2)
5/16	(7.94)	7 x 19	22	(558.8)
3/8	(9.53)	7 x 19	26	(660.4)
1/8	(3.18)	1 x 19	20	(508.0)
5/16	(7.94)	7 x 31 (1)	22	(558.8)
3/8	(9.53)	7 x 31 (1)	26	(660.4)
3/16	(4.76)	6 x 31 (2)	15	(381.0)
1/4	(6.35)	6 x 31 (2)	18	(457.2)

NOTE: (1) DMS 2187, Type 1, Comp. A (7-Flex).
(2) DMS 2192, Type 1, Comp. A.

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		TERMINAL NUMBERS				
		MS20663, MS20664, RA 2487, RA2490, AN663 AND AN664			S–1250449	
DASH NO.	CABLE DIAMETER INCH (MM)	AS (1) DIAMETER INCH (MM)	BS SPHER. DIA. INCH (MM)	RS (1) MAX. RAD. INCH (MM)	Y DIAMETER INCH (MM)	X LENGTH INCH (MM)
–2	1/6 (1.59)	$0.112^{+.000}_{-.003}$ $\left(2.84^{+.000}_{-.076}\right)$	$0.190^{+.000}_{-.003}$ $\left(4.83^{+.000}_{-.076}\right)$	0.014 (0.36)	$0.190^{+.000}_{-.005}$ $\left(4.83^{+.000}_{-.127}\right)$	0.270 ±.010 (6.86 ±.25)
–3	3/32 (2.38)	$0.143^{+.000}_{-.003}$ $\left(3.63^{+.000}_{-.076}\right)$	$0.253^{+.000}_{-.003}$ $\left(6.43^{+.000}_{-.076}\right)$	0.019 (0.48)	$0.219^{+.000}_{-.005}$ $\left(5.56^{+.000}_{-.127}\right)$	0.390 ±.010 (9.91 ±.25)
–4	1/8 (3.18)	$0.190^{+.000}_{-.003}$ $\left(4.83^{+.000}_{-.076}\right)$	$0.315^{+.000}_{-.003}$ $\left(8.0^{+.000}_{-.076}\right)$	0.023 (0.58)		
–6	3/16 (4.76)	$0.255^{+.000}_{-.005}$ $\left(6.48^{+.000}_{-.127}\right)$	$0.442^{+.000}_{-.005}$ $\left(11.23^{+.000}_{-.127}\right)$	0.033 (0.84)	$0.375^{+.000}_{-.005}$ $\left(9.53^{+.000}_{-.127}\right)$	0.770 ±.010 (19.56 ±.25)
–8	1/4 (6.35)	$0.348^{+.000}_{-.005}$ $\left(8.84^{+.000}_{-.127}\right)$	$0.567^{+.000}_{-.005}$ $\left(14.40^{+.000}_{-.127}\right)$	0.042 (1.07)	$0.630^{+.000}_{-.010}$ $\left(16.0^{+.000}_{-.25}\right)$	0.938 ±.010 (23.83 ±.25)
–10	5/16 (7.94)	$0.413^{+.000}_{-.005}$ $\left(10.49^{+.000}_{-.127}\right)$	$0.694^{+.000}_{-.007}$ $\left(17.63^{+.000}_{-.178}\right)$	0.046 (1.17)		
–12	3/8 (9.53)	$0.468^{+.000}_{-.007}$ $\left(11.89^{+.000}_{-.178}\right)$	$0.812^{+.000}_{-.007}$ $\left(20.62^{+.000}_{-.178}\right)$	0.046 (1.17)		
–100	5/16 (7.94)				$0.755^{+.000}_{-.010}$ $\left(19.18^{+.000}_{-.25}\right)$	1.063 ±.010 (27.0 ±.25)
–120	3/8 (9.53)				$0.880^{+.000}_{-.010}$ $\left(22.35^{+.000}_{-.25}\right)$	1.531 ±.010 (38.89 ±.25)

NOTE: (1) AS AND RS DIMENSIONS DO NOT APPLY TO RA 2487 TERMINALS

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Swaged Cable Terminals
Figure 204/20-10-20-990-804

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CABLE DIAMETER INCH	(MM)	NO. OF STRANDS X WIRES PER STRAND	PROOF-LOAD LBS (KGS) ZINC COATED CARBON STEEL SPECIFICATION	MINIMUM	MEAN	MAXIMUM
1/16	(1.59)	7 X 7	DMS 1989, TYPE 1 & DMS 2220, TYPE 1, COMP. A	288 (129.60	300 (135.00)	312 (140.40)
3/32	(2.38)	7 X 7		552 (248.40)	575 (258.75)	598 (269.10)
1/8	(3.18)	1 X 19	DMS 2114, TYPE 1	1,260 (567.00)	1,312 (590.40)	1,365 (614.25)
1/8	(3.18)	7 X 19	DMS 1989, TYPE 1 & DMS 2220, TYPE 1, COMP. A	1,200 (540.00)	1,250 (562.50)	1,300 (585.00)
3/16	(4.8)	7 X 19	DMS 1989, TYPE 1 & DMS 2220, TYPE 1, COMP. A	2520 (1134.00)	2,625 (1181.25)	2,730 (1228.50)
1/4	(6.35)	7 X 19	DMS 1989, TYPE 1 & DMS 2220, TYPE 1, COMP. A	4,200 (1890.00)	4,375 (1968.75)	4,550 (2047.50)
5/16	(7.94)	7 X 31	(1) DMS 2187, TYPE 1, COMP. 1	5,880 (2646.00)	6,125 (2756.25)	6,370 (2866.50)
3/8	(9.53)	7 X 31		8,640 (3888.00)	9,000 (4050.00)	9,360 (4212.00)
3/16	(4.8)	6 X 31	(1) DMS 2192, TYPE 1, COMP. A	2,400 (1080.00)	2,500 (1125.00)	2,600 (1170.00)
1/4	(6.35)	6 X 31		4,200 (1890.00)	4,375 (1968.75)	4,500 (2025.00)

NOTE: (1) SLAT DRIVE CABLES

CAG(IGDS)

BBB2-20-101A

Cable Proofload/Prestretching Values
Figure 205/20-10-20-990-805

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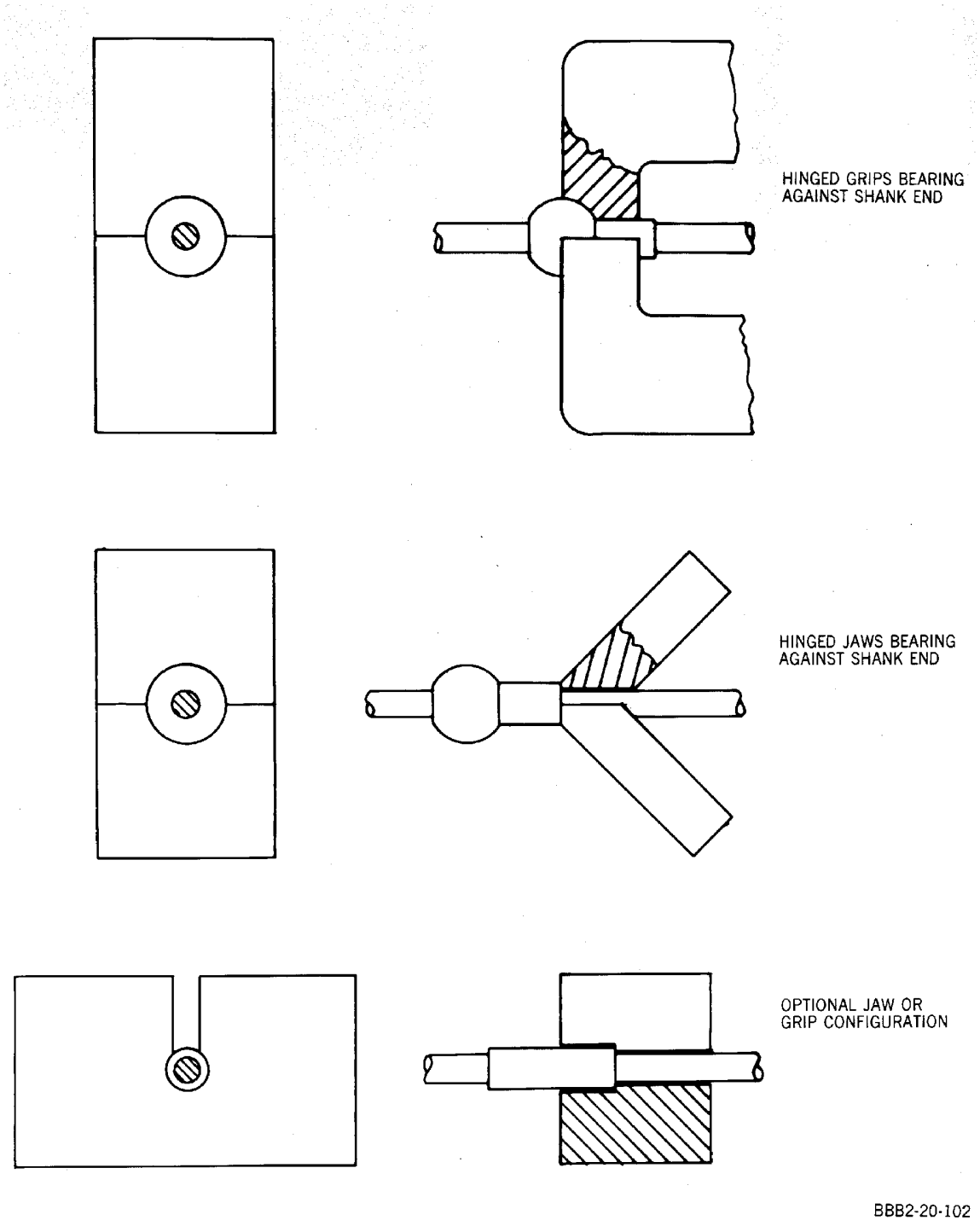

Proofload Jaws and Grips
Figure 206/20-10-20-990-806

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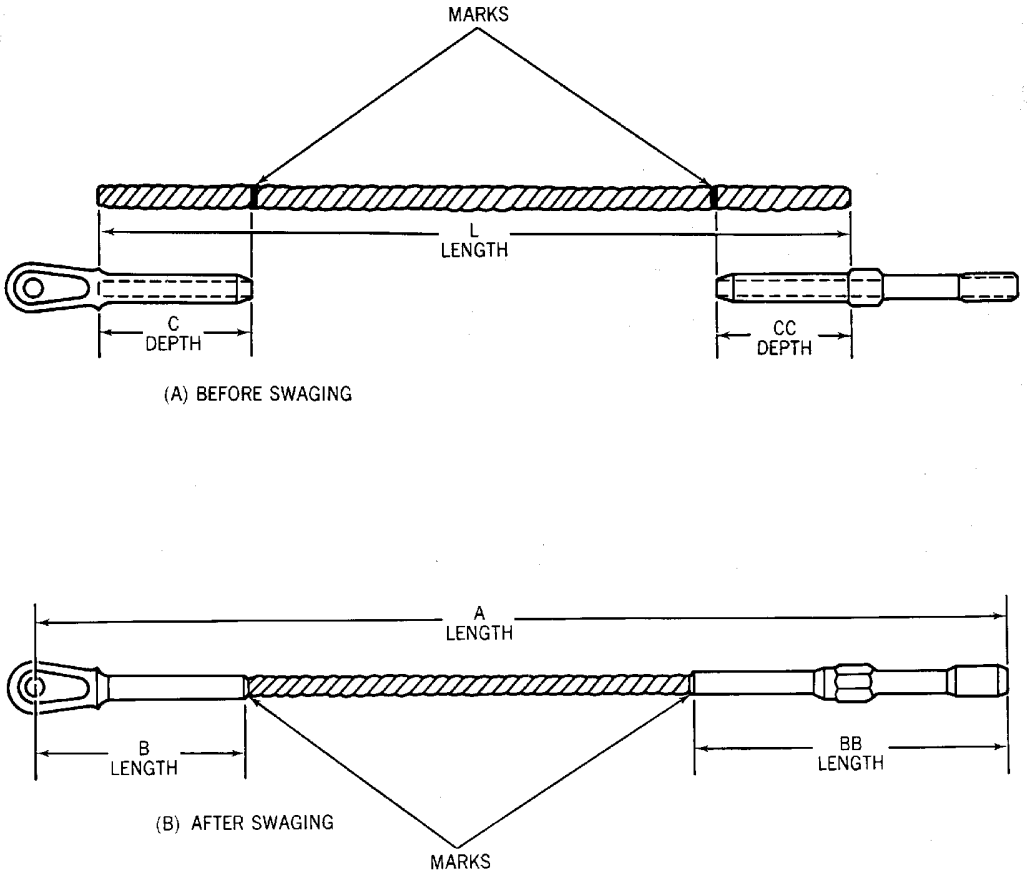

Typical Cable Assembly Before and After Swaging
Figure 207/20-10-20-990-807

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5. Coiling of Cables

A. Cable and cable assemblies shall not be coiled with coil diameters less than those shown in Table 203. Ends of cables must not be twisted.

(1) Special precautions must be taken for 1 x 19 cables since this cable kinks very easily.

6. Cable Length Calculation

A. Each individual reel of metallic cable should be tested for permanent stretch as follows:

(1) Prestretch sample 100-inch (2540 mm) minimum length preferred) using loads listed in Figure 205 for applicable size.

(2) Measure increase in length after load release and divide by original length to establish permanent stretch per inch (millimeter).

(3) Calculate cable length L (Figure 207) as follows:

(a) Establish A (Figure 207) from engineering drawing or measurement as applicable.

(b) Establish B (Figure 207) by measurement of fitting swaged on sample piece of cable.

(c) Establish C (Figure 207) by measurement of fitting prior to swaging.

(d) When B and BB are equal and C and CC are equal:

L = A - 2B + 2C - total permanent stretch.

(e) When B and BB are not equal and/or C and CC are not equal:

L = A - B - BB + C + CC - total permanent stretch.

7. Cable Cutting

A. Cut cables as follows:

(1) Cut cables to calculated length ±0.100 inch (±2.54 mm), reference Paragraph 6..

(2) Use cutting method that will produce clean ends that do not expand larger than applicable terminal bore diameters and which will not unravel during normal handling.

8. Cable and Fitting Assembly

A. Prepare cable and fitting as follows:

(1) Select and determine position of fittings, stops, etc., from engineering drawing.

(2) Do not remove plating from fittings prior to assembly and swaging.

(3) Strip plastic from plastic coated cables sufficient amount to allow penetration into terminal bore as required.

(4) Strip small 1/16 and 3/32 inch (1.59 and 2.38 mm) diameter plastic coated cable ends with Speedex-Trigomatic Model 200 wire stripper. Make test cut on scrap material to ensure that there is no nicking or cutting of cable before proceeding further.

NOTE: Only those areas specified on the engineering drawing should be stripped from nylon coated cable using a WS20 cable stripper.

(5) Mark cut cable using either marking crayon No. 43 MM or brush pen with black raw stock marking ink at distance from end equal to depth of terminal bore (Figure 207). Allow for surplus length necessary to handle ball or shankless-type fittings. Place similar marks at location of all intermediate fittings.

NOTE: The cable marks should not be removed until after swaging, proof-loading, and prestretching and check are completed.

(6) On nylon coated cable only, prior to insertion of cable into terminal shank provide protection for all joints except ball, ball-shank, and stop-type terminals as follows:

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(a) Select 1-inch (25.4 mm) length of heat shrinkable tubing AMS 3634 with an I.D. size 1/16 inch (1.59 mm) larger than nylon coated cable O.D.

(b) Slip tubing over cable prior to insertion of cable into terminal shank.

(c) After swaging and using clean, dry cloth, wipe end surface of terminal on bare and nylon coated wire rope, in area to be covered by heat shrinkable tubing. Center tubing over joint.

NOTE: Corrosion preventive compound is not required in joint under tubing.

(d) Shrink tubing per manufacturer's instructions.

(e) Insert cable into shank type terminals until cable penetrates entire bore and depth marks are plainly visible and just touch terminal end where cable enters. (Figure 207)

(f) Insert cable into ball of shankless-type terminals until depth marks are plainly visible and just touch terminal where cable enters. At this point, sufficient amount of cable should protrude through terminal to allow conformance to dimensions in Figure 204 and/or provide for any surplus required for handling during swaging.

(g) If cable is not tight enough in fitting bore to prevent slippage, anchor cable by bending slightly when half inserted. Ball or intermediate fittings can be held in place by wrapping cable on both sides of fitting with tape or light wire.

9. Identification

A. All cables shall be identified as follows:

(1) A linen or plastic identification tag shall be attached to each cable assembly.

(2) In addition to linen or plastic tag all cable assemblies shall be identified on each end fitting by electrochemical etch.

(3) Electrochemical etch identification shall include federal supply code for manufacturer and letter "P". Letter height shall be 0.032 to 0.062 inch (0.812 to 1.57 mm).

10. Protective Treatment

A. All cable assemblies shall be treated with corrosion preventive compound except as follows:

NOTE: Protective treatment shall not be applied to nylon coated cable, except in places where cable is stripped bare and is not protected. (Paragraph 8.) Corrosion resistant (stainless) steel cables and assemblies otherwise specified on engineering drawing.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1097, SOLVENT/MIL-PRF-680 TYPE 1 (DPM 518)

HAZMAT 1000, REFER TO MSDS

(1) Do not use strippers or solvents on cables or cable assemblies before or after protective treatment, except when checking for suspected corrosion. Suspected areas of cable(s) may be cleaned using a clean cloth dampened with cleaning solvent MIL-PRF-680, Type 1. Check cable after cleaning and if found satisfactory, coat immediately with corrosion preventive compound D-5035NS.

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(2) Corrosion preventive compound shall not be permitted on bearings. When assemblies containing bearings or quick-disconnects are dipped, support terminal outside tank whenever possible. When not possible, or when splashing or draining of MIL-PRF-16173 Grade 4, corrosion preventive into bearing or quick-disconnect may occur, protect bearing or quick-disconnect by masking with greaseproof paper prior to immersion.

(3) Clean cables before corrosion preventive treatment by wiping with clean, dry cloth. Do not use solvents. Clean zinc coated cables additionally by wiping with a clean cloth dampened with DMS 2150 corrosion inhibiting compound. Ensure that residual film of DMS 2150 is not discernible to unaided eye.

(4) Corrosion of cable or terminals is not acceptable. Applicable cable assemblies should be coated with MIL-PRF-16173, Grade 4 corrosion preventive compound. Allow assemblies to drain and solvent to evaporate completely. Using clean dry cloth, wipe sections of cable which have an excessively heavy coating or are covered with runoffs and drippings, such as bottom of dipped coil, and coat with uniform layer of corrosion preventive compound MIL-PRF-16173, Grade 4. When immersion is used for applying coating, do not exceed 2 minutes.

(5) Do not coat threads of terminals.

(6) Solids (nonvolatile) content of MIL-PRF-16173, Grade 4 corrosion preventive compound shall be maintained at 47 to 51 percent as determined by MIL-PRF-16173. Zahn cup No. 2 shall be used. Viscosity shall be 90 seconds maximum for cold immersion tank compound and 70 seconds maximum for heated immersion tank compound. Temperature for heated compound shall be 200°F maximum. For method which utilizes hot dipping, viscosity shall be sufficient to produce coating which satisfies requirements of Paragraph 10.A.(7).

NOTE: The viscosity for heated immersion tank method may be adjusted by changing the temperature (200°F maximum) of the compound, by adding fresh material, or by adding Douglas #2 solvent.

(7) Applied corrosion preventive compound coating shall have following characteristics:

(a) Valleys between strands shall have dark line at base of valley.

(b) All other surfaces shall have pronounced amber color. Metallic sheen of uncoated cable shall have been dulled by coating.

(c) Buildup of coating thickness, dripping, or sagging of coating to extent that cable construction form cannot be seen is not acceptable.

(d) Cables that have been coated with MIL-PRF-16173, Grade 4, corrosion preventive compound which was maintained at 47 to 51 percent solids shall be allowed to air dry in coils or straight lengths for minimum of 6 hours. Cables that have been coated at room temperature with concentrated MIL-PRF-16173, Grade 4, corrosion preventive compound shall be allowed to dry minimum of 4 hours. Cables that have been coated with heat concentrated MIL-PRF-16173, Grade 4, corrosion preventive compound shall be allowed to dry minimum of 2 hours.

(8) Protect assemblies for which normal application procedures are not practical by applying thin coat of corrosion preventive compound with clean cloth, clean brush, or piece of foam material which has been dipped in MIL-PRF-16173, Grade 4, corrosion preventive compound. Cables can also be touched up by spraying with D-5035NS aerosol containers of corrosion preventive compound.

(9) Do not remove protective coating from cables. At conclusion of final fabrication of cable, applicable assemblies should be checked for adequate corrosion preventive coating.

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TUBING AND HOSE - MAINTENANCE PRACTICES

1. General

A. This section contains information for the identification, handling, and general removal/installation procedures for permanent lines and hoses except for ducts.

(1) The data for fittings and couplings is contained in:

- Ducts, Clamps, and Couplings (DUCTS, CLAMPS, AND COUPLINGS - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-11/201)
- Fluid line fittings (FLUID LINE FITTINGS - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-13/201)
- AN and MS fitting (AN and MS FITTING - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-03/201)

B. Pipes and hoses that transmit fluids or gases are subject to damage during the life of the aircraft. When maintenance is done on components, or when maintenance is done in the immediate area.

2. Identification of Tubes and Hoses

A. All permanent lines and hoses, are identified to show the systems on which installed. Identification is to be readily in view.

(1) Identification is done by a identification tape or with a color band that agrees to the system that it is used on. (Table 201, Figure 201)

- The location of identification tapes will change according to the length of the pipe or hose assembly.
- Skydrol resistant hose assemblies are identified when the aircraft was assembled and do not require color identification.
- Heating and ventilation flexible air ducts are identified by a part number only and are not color identified.
- Lines and ducts that are in areas that have temperatures more than 250°F (121°C) are identified by a part number only and are not color identified.
- All lines that vent to the outside atmosphere, or used as fill, drain, or dump must be identified with the tape of the basic system, such as Class -3 Fuel, Class -11 Air Conditioning, etc. The secondary function, such as “VENT”, “FILL”, “DRAIN”, “DUMP”, “VENT AND DRAIN”, etc., must be printed in the white area of the basic tape.
- Static and pitot system hoses are identified, by function and the system, with a tape of white acetate tape printed with function.

Table 201 Basic Identification Tapes

CLASS	BASIC FUNCTION NAME	BASIC COLOR CODE	SYSTEM SYMBOL	PRINTING AREA	SECONDARY COLOR
Class -3	Fuel	Red	Four Point Star	White	
Class -5	Lubrication	Yellow	Staggered Squares	White	
Class -6	Hydraulic	Blue-Yellow	Circles	White	
Class -6-1	Hydraulic, L1*[3]	Blue-Yellow	Circles	White	Black
Class -6-2	Hydraulic, R2*[3]	Blue-Yellow	Circles	White	White
NOTE: Hydraulic lines have additional marking to identify function and direction of fluid flow within each line.					

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Table 201 Basic Identification Tapes (Continued)

CLASS	BASIC FUNCTION NAME	BASIC COLOR CODE	SYSTEM SYMBOL	PRINTING AREA	SECONDARY COLOR
Class -7	Compressed Gas	Orange	Broad Diagonal Stripe	White	
NOTE: Compressed gas lines are lines which carry a gaseous substance, other than air under pressure or vacuum.					
Class -8	Instrument Air	Orange-Gray	Continuous Zig-Zag Line	White	
NOTE: Instrument air lines are lines which carry air for actuating pressure operated gauges					
Class -9	Coolant	Blue	Horizontal S	White	
Class -10	Breathing Oxygen	Green	Rectangle	White	
Class -11	Air Condition	Brown-Gray	Gravel Pattern	White	
Class -12	Fire Protection	Brown	Horizontal Diamond	White	
Class -14	Warning Symbol	White	Skull & Crossbones	*[1]	*[2]
Class -16	Pneumatic	Orange-Blue	Continuous X-form Lattice	White	
NOTE: Pneumatic air lines are lines which carry air, other than instrument air, under pressure.					
Class -16-1	Pneumatic, 1 (System 1)	Orange-Blue	Continuous X-form Lattice	White	Pink
Class -16-2	Pneumatic, 2 (System 2)	Orange-Blue	Continuous X-form Lattice	White	Yellow
Class -17	Electrical Conduit	Brown-Orange	Lighting Bolt	White	
Class -21	Potable Water	White-Blue	Large Drops	White	
Class -21-1	Potable Water, 1 (System 1)	White-Blue	Large Drops	White	Pink
Class -21-2	Potable Water, 2 (System 2)	White-Blue	Large Drops	White	Yellow
Class -21-3	Potable Water, 3 (System 3)	White-Blue	Large Drops	White	Lt. Green
Class -22	Waste Water	White-Brown	Connected Dots	White	
Class -23	Vacuum	Gray-Orange-Gray	Vertical Wavy Line	White	

*[1] This symbol should be used sparingly and should not be used on lines to warn against high pressure , or hazard already identified.

*[2] This symbol must be placed immediately adjacent to the identification group at the end opposite the functional tape.

*[3] Hydraulic systems also have a left or right designation.

B. The location of Identification Tape

(1) General rules for the location for the application of an identification tape to a line or electrical conduit are as follows:

NOTE: Take in consideration all rules before the tape is applied.

- Apply to the two ends of a removable line.

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- On a removable line, 48 in. (1219 mm) or less and fully in view in a compartment or area, it is necessary to have only one tape applied.
- When possible, put the tape where it will not be put out of view by other parts or accessories when seen in the aircraft.
- One identification tape must be seen in each compartment that the line goes through. The identification band must be able to be read by maintenance personnel.
- Apply the identification band at intervals on lines of large length. This is necessary to make sure of positive identification when seen from the usual observation points, including through access doors.
- Permanent lines, brazed or swaged line assemblies:
- A brazed line assembly with more than one short outlet does not have to have the each of the outlets identified. if the tape will be seen on the assembly in each compartment, accessible for maintenance, after installation in the aircraft.

C. Identification tape will not be necessary as follows:

- Tapes are not necessary, adjacent to permanent joints, such as brazed or swaged run-unions and T-fittings.
- A straight line shorter than 8 in. (203 mm) or a bent line with less than 4 in. (102 mm) of straight segment.
- A line of such configuration that prevents the correct application of the tape.
- All lines in the engine nacelles of commercial aircraft.
- No part of a line in an integral fuel tank will be identified with tape.
- For hose and hose assemblies that include the flexible metal hose, except when specially necessary.

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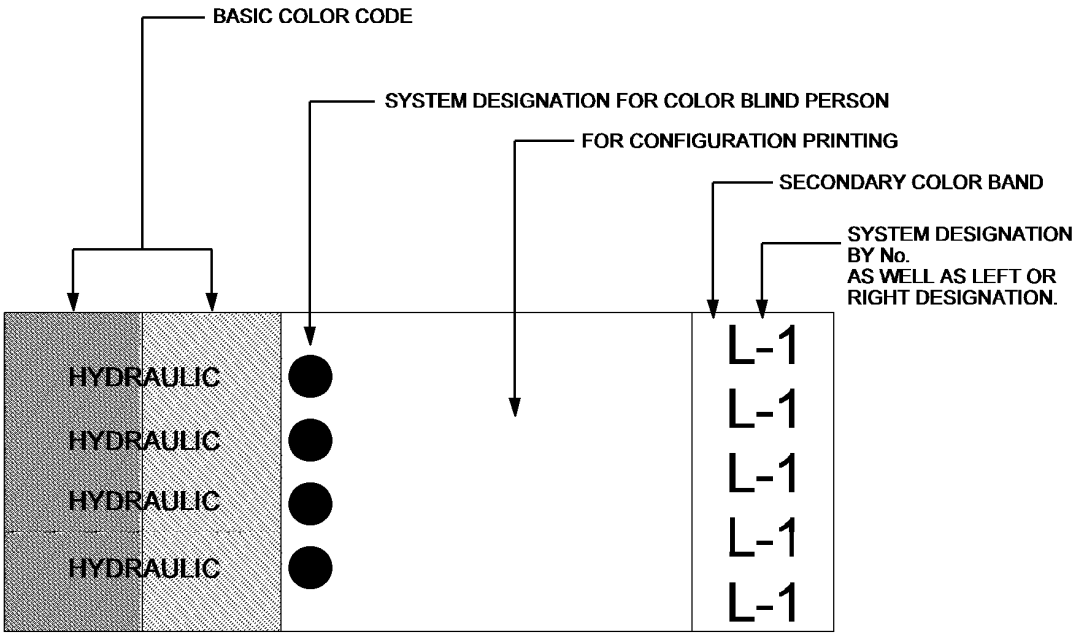

TYPICAL FLUID LINE IDENTIFICATION TAPE
(REFER TO TABLE "BASIC IDENTICATION TAPES" FOR MORE DETAILED INFORMATION.)

BBB2-20-9B
S0006525640V2

Tubing and Hose Identification Markings
Figure 201/20-12-01-990-801

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3. General Removal/Installation of Tubing or Hose

A. Removal of Tubing or Hose:

(1) For detailed removal instructions, refer to the applicable Aircraft Maintenance Manual (AMM) procedure.

(2) Put protective caps and plugs on all tubing, hoses, and fittings immediately after being disconnected from the system or component to prevent contamination.

(3) When many lines or hoses are disconnected in the same work area, tag lines or hoses for identification on installation.

B. Installation of Hose:

(1) For detailed installation instructions, refer to the applicable AMM procedure.

(2) Visually examine the hose for cleanliness before installation.

(a) A hose with protective caps not installed must be fully cleaned before installation.

(3) Examine the hose for damage.

(a) Replace the hose, if a condition that follows exists:

- Two or more broken wires in one plait or many broken wires in a specified area.
- Hose protected by a protective sleeve, and there is worn areas or chafing into the metal braid.
- Abrasion/chafing is extended throughout one plait or one plait to another.

(4) Make sure that the fittings are correctly aligned and attached before installation of the hose. (PERMANENT PIPING - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-04/201 Config 1)

WARNING: HIGH TEMPERATURE ANTISEIZE IS AN AGENT THAT IS POISONOUS. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HIGH TEMPERATURE ANTISEIZE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HIGH TEMPERATURE ANTISEIZE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(5) Apply the applicable anti-seize lubricant to the fittings. (ANTISEIZE LUBRICANTS - MAINTENANCE PRACTICES, PAGEBLOCK 20-60-05/201)

(6) Install the hose on the fitting and tighten the connectors to the correct torque values. Use a different wrench to apply opposite direction torque to prevent the flexible hose from being twisted. (PIPING COUPLING NUT TORQUE VALUES - MAINTENANCE PRACTICES, PAGEBLOCK 20-30-02/201)

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(7) Hose assemblies installed on non-moving connections must have no twist in it after the B-nut has been tightened. Hoses must not be under tension or cause deflection of rigid tubing when under full system pressure.

(8) Make sure that the hose installed on the moving connection is free of torsion or tension stresses during the full range of travel when full system pressure is applied. The hose must not cause deflection of rigid tubing to which hose is connected.

(9) Make sure that the hose is free to expand, contract, and is clear of all structure. Where there is not sufficient clearance between the hose and structure, protection must be given to the hose to prevent damage from chafing.

(10) Do not use support clips on the hose unless approved by enginneering.

(11) The bend radius of installed wire braided hoses and hose assemblies must not be less than that necessary by the applicable specification. (Table 202)

Table 202 Bend Radius Of Kevlar Braided Hoses

Hose Size	Minimum Bend Radius
-04	3.0 in. (76.2 mm)
-06	5.0 in. (127.0 mm)
-08	5.75 in. (146.05 mm)
-10	6.5 in. (165.1 mm)
-12	7.75 in. (196.85 mm)
-16	12.0 in. (304.8 mm)
NOTE: Bend radius is measured on inside of hose bend.	

C. Connection of the Ratchet Type Quick Disconnect Coupling

(1) Connect the ratchet type quick disconnect coupling as follows:

(a) Before installation, visually make sure that the interiors of all coupling halves are clean.

NOTE: Do not clean off the solid film lubricant or oil that can be on the coupling threads

(b) Align the two halves of the coupling and connect the components together.

(c) Pull back on the socket sleeve and turn the socket half on the nipple half until the threads are fully bottomed.

(d) When fully bottomed, release the socket sleeve to engage the locking teeth.

NOTE: The socket can be lossened a small amount (one tooth maximum) to get the full engagement of the locking teeth.

NOTE: The locking teeth can look to be fully engaged without having the coupling halves connected with the threads fully engaged.

(e) Visually make sure that the locking teeth are fully engaged. (Figure 202)

D. Installation of Tubing

(1) For detailed installation instructions, refer to the applicable AMM procedure.

(2) Visually make sure that the tubing is clean before installation.

(a) Tubing with the protective caps missing must be fully cleaned before installation.

(3) Examine the tubing for damage, particularly at flared tubing ends, fittings, and at bends. (PERMANENT PIPING - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-04/201 Config 1)

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(a) Replace tubing that is damaged more than the limits.

(4) When a flexible coil pipe is connected to a control surface actuator, do the steps that follow:

(a) Make sure that the flexible coil pipe is installed with the applicable control surface in the neutral position.

(b) Make sure that the applicable cylinder is in the middle travel position.

1) This will get the minimum preload when the pipe ends are connected to the cylinder fittings and the pipe support or clamp is attached.

(5) Make sure that the fittings are correctly aligned and attached before installation of the tubing.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1196, ANTISEIZE/HIGH TEMPERATURE (DPM 377)

HAZMAT 1000, REFER TO MSDS

(6) Apply anti-seize to fittings. (ANTISEIZE LUBRICANTS - MAINTENANCE PRACTICES, PAGEBLOCK 20-60-05/201)

(7) Install tubing on fittings, tighten B-nuts to the correct torque value. (PERMANENT PIPING - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-04/201 Config 1)

(8) If a line connection is broken or a component is replaced, install a new o-ring if one was installed.

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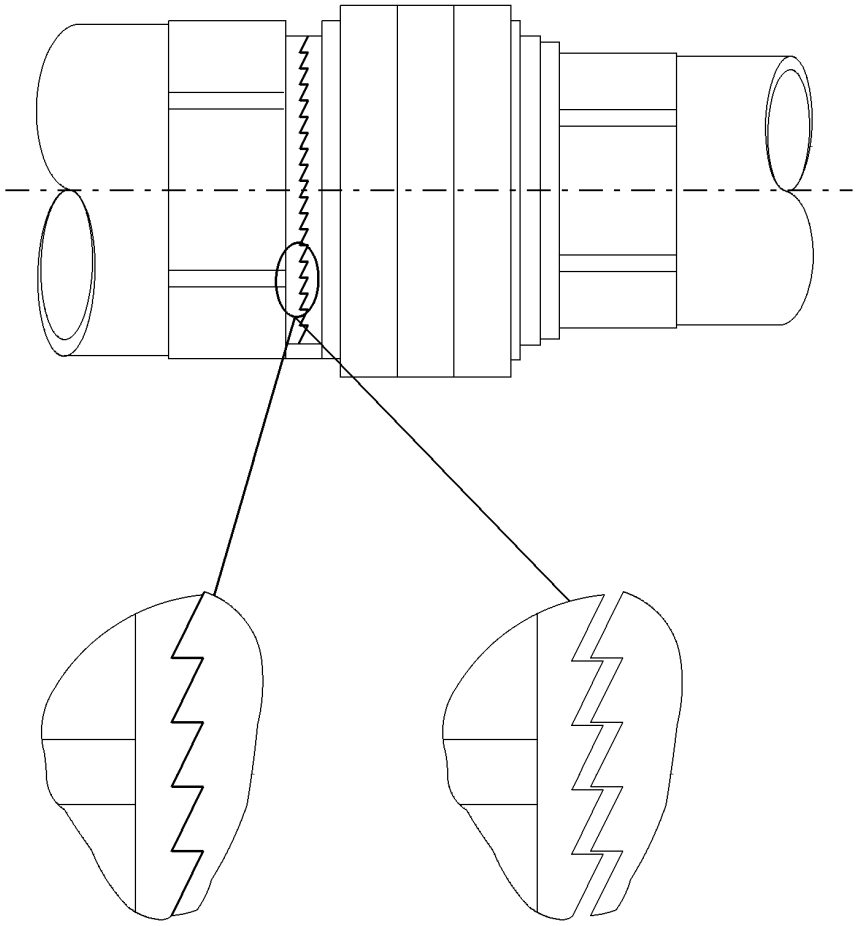

ACCEPTABLE AND NOT ACCEPTABLE TEETH ENGAGEMENT

BBB2-20-198
S0000477667V1

Ratchet Type Quick Disconnect Coupling
Figure 202/20-12-01-990-805

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AN and MS FITTING - MAINTENANCE PRACTICES

1. General

A. This maintenance practice has the removal/installation, alignment, and fabrication procedures for flared (AN) and flareless (MS) tubing.

- Identification of MS Fittings (Paragraph 3.)
- Removal/Installation Flared (AN) or Flareless (MS) Tubing (Paragraph 4.)
- Fabrication of Tubing of installation Flared (AN) Fitting (Paragraph 5.)
- Fabrication of Tubing of installation Flareless (MS) Fitting (Paragraph 6.)
- Proof Testing (Paragraph 7.)

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201 Tool and Equipment List

Tool Part Number	DESIGNATION	Manufacturer
D9872– 0.25 in. (6.35 mm) - 0.375 in. (9.525 mm)	Chipless pipe cutter - ratchet dual cut.	Deutsch Metal Products Division
D9853– 0.50 in. (12.70 mm) - 0.75 in. (19.05 mm)	Chipless pipe cutter - ratchet dual cut.	Deutsch Metal Products Division
D9852– 1.0 in. (25.40 mm) - 1.5 in. (38.10 mm)	Chipless pipe cutter - ratchet dual cut.	Deutsch Metal Products Division
D9851– 0.25 in. (6.35 mm) - 0.375 in. (9.525 mm)	Deburring tool plug type	Deutsch Metal Products Division
D9850– 0.50 in. (12.70 mm) - 0.75 in. (19.05 mm)	Deburring tool plug type	Deutsch Metal Products Division
D9849– 1.0 in. (25.40 mm) - 1.5 in. (38.10 mm)	Deburring tool plug type	Deutsch Metal Products Division
Tube flaring machine (Model DF)		Conrac

Table 202 Consumables

Bulk Reference Name	Description	Specification
B60103	Perchloroethylene	DPM 1293
B60016	Hand wipe cleaner	DPM 6380–1
G60015	Abrasive paper No. 320 grit	DPM 5695-4
G60428	White cotton cleaning wipers	DMS 1820 T1A2

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Table 202 Consumables (Continued)

Bulk Reference Name	Description	Specification
C60068	Fluid resistant primer	DMS 1786
G60225	Large Chisel point marking pen (RED)	DPM 5446
G60160	identification lacquer (tubed), (baby pink)	DPM 5492–7752–103–3
D60008	Antiseize lubricants	DPM 377
	clean dry compressed air	

3. Identification of MS Fittings

Table 203 Identification of MS Fittings

Name and part No.	Tube Outside Diameter (OD)	Fitting Material
Sleeves, MS21922 *[1]	-4 *[4]	*[2], *[3]
Nuts, MS21921 *[1]	-4 *[4]	*[5], *[6], *[7], *[8]

*[1] Basic Part
*[2] C=17--4PH Stainless steel
*[3] No Letter=Cadmium Plated Carbon Steel
*[4] OD in 1/16ths of an inch.
*[5] D=All Aluminum Alloy except 7075 (“D” is optional)
*[6] W=Aluminum Alloy 7075
*[7] No Letter= Carbon Steel (Refer to Footnote # 8)
*[8] J=Class 304, K=Class 316, S=Class 347

4. Removal/Installation Flared (AN) or Flareless (MS) Tubing

A. Removal of Flared (AN) or Flareless (MS) Tubing

(1) Remove the flared (AN) or flareless (MS) tubing. (TUBING AND HOSE - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-01/201)

B. Installation of Flared (AN) Tubing

(1) Install the flared (AN) tubing. (TUBING AND HOSE - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-01/201)

(a) Visually examine the tubing for cleanliness before installation. Tubing with protective caps missing must be fully cleaned before installation.

(b) Examine tubing for damage, particularly at flared tubing ends, fittings, and at bends. Tubing which is damaged more than the limits must be replaced. (PERMANENT PIPING - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-04/201 Config 1)

(c) Lubricate the threads of the fitting. (ANTISEIZE LUBRICANTS - MAINTENANCE PRACTICES, PAGEBLOCK 20-60-05/201)

(d) Make sure that the fittings are correctly aligned. (PERMANENT PIPING - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-04/201 Config 1)

(e) Torque the fittings to the correct torque values. (PIPING COUPLING NUT TORQUE VALUES - MAINTENANCE PRACTICES, PAGEBLOCK 20-30-02/201)

(f) Make sure that tubing is not nearer than 3/32 in. (2 mm) to the adjacent structure, adjacent tubing, or fittings, except where specifically approved. (PERMANENT PIPING - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-04/201 Config 1)

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C. Installation of Flareless (MS) Tubing

(1) Install the flareless (MS) tubing as follows:

(a) Before tubing with MS is installed, make sure that all other related threaded fittings are correctly installed and torqued to the correct value. (PIPING COUPLING NUT TORQUE VALUES - MAINTENANCE PRACTICES, PAGEBLOCK 20-30-02/201)

(b) Clean the sealing area of sleeve with white cotton cleaning wipers, G60428 to remove loose cadmium plating, dirt, chips or other material which can prevent correct seating.

(c) Lubricate external sleeve surfaces and fitting threads

(d) Seal the two ends of the tube in fittings by firm hand loading or very light wrenching. A sharp increase in wrenching tightness will be evident at moment of seating.

(e) Hold the tube immediately behind the nut and push and pull side to side to make sure that the tube ends are seated. The tube will rattle or feel loose if the sleeve is not seated correctly.

(f) Torque the fittings to the correct torque values. (PIPING COUPLING NUT TORQUE VALUES - MAINTENANCE PRACTICES, PAGEBLOCK 20-30-02/201)

NOTE: Use the torque value based on tubing material regardless of the nut or fitting material.

(g) Apply the torque stripe as follows:

NOTE: Alignment of stripes is a means of detecting if the initial tightening of parts has been changed.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1497, CLEANER/HANDWIPE (DPM 6380-1)

HAZMAT 1000, REFER TO MSDS

1) Clean the fitting with a white cotton cleaning wipers, G60428 made moist with hand wipe cleaner, B60016 then wipe dry with white cotton cleaning wipers, G60428.

NOTE: Do not let the hand wipe cleaner, B60016 touch any area already torque striped. The solvent will dissolve the torque stripe.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1107, PRIMER/FR (DMS QPL 1786)

HAZMAT 1000, REFER TO MSDS

2) Apply a stripe with a red large chisel point marking pen (permanent), G60225 that is ½ in. (13 mm) long and ⅛ in. (3 mm) wide. This stripe must be applied across the torque item and the adjacent surface.

- fluid resistant primer, C60068 on skydrol systems.

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- Red large chisel point marking pen (permanent), G60225 in the interior of the auxiliary fuel cell.
- red identification lacquer (tubed), G60160 -103--3 baby pink in color on oxygen system.

5. Fabrication of Tubing of installation Flared (AN) Fitting

A. Prepare tube ends as follows:

CAUTION: DO NOT USE A HACKSAW TO CUT THE PIPE. FILINGS IN THE SYSTEM CAN CAUSE CONTAMINATION AND DAMAGE TO THE EQUIPMENT.

(1) Cut the tubing square 90 degrees (±1/2 degree) to the tube length centerline.

(2) Deburr the pipe OD with 320 grit sandpaper, G60015:

(3) Deburr the Inside Diameter (ID) edges of the tube. (PERMANENT PIPING - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-04/201 Config 1)

NOTE: Tubing, that is ½ in. (13 mm) or less, can be cut and deburred with a Deutsch ratchet-type hand-held tube cutter and a Deutsch deburring tool or equivalent.

(4) For “AN” fittings, make sure that chamfering of tube ends does not decrease the wall thickness by more than ⅓.

(5) Clean the pipe section. (PERMANENT PIPING - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-04/201 Config 1)

B. Flaring the Tube

(1) Flare tube with a Double Flare (Model DF) Tube Flaring Machine as follows:

CAUTION: NEVER OPERATE FLARING MACHINE WITH OPERATING LEVER IN FLARE OR UPSET POSITION WITHOUT TUBING IN DIE OR DAMAGE TO DIE OR PUNCHES WILL RESULT.

(2) Make sure that the tube is clean. (PERMANENT PIPING - MAINTENANCE PRACTICES, PAGEBLOCK 20-12-04/201 Config 1)

NOTE: Burrs, dirt, chips, or other contaminants will cause severe galling and pitting of flares.

(3) Find the size of tubing to be flared and make the selection of the applicable size die and punch. (Table 204)

Table 204 Upset, Flare Punches, and Dies

TUBE OD NOMINAL	WALL THICKNESS NOMINAL	UPSET PUNCH NO.*[1]	WALL THICKNESS NOMINAL				UPSET PUNCH No.	FLARE PUNCH No.	DIE No.
			0.028 in. (0.711 mm)	0.035 in. (0.889 mm)	0.042 in. (1.067 mm)	0.049 in. (1.245 mm)			
¼ in. (6 mm)	0.016 in. (0.406 mm) or 0.020 in. (0.508 mm)	400	-28	-35	-42	-49	420	437	433
5/16 in. (8 mm)		500	-28	-35	-42	-49	520	537	533
⅜ in. (10 mm)		600	-28	-35	-42	-49	620	637	633

NOTE: Select dash numbers indicated beneath tube wall thickness and add to upset punch part number. Tubes with 0.016 in. (0.406 mm) and 0.020 in. (0.508 mm) wall thickness requires same upset punch and does not have any dash numbers.

*[1] UPSET PUNCH NO. is for 0.016 in. (0.406 mm) or 0.020 in. (0.508 mm) wall thickness only.

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Table 205 Nominal Pressure Settings For 5052–0 and 6061T-4 Tubing

OD X WALL (INCH)	AIR SUPPLY PRESSURE	UPSET REGULATOR PRESSURE	FLARE REGULATOR PRESSURE	TUBE STOP ADJUSTMENT
NOTE: The values in this table are suggested values only; some adjustment may be necessary due to pressure and material variances.				
5052-0 Tubing				
1/4 x .020	40 psig (276 kPa)	20 psig (138 kPa)	20 psig (138 kPa)	½ in. (13 mm)
1/4 x .028	45 psig (310 kPa)	24 psig (165 kPa)	16 psig (110 kPa)	15/32 in. (12 mm)
5/16 x .028	50 psig (345 kPa)	30 psig (207 kPa)	20 psig (138 kPa)	15/32 in. (12 mm)
5/16 x .035	62 psig (427 kPa)	34 psig (234 kPa)	36 psig (248 kPa)	15/32 in. (12 mm)
3/8 x .028	62 psig (427 kPa)	50 psig (345 kPa)	10 +10 / -0 psig (69 +69 / -0 kPa)	15/32 in. (12 mm)
6061T-4 Tubing				
5/16 x .028	50 psig (345 kPa)	30 psig (207 kPa)	20 psig (138 kPa)	15/32 in. (12 mm)
3/8 x .028	62 psig (427 kPa)	50 psig (345 kPa)	10 +10 / -0 psig (69 +69 / -0 kPa)	15/32 in. (12 mm)

(4) Before operating the tube flaring machine, make sure of the nominal pressure settings.

(5) Install the tube stop in the tool bar.

(a) For the distance from the flat surface of the tool bar to the face surface of the tube stop. (Table 205)

(6) Adjust the air supply regulator on the rear of the tube flaring machine to the applicable operating pressure. (Table 205)

(7) Put the operating lever to the upset position and set the upset pressure regulator to the applicable operating pressure. (Table 205).

(8) Put the operating lever to the flare position and set the flare pressure regulator to the applicable operating pressure. (Table 205)

(9) Make a sample of the tube at the start of each job and evaluate for these requirements. (Paragraph 5.B.(9)(a))

(a) Tube ends must satisfy the applicable requirements that follow:

1) Make sure that the completed flares are concentric with OD of the tube to within 0.005 in. (0.127 mm) Total Indicator Reading (TIR) and are square with the tube centerline to within 1/2 degree.

2) Make sure that the immediate area of the flare tangent point is free from nicks, scratches, or other imperfections.

3) The finished flares must meet the acceptability limits. (Figure 201, Figure 202)

4) Do a visual check of completed flares using 4X magnification.

5) Make sure that the nuts and sleeves are in the correct directional relationship.

6) Flares must keep an 82 percent minimum percentage of the initial tubing wall thickness.

NOTE: Tubing ⅛ in. (3 mm) OD or less requires a minimum of 74 percent of initial tubing wall thickness.

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(10) Make adjustments for variations in material properties and pressure fluctuations, if necessary.

(11) Flare the tubing and take go/no-go measurements of each part immediately after the tube is flared.

(12) Lopsided flares that are produced and flares are not within requirements of Paragraph 5.B.(9)(a).

(a) Examine for misalignment of the tool bar, die, and the nose ring face plate.

(13) Proof test flared tubing. (Paragraph 7.)

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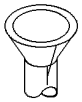
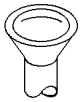
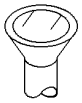
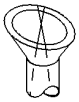
ACCEPTANCE LIMITS - SINGLE FLARES

CONDITION	PROBABLE CAUSE	DISPOSITION
1. Extruded Fin-Exterior  Wedge raised above basic surface of flare marks diametrically opposite.	Usually caused by worn thread clamping die. This condition prevents sleeve from seating properly.	Not Acceptable.
2. Die Crease  Slight longitudinal fin raised along side of tube and/or flare.	Usually caused by tube being slightly larger than nominal dimension; clamping dies extrude metal slightly.	Not cause for rejection if raised area is less than 0.004 in. (0.102 mm) high on flared portion. On straight portion of tube, crease is acceptable if it will allow free passage of sleeve onto flare. If this condition becomes chronic, the cause should be determined and corrected.
3. Scratches or Grooves - Interior Annular  Marks appearing approximately parallel to lip of flare.	Sometimes caused by metal chip pick-up on rotary mandrel.	Not cause for rejection unless depth of mark exceeds 10% of flare thickness to a maximum of 0.002 in. (0.051 mm) and are not sharp "V" bottomed.
4. Scratches, Grooves or Material Separation - Interior Longitudinal or Spiral  Marks appearing approximately perpendicular to lip of flare or spiraling outward to tip of flare.	Usually caused by scored mandrels, metal chip pick-up during flaring, or defects in the tube material.	Any such mark on the outermost 30% of the inner area of the flare is cause for rejection. Marks in the lower 70% of flared area acceptable if depth does not exceed 10% of flare thickness to a maximum of 0.002 in. (0.051 mm) and are not sharp "V" bottomed.
6. Angled or Eccentric Flare  Flared portion is eccentric with tube. Lip of flare not perpendicular to tube centerline. Thickness of flare wall varies.	Can be caused by loose clamping dies or mandrel or dies out of alignment. Angled instead of square cut-off can also result in this condition.	Acceptable within the limits. Refer to footnote #1.

Footnote #1: Tubing requiring S5021205-62 double flare ends prior to forming, to allow minimum straight away required by flaring machine, shall be anodized prior to flaring or forming to prevent entrapment of anodize solution.

(Continued)

BBB2-20-200
S0000479868V1

Acceptance Limits - Single Flares
Figure 201/20-12-03-990-803 (Sheet 1 of 3)

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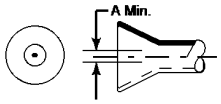
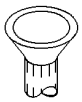
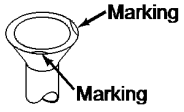
ACCEPTANCE LIMITS - SINGLE FLARES (Continued)

CONDITION	PROBABLE CAUSE	DISPOSITION
7. Rough Edge  Lip of flare with jagged, saw tooth, or uneven edge.	Usually results from improper cutting or burring. However, too much mandrel pressure can cause similar condition.	Not Acceptable.
5. Cracked Flare  Cracks, usually longitudinal, in flared portion.	Usually caused by too great an eccentric setting on the rotary mandrel, too high a pressure on the ram mandrel or by flaw in tube material; may also result from improper cutting or burring operations.	Not Acceptable.
8. Tube Closure  Tube inside diameter decreased by flaring operation locally at bottom of flare.	Usually caused by too great an eccentric adjustment of rotary mandrel. Appears more frequently on small diameter tubing. Use of ram mandrel will alleviate condition.	Acceptable providing inside diameter is not reduced beyond the "A" dimensions given below if less than "A" Dimension, does not increase wall thickness by more than 25 percent.

Tube Size	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3
A Min.	0.049	0.112	0.159	0.221	0.284	0.378	0.471	0.596	0.820	1.065	1.299	1.768	1.768	2.25	2.75

CONDITION	PROBABLE CAUSE	DISPOSITION
9. Clamping Die Marks - Tube  Small irregular impressed marks on exterior of tube in area gripped by clamping dies.	Caused by clamping action of dies. Dies are etched to assist in holding tube - these etched marks are transferred to tube surface.	Acceptable if depth of marks does not exceed 5% of actual wall thickness of tubing not to exceed 0.002 in. (0.051 mm) and are not sharp edged or "V" bottomed.
10.  Wedge raised above basic surface of flare marks diametrically opposite.		Acceptable.
11. Marks on Lip & Flare Surface - Exterior  Smooth abrasive finished surfaces on exterior flare areas of lip of flare.	Caused by abrasive polishing to clean up surface of irregularities. NOTE: Steel wool shall not be used in polishing.	Acceptable if maximum depth of scratches does not exceed 5% of wall thickness not to exceed 0.001 in. (0.025 mm).

(Continued)

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Acceptance Limits - Single Flares
Figure 201/20-12-03-990-803 (Sheet 2 of 3)

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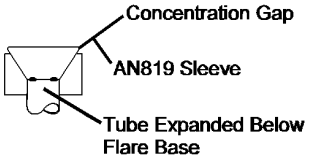
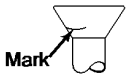
ACCEPTANCE LIMITS - SINGLE FLARES (Continued)

CONDITION	PROBABLE CAUSE	DISPOSITION
12. Marks in Flare Area Including Area Under Sleeve  Scratches or dings on surface face.	Marks are usually caused by storing and handling.	Any mark which does not penetrate deeper than 5% of the tube wall thickness is considered acceptable.
13. Sleeve Indention 	Usually caused by: 1. Worn fittings used during pressure test. 2. Too small in included angle on sleeve. 3. Improper or worn tooling. 4. Nut torqued repeatedly during various installations. 5. Some indentations is normal on 5052-0 tubing.	Acceptable if the indentation does not exceed 20% of the nominal wall thickness for 5052-0 tubing or 12% for tubes of any other material and the indention is not sharp, ragged or "V" bottomed.
14. "Tulip" Flares 	Caused by improper machine setting, or worn dies. The flare mandrel is not allowed to form the flare against the die. Dies shall conform to MS33584 configuration.	Not Acceptable if the AN819 sleeve cuts the tube before the sleeve contacts the back of the flare.
15. Mark extending part way around the periphery on the back of the flare. 	Caused by partial contact of the sleeve with the back of the flare.	Acceptable: Within the limits described below (a) Slight differences in flare angles and concentricity within MS33584 and the applicable sleeve drawing tolerances may result in only one side of the sleeve being marked when the sleeve is rotated against the flare. This condition is acceptable where the dimensional limits of footnote #1, the sleeve drawing and condition (13) of this table are met.
16. Cracked, Removable Ring  Loose, hanging or separable section on flare interior.	Improper deburring of tube end. Do not confuse with acceptable grooves defined in Condition 3.	Unacceptable: Improved end preparation. Proper maintenance of tooling will prevent this condition.
17. Pits - Interior Surface 	Caused by metal chip or defect on toll during flaring or defect on I.D. on tube surface.	Any mark which does not penetrate deeper than 5% of the tube wall thickness is considered acceptable.

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S0000479869V1

Acceptance Limits - Single Flares
Figure 201/20-12-03-990-803 (Sheet 3 of 3)

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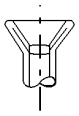
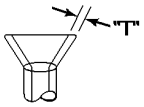
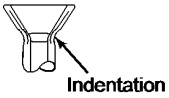
ACCEPTANCE LIMITS - DOUBLE FLARES

CONDITION	PROBABLE CAUSE	DISPOSITION
1. Conditions 1,2,3,4,5,6,9,11 and 12 in single flares. Also apply to double flares.	Causes are similar and acceptability classification is the same as for single flared tubing.	
2. Extruded Flare  Inner edge of flare extends partially or fully into inside diameter of tube	Caused by tube extending too far out of clamping dies before flaring, or use of cone mandrel without stop and too much pressure.	Acceptable if no portion of flare extends past the minimum inside diameter.
3. Indentation - Inner Tube  Marking on inside diameter of tube below flare.	Usually caused by pilot of second operation tool when mandrel is misaligned with clamping die.	Not Acceptable.
4. Flatted Lip  Outer lip of flare is flatted or ringed; not smooth circular contour.	Various contours are possible with various in setting of machine and positioning of tubing.	Any form is acceptable providing flare basically is perpendicular to centerline of tube and is not cracked along bend.
5. Thin Flare 	Can be caused by use of cone flaring mandrel without stop.	Acceptable if total thickness "T" is not less than 1.5 times the tube wall thickness.
6. Varying Flare Thickness  Variation of flare thickness as evidenced by noticeable step or change in exterior flare surface.	Usually caused by misalignment of dies.	Acceptable if variation does not exceed 0.004 in. (0.102 mm).
7. Waved Edge - Interior Flare  Marking on inside diameter of tube below flare.	Caused by variable in tooling.	Acceptable if limits given in condition 2 and footnote #1 are not exceeded.
8. Sleeve Indention 	Usually caused by: 1. Worn fittings used during pressure test. 2. Too small an included angle on sleeve. 3. Improper or worn tooling.	Acceptable if the indentation does not exceed 12% of the nominal wall thickness.

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Acceptance Limits - Double Flares
Figure 202/20-12-03-990-804

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6. Fabrication of Tubing of installation Flareless (MS) Fitting

A. Prepare tube ends. (Paragraph 5.A.)

(1) For “MS” fittings, make sure that chamfering of tube ends does not decrease the wall thickness by more than 25%.

B. Assembly Requirements

(1) The sleeve sealing surface must be smooth and free from nicks, scoring, and spiral or longitudinal tool marks. (Figure 203)

(a) Bare plated areas or collected plating moved from the swage die is not satisfactory.

(2) The sleeve must be concentric and show no local die distortion. The sleeve must show no cracks at when seen with a 10X magifying glass.

(3) Longitudinal movement of the sleeve is permitted, but must be more than 0.020 in. (0.508 mm).

NOTE: It is possible for the sleeve to rotate on the tube.

(4) For machine assembly, follow the manufacturer's instructions.

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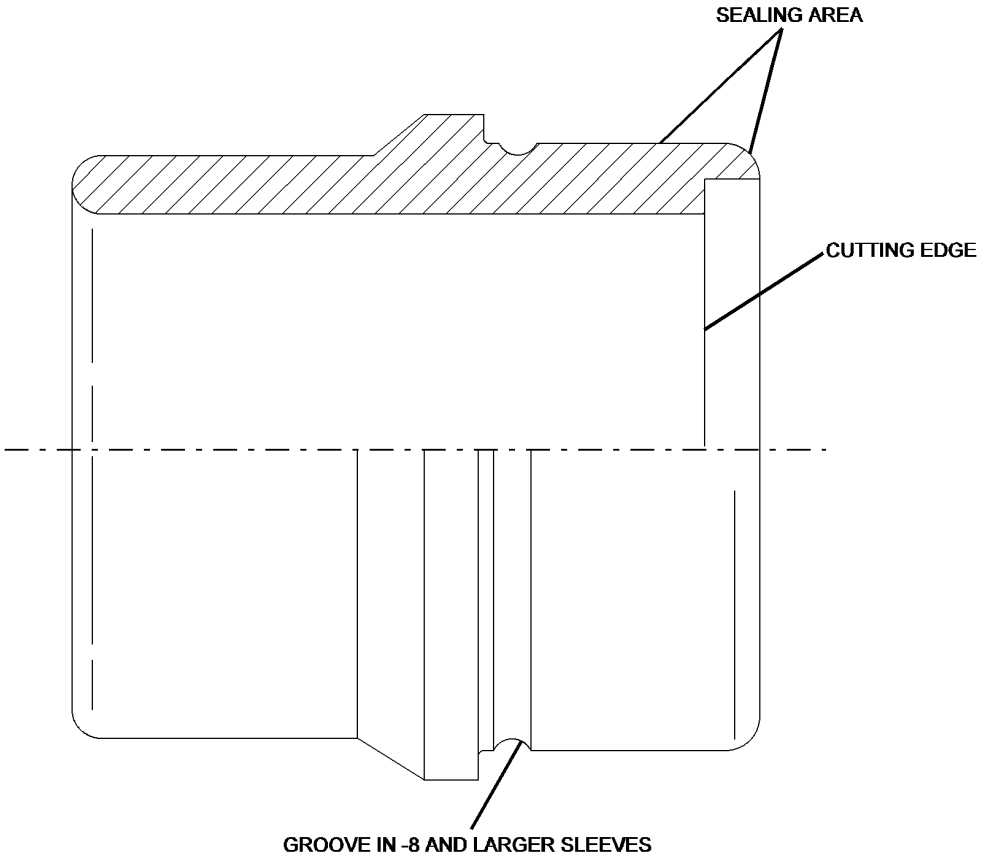

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MS 21922 Flareless Sleeve
Figure 203/20-12-03-990-805

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7. **Proof Testing**

A. Do a proof test of the piping of the new line when specified, to value refered to on the engineering drawing as follows:

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1009, PERCHLOROETHYLENE (DPM 1293)

HAZMAT 1000, REFER TO MSDS

(1) Degrease tubing to remove the forming lubricants, before pressure testing with perchloroethylene solvent, B60103.

(2) Visually examine the fittings for smoothness of the sealing surfaces and for good condition before each use. Clean the sleeves and sealing surfaces of test stand end fittings with a clean white cotton cleaning wipers, G60428 to remove the contamination.

NOTE: Use Corrosion Resistant Steel (CRES) test fittings only for test stands.

(3) Lubricate the male threaded fitting and the backside of the sleeve with test fluid.

(4) Tighten fittings sufficiently to prevent leakage, but not more than the minimum torque value of the applicable torque table. (PIPING COUPLING NUT TORQUE VALUES - MAINTENANCE PRACTICES, PAGEBLOCK 20-30-02/201)

(5) Before closing the downstream end or ends of the tube assembly, do the steps that follows:

(a) Put a cap on the ends not tested and move test fluid through each downstream end.

(b) Make sure that a fluid pressure of 5 psig (34 kPa) maximum causes the fluid to exit in a full flow and fall between 2 in. (51 mm) and 4 in. (102 mm) from end of tubing.

(c) Examine the fluid outflow for the indication of decreased flow through the tubing. Reject the assemblies that do not satisfy this requirement.

(6) Pressurize tubing at a rate not more than 400 psi (2758 kPa)/second to the specified proof pressure. Hold at the maximum pressure for 10 seconds minimum.

(a) No leakage is permitted.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1007, HYDRAULIC FLUID/PETROLEUM-BASE (DPM 366/5414/6176)

HAZMAT 1000, REFER TO MSDS

(7) Pressurize the test tubing with swage to braze unions (7D0246 type) or swage to swage unions (7D0020 and 7D0094 type) with water only.

NOTE: Pressure test all other tubing with water, or DPM 366 or DPM 6160 hydraulic fluid.

NOTE: Hydraulic fluid MIL-H-5606 will attack silicone seals in fittings.

(8) Before the downstream end or ends of the tube assembly is closed, do the steps that follow:

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(a) Cap the ends not tested and pass test fluid through each downstream end.

(b) Make sure that a fluid pressure of 5 psig (34 kPa) maximum causes the fluid to exit in a full flow and fall between 2 in. (51 mm) and 4 in. (102 mm) from end of tubing.

(c) Check fluid outflow for evidence of restricted flow through the tubing. Reject assemblies not meeting this requirement.

(9) Wipe flareless sleeves and sealing areas of flares and sleeves with a clean cloth to remove any contamination.

(10) When additional underwater testing is required by engineering drawing for critical air carrying piping, test (after normal pressure testing) to specified pressure using nitrogen as test medium. Hold for 30 seconds minimum. No visible leakage is allowed.

(11) After pressure testing, blow out piping with filtered (10 micron) moisture-free air until dry to touch or bake tubing in oven at temperature not to exceed 175°F (79°C).

B. Final Cleaning

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1009, PERCHLOROETHYLENE (DPM 1293)

HAZMAT 1000, REFER TO MSDS

(1) Vapor degrease all completed and pressure tested piping with perchloroethylene solvent, B60103.

NOTE: Piping that has been pressure tested with water, more cleaning is not necessary unless visibly contaminated.

(2) After the cleaning is complete, make sure that the piping is free from internal contamination such as grit, metal flakes or other abrasive material.

(a) Repeat cleaning of piping as necessary.

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PERMANENT PIPING - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides instructions for the repair of permanent piping using Deutsch, Aeroquip Linair or Harrison swaging equipment and piping repair instructions using CryoFit fittings.

NOTE: Deutsch CRES 21-6-9 fittings can be used for repairs on CRES and titanium piping. Titanium fittings may be used on titanium tubing only.

NOTE: Aeroquip R80000 series 6AL-4V titanium fittings can be used for repair of CRES (21-6-9 or 304 1/8 HD), aluminum alloy (6061-T6) and titanium tubing.

NOTE: Harrison Series 35000 flareless sleeves can be used for repair of CRES (21-6-9 or 304 1/8 HD), aluminum (6061-T6) and titanium tubing.

NOTE: In many situations a permanent piping repair requires the replacement of portions of one or more adjoining piping assemblies. The need for this can be determined during the pre-repair evaluation. Some circumstances that warrant changing adjacent assemblies are: the lack of adequate swage tool clearance; insufficient personnel workspace or not enough straight piping section in the failed assembly to add repair fitting(s).

NOTE: For hydraulic piping, segments from 304 1/8 hard material may replace CRES 21-6-9 material, with the condition to use the same O.D. tube size as tube size as the original pipe, and one dimensional increase in wall thickness as shown in table for 304 1/8 Hard hydraulic piping.

NOTE: Harrison Series 35000 flareless sleeves should be used when using segments of 304 1/8 hard material to replace CRES 21-6-9 material.

NOTE: For repairs to fuel piping, refer to STANDARD PRACTICES, AIRPLANE OVERHAUL MANUAL, REPAIR OF FUEL LINES, SUBJECT 20-10-17).

B. Four types of repair cover the most probable conditions of repairs to permanent piping.

C. Upon completion of piping repair, the hydraulic system or sub-system must be bled or flushed, serviced, and pressure tested at system pressure in accordance with procedures given. (HYDRAULIC SYSTEM FLUSHING - GENERAL, PAGEBLOCK 29-01-00/201) (HYDRAULIC SYSTEMS GENERAL - SERVICING, PAGEBLOCK 12-13-02/301)

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Chipless pipe cutter - ratchet dual cut. D9872 (1/4 - 3/8 inch) D9853 (1/2 - 3/4 inch) D9852 (1 - 1 1/2 inch)	Deutsch Metal Components Division
Deburring tool - plug type D9851 (1/4 - 3/8 inch) D9850 (1/2 - 3/4 inch) D9849 (1 - 1 1/2 inch)	Deutsch Metal Components Division

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Table 201 (Continued)

Name and Number	Manufacturer
Pipe marking tool D9862S (1/4 - 3/8 inch) D9862M (1/2 - 3/4 inch) D9862L (1 - 1 1/2 inch)	Deutsch Metal Components Division
Dual swage union S4929451	Deutsch Metal Components Division
Swage tool D10001 (1/4 - 3/8 inch) D10002 (1/2 - 3/4 inch) D10003 (1 - 1 1/2 inch)	Deutsch Metal Components Division
Swage inspection gauge D9892	Deutsch Metal Components Division
Portable hydraulic power unit D1004	Deutsch Metal Components Division
D12323-1-3456 Kit, tube repair for 3/16 through 3/8-inch O.D. tubing	Deutsch Metal Components Division
D12324-1-812 kit, tube repair for 1/2 through 3/4-inch O.D. tubing	Deutsch Metal Components Division
D12325-1-124 kit, tube repair for 1 through 1 1/2-inch O.D. tubing	Deutsch Metal Components Division
Kit, Swage DLT Series 5-40 ton	The Deutsch Company
Swage tool kit RTST8-02-002 (Sizes 3/16 inch - 1 1/2 inch)	Aeroquip Linair Division Gardena, CA
Portable Air-hydraulic power unit 10-00401A (Foot operated) 10-00402A (Hand operated)	Aeroquip Linair Division Gardena, CA
Tube cutting and deburring tool kit RTRK0-01-001	Aeroquip Linair Division Gardena, CA
Marking pen, black, low chlorine level #13401 T.E.C fine point DPM 6230	Advanced Metal Components, Inc. Menlo Park, CA
Marking gauge MG4PHS111-XX	Advanced Metal Components, Inc. Menlo Park, CA
Marking gauge MG2PHS111-24	Advanced Metal Components, Inc. Menlo Park, CA
Installation tool, Cryolive UT920979-XX	Advanced Metal Components, Inc. Menlo Park, CA
Extended time tool ET4PHS111-XX & UT2PHS111-24	Advanced Metal Components, Inc. Menlo Park, CA
Installation tool, union UT4PHS111-XX & UT2PHS111-24	Advanced Metal Components, Inc. Menlo Park, CA
Installation stop OS9452K-Size	Advanced Metal Components, Inc. Menlo Park, CA
Test coupling TC2PHS111-24	Advanced Metal Components, Inc. Menlo Park, CA
Portable hand swager, Model 5175 (tubing size 04 thru 08)	Sierracin/Harrison Corp. Burbank, CA
Model 5720 (tubing size 10 thru 24)	

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Table 201 (Continued)

Name and Number	Manufacturer
Gage, Mueller, 5919	Mueller Gages Co. San Gabriel, CA
Lubricant, antiscoring extreme pressure No. 3	Chicago Manufacturing and Distributing Co.
Alkaline cleaner DPM 3285	
Suitable container (capacity as required)	
Aluminum oxide sheets 320 grit	
Tension tool, sta-strap no. GS4H	
Tape, masking, paper pressure sensitive Type 2 DMS 1861	
Tube repair kit (sizes -3 through -12) DLTFRPSKT3008	Deutsch Permaswage
Tube repair kit (sizes -16 through -24) DLT40PSKT3000	Deutsch Permaswage
Caps and plugs, protective MIL-C-5501 (Types 1 through 15)	
Container 1 U.S. gal (3.8L)	
Cloth, low-lint MIL-C-85043	
Gloves	
Tongs	Dac Tooling
Wipers, cleaning Type 1, Class A DMS 1820	
Source of clean, dry compressed air	
Cleaner, Hand Wipe, Brulin MP 1793, DPM 6380-1	Brulin Company, Inc. Richmond, CA
Cleaner, Hand Wipe, EPA 2000, DPM 6380-2 or Cleaner/Solvent, hand wipe, bulk, DPM 6380-4	DPM 6380-2 is superseded by DPM 6380-4, however the DPM 6380-2 can be used until supplies are depleted. Contec, Inc., Spartanburg, SC
Cleaner, Hand Wipe, PF Degreaser, DPM 6380-3	P-T Technologies, Inc. Safety Harbor, FL

NOTE: Manufacturing of Deutsch 10000 series swaging equipment has been discontinued. Deutsch 12000 and DLT series swage equipment are the latest permaswage tools in production.

3. Types of Piping Repair

A. Type 1 repair - Requires only one piping cut and one dual swage union to repair damaged pipe. Type 1 repair would apply under the following conditions:

(1) Damaged area is in a straight section of piping damage is less than 1/4 inch (6.35 mm) in length, unless a Deutsch extended length union is used.

(2) There is sufficient clearance to allow cutting and swaging.

B. Type 2 repair - Requires two piping cuts, two dual swage unions, and a new piping segment installed. Type 2 repair would apply under the following conditions:

(1) Damaged area exceeds 0.300 inch (7.62 mm) in length.

(2) Damaged area is in or near a bend in piping.

(3) Damaged area is inaccessible for cutting and swaging.

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(4) Defective (leaking) permanent run-union.

C. Type 3 repair - Requires one piping cut, one dual swage union, and a new piping segment with end fitting. Type 3 repair would apply under the following conditions:

(1) Damaged, leaking, brazed end fitting or bulkhead fitting.

(2) Damaged area near a brazed end fitting and within swage tool space requirements.

NOTE: If a new piping segment with brazed end fitting is not available, brazed fittings may be replaced with swage-type fittings, Harrison expanded pipe sleeve fittings, or standard flare or flareless type fittings . A compatible threaded connecting fitting must also be installed, if a flare fitting is used on a flareless pipe.

D. Type 4 repair - Requires one to three piping cuts, one or more dual swage unions, and a new piping segment with brazed tee. Type 4 repair would apply under the following conditions:

(1) Damaged, leaking, brazed branch tee or bulkhead tee.

(2) Damaged near a brazed tee and within swage tool space requirements.

NOTE: If a new piping segment with brazed tee is not available, brazed tees may be replaced with standard type tees. In such case, a compatible threaded connecting fitting must also be installed.

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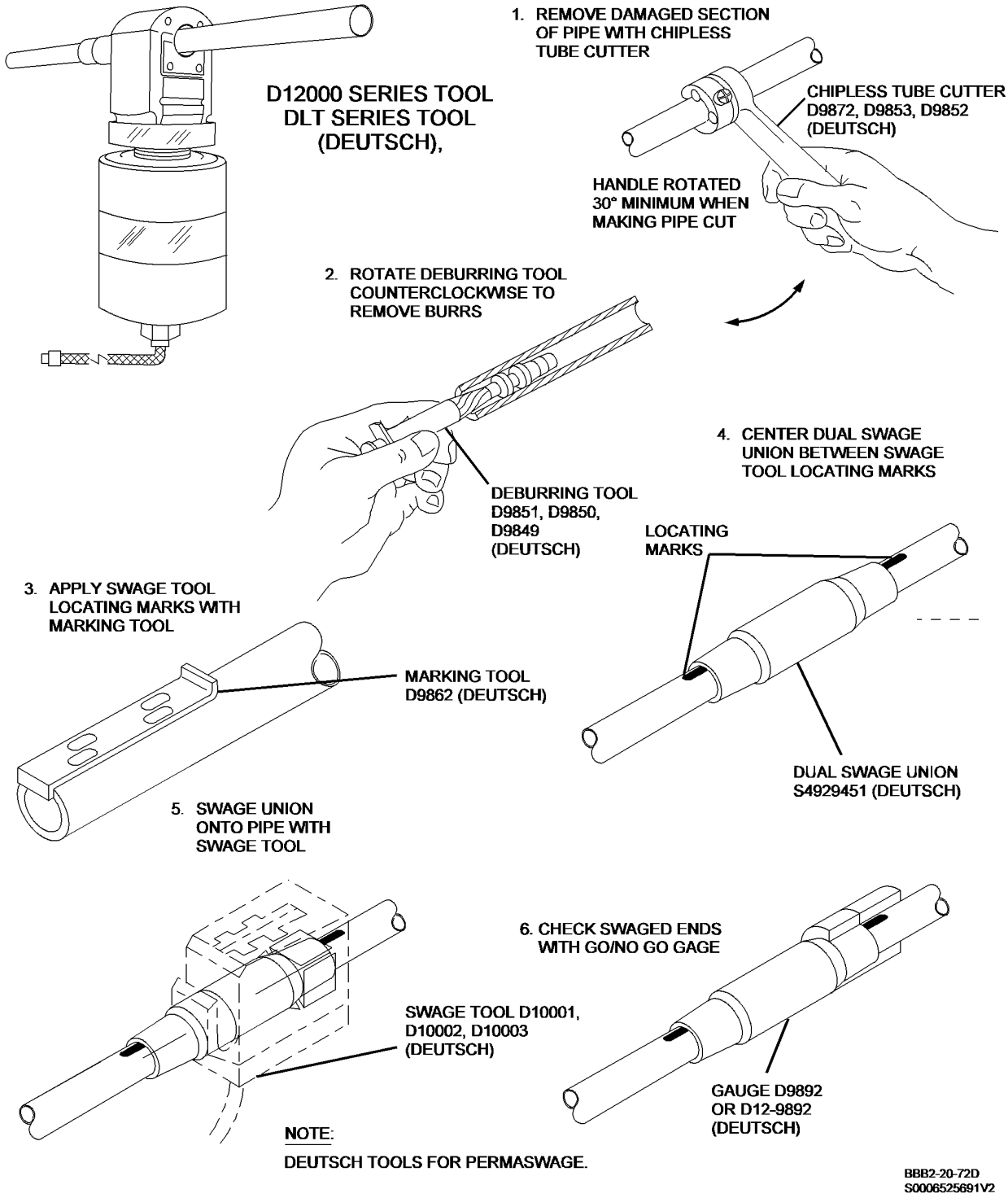

Piping Repair Sequence
Figure 201/20-12-04-990-902

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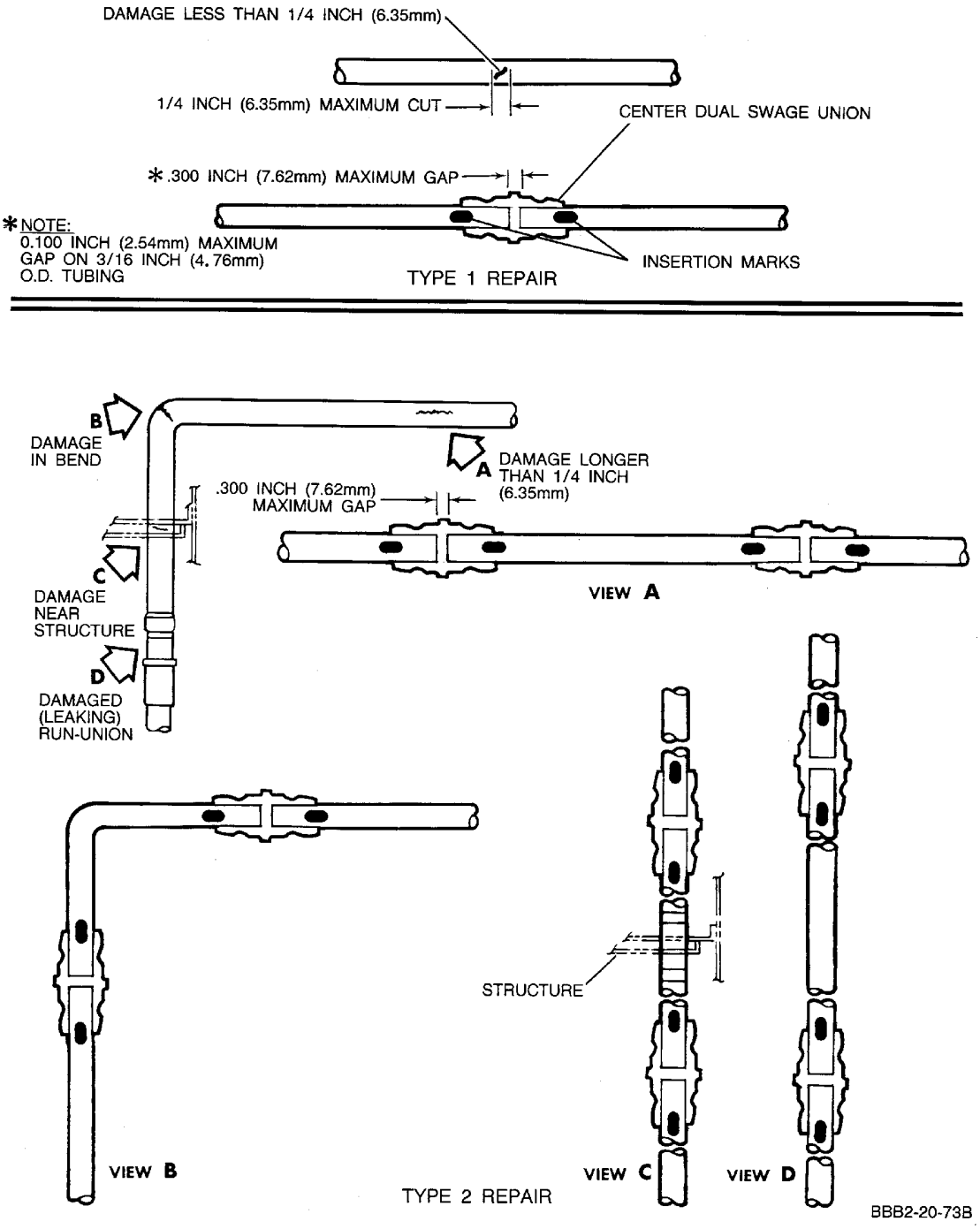

Types of Piping Repair
Figure 202/20-12-04-990-903 (Sheet 1 of 2)

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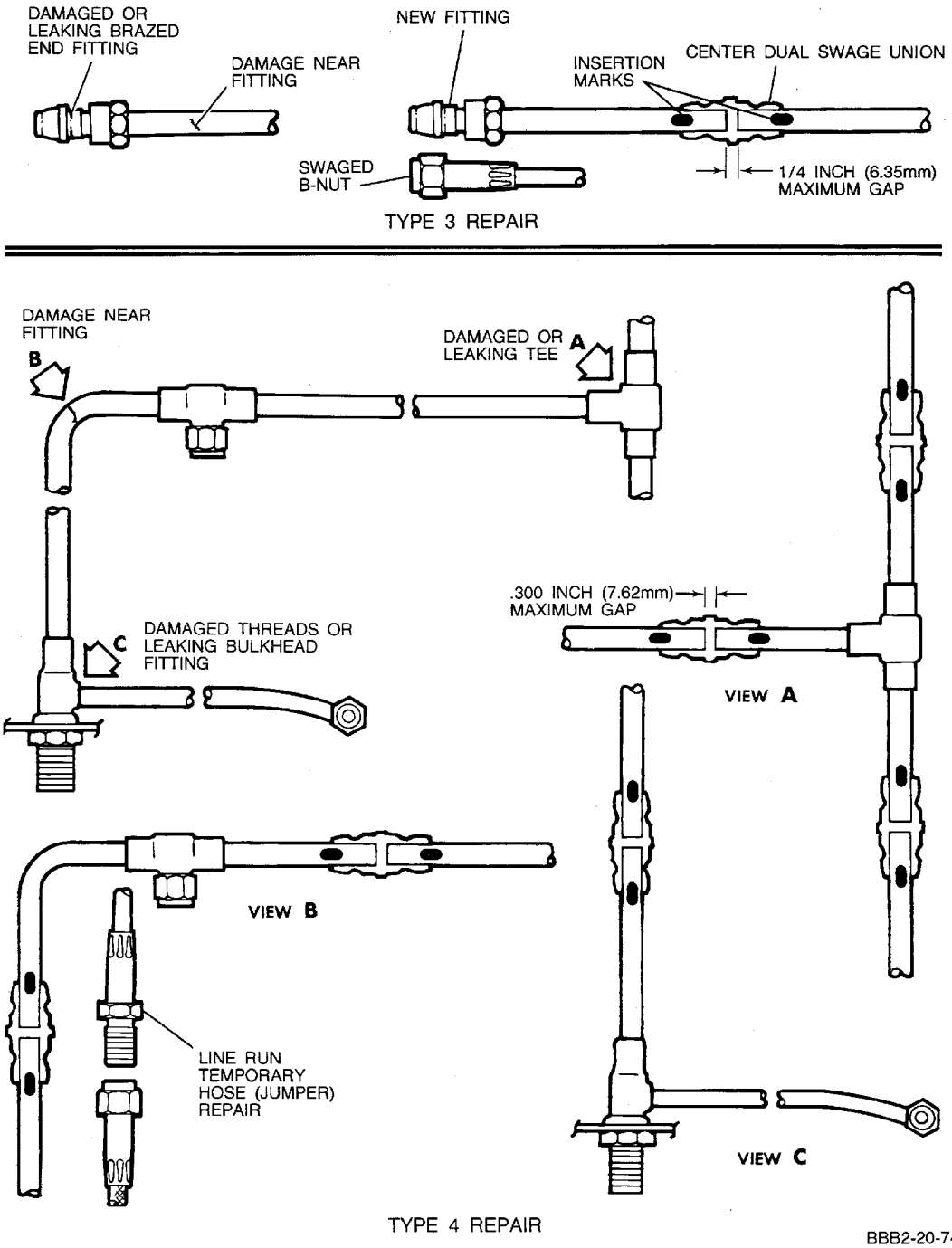

Types of Piping Repair
Figure 202/20-12-04-990-903 (Sheet 2 of 2)

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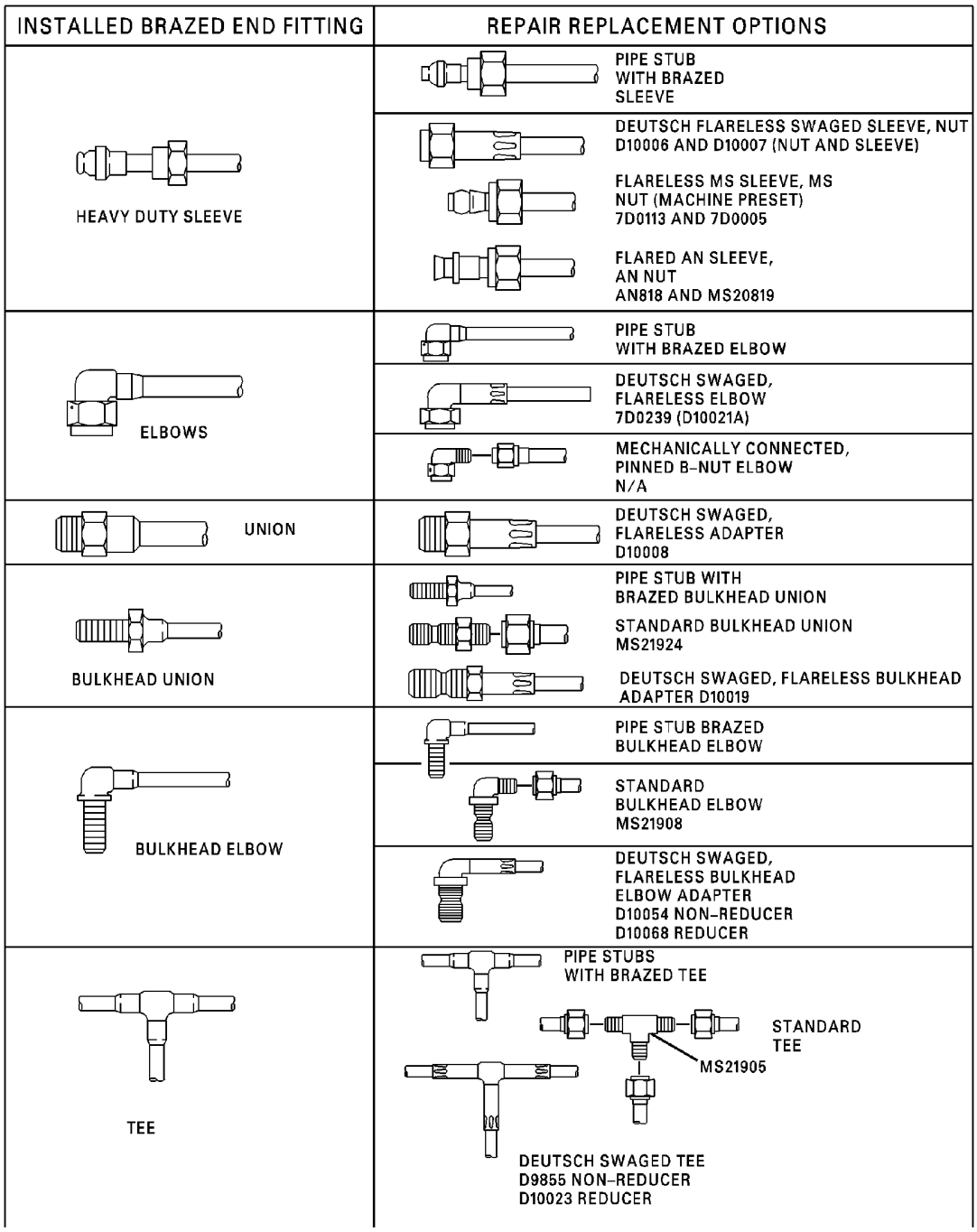

Brazed Fitting Replacement Guide
Figure 203/20-12-04-990-904

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4. Approved Repair

A. Repair Piping

(1) Select type of repair required.

NOTE: A new dual swage union must be in a location that will allow the swage tool to clear any piping bend radius or other obstruction.

(2) All new piping segments to be installed must be same diameter and material as original piping.

NOTE: Piping with wall thickness for high pressure hydraulic lines may be used for repair of hydraulic return and other low pressure system lines if the thinner wall material is not available.

NOTE: Prebrazed piping repair segments are furnished with wall thickness for high pressure hydraulic lines to prevent inadvertent use of thinner wall material.

NOTE: New piping segments must be cleaned prior to installation.

NOTE: Hoses may be used in place of pipe segments or complete assemblies to facilitate proper repair when original pipe shapes cannot be obtained or duplicated. If a hose is to connect directly to a pipe segment, install appropriate pipe end fitting, such as a swaged flareless adapter, as outlined in this chapter. Observe maintenance practices for hose installation as outlined in chapter TUBING AND HOSE, SUBJECT 20-12-01.

NOTE: Hydraulic hose assemblies may be used to replace an entire rigid pipe assembly or a segment of rigid pipe assembly when the original pipe shapes cannot be obtained or duplicated. If a hose is to connect directly to a pipe segment, install the appropriate end fittings as outlined in chapter TUBING AND HOSE, SUBJECT 20-12-01, and AN and MS FITTING, SUBJECT 20-12-03.

NOTE: Hose restrictions are as follows:

- Coiled tubing may not be replaced by a hose assembly without specific approval from The Boeing Company.
- Hose assemblies must be approved for use in phosphate ester hydraulic systems and approved for pressure in that application.
- Hose assemblies must be periodically inspected for condition and security at intervals no greater than every "C" Check until hose assemblies are replaced with rigid tube assemblies.
- Replacement of hose assemblies should be scheduled for the next convenient maintenance period.
- The length of the replacement hose assembly should be approximately the same length of the pipe segment or entire pipe assembly which is being replaced.

(a) Steel tubing - CRES, 21Cr-6NI-9Mn

Table 202

		CRES, 21CR-6NI-9Mn Hydraulic Piping				Other Systems (except water)	
O.D. Tube Size		Pressure Wall		Return Wall		Wall	
Inch	(mm)	Inch	(mm)	Inch	(mm)	Inch	(mm)
1/4	(6.35)	0.016	(0.41)	0.016	(0.41)	0.016	(0.41)
5/16	(7.94)	0.016	(0.41)	0.016	(0.41)	0.016	(0.41)
3/8	(9.53)	0.020	(0.51)	0.016	(0.41)	0.016	(0.41)

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Table 202 (Continued)

		CRES, 21CR-6NI-9Mn Hydraulic Piping				Other Systems (except water)	
O.D. Tube Size		Pressure Wall		Return Wall		Wall	
Inch	(mm)	Inch	(mm)	Inch	(mm)	Inch	(mm)
1/2	(12.7)	0.026	(0.66)	0.016	(0.41)	0.016	(0.41)
5/8	(15.8)	0.033	(0.84)	0.016	(0.41)	0.016	(0.41)
3/4	(19.05)	0.039	(0.99)	0.016	(0.41)	0.016	(0.41)
1	(25.4)	0.052	(1.32)	0.020	(0.51)	----	
1 1/4	(31.75)	----		0.024	(0.61)	----	

Table 203

		304-1/8 Hard Hydraulic Piping				Other Systems (except water)	
O.D. Tube Size		Pressure Wall		Return Wall		Wall	
Inch	(mm)	Inch	(mm)	Inch	(mm)	Inch	(mm)
1/4	(6.35)	0.020	(0.51)	0.020	(0.51)	----	
5/16	(7.94)	0.020	(0.51)	0.020	(0.51)	----	
3/8	(9.53)	0.028	(0.71)	0.028	(0.71)	----	
1/2	(12.7)	0.035	(0.89)	0.035	(0.89)	----	
5/8	(15.8)	0.042	(1.07)	0.042	(1.07)	----	
3/4	(19.05)	0.058	(1.43)	0.058	(1.43)	----	
1	(25.4)	0.065	(1.7)	0.065	(1.7)	----	
1 1/4	(31.75)	0.083	(2.11)	0.035	(0.89)	----	
1 1/2	(38.1)	----		0.035	(0.89)	----	

WARNING: APPROPRIATE PIPING SYSTEM MUST BE DEPRESSURIZED BEFORE REPAIRING, SUDDEN PRESSURE RELEASE COULD CAUSE SERIOUS INJURY TO PERSONNEL.

(b) Aluminum alloy tubing - 6061-T6.

O.D. Tube Size		Low-Pressure Piping Wall	
Inch	(mm)	Inch	(mm)
5/8	(15.8)	.042	(1.07)
3/4	(19.05)	.049	(1.25)

Table 204 MATERIAL REPLACEMENT FOR HYDRAULIC TUBES TABLE #1

MATERIAL NUMBER	MATERIAL	SPECIFICATION	REPLACEMENT MATERIAL
1	A1 Tube 6061-T6	MIL-T-7081 AMS 4083	Material No. 3 or No. 4. Note: Use thin wall thickness of the same tube size.

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Table 204 MATERIAL REPLACEMENT FOR HYDRAULIC TUBES TABLE #1 (Continued)

MATERIAL NUMBER	MATERIAL	SPECIFICATION	REPLACEMENT MATERIAL
2	A1 Tube 5052-0	WW-T-700/4 AMS 4071	Material No. 1.
3	CRES Tube Type 304	MIL-T-6845 1/8 hard seamless drawn AMS 5566, Type 1	Material No. 4.
4	CRES Tube Type 21-6-9	AMS 5561	Material No. 3. Use next higher wall thickness of the same tube size.
5	CRES Tube Type 321	MIL-T-8802 Type 1	Material No. 3.
6	Titanium	DMS 1897	Material No. 3. Note: For coiled tubes, it is not permitted. For normal tubes, use next higher wall thickness of the same tube size. Material No. 4. For coiled tubes it is not permitted. Use for normal tubes only. Material No. 7, Class 2
7	Titanium	DMS 2241	Material No. 6.

(c) Clean piping each side of damage to minimum distance of 3 inches (76.2 mm). For CryoFit unions, clean piping to minimum distance of 2(±1/2) inch (50.8(±12.7) mm) and 2(±1/4) inch (50.8(±6.35) mm) for Cryolive sleeves. If pipe is painted, proceed as follows:

NOTE: No painted portion of piping should be allowed inside fitting.

1) Mask area to be cleaned of paint with masking tape.
2) Using 400 grit or finer aluminum oxide abrasive paper or nylon abrasive pads, remove paint by hand rubbing, wet or dry.

NOTE: On aluminum piping, dry aluminum wool can be used.

WARNING: WATERBASE ALKALINE CLEANER IS AN AGENT THAT IS POISONOUS, CORROSIVE, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN WATERBASE ALKALINE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET WATERBASE ALKALINE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

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TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

3) On completion of paint removal, clean tubing with alkaline cleaner, rinse and dry.

(3) Before cutting, place suitable open-top container under piping to catch fluid.

CAUTION: PIPING MUST NOT BE CUT WITH A SAW OF ANY TYPE. CHIPS WILL DAMAGE SYSTEM.

CAUTION: DO NOT CUT PRELOADED LINE. LOOSEN CLAMPS TO RELAX PRELOAD AND PREVENT SIDELOAD AND BREAKAGE OF CUTTER WHEELS.

(4) Cut damaged section from piping, using chapels pipe cutter, if available, or rolling blade pipe cutter as follows:

(a) Check that pipe cutter wheels are not chipped or exceptionally dull.

(b) Apply light pressure adjustment to cutting tool roller blade to prevent reduction of piping O.D.

CAUTION: IF CUTTER WHEEL BREAKAGE OR CHIPPING OCCURS, THE PIPING RUN INVOLVED MUST BE FLUSHED TO RETRIEVE AND ACCOUNT FOR ALL FRAGMENTS OF THE DAMAGED CUTTING WHEEL.

(c) Check pipe cutter often while cutting pipe to make certain fragmentation has not occurred.

(5) For other than straight pipe (Type 1) repairs, use removed section of piping as template and mark and cut new piping segment to suit repair application. Use appropriate replacement fittings.

NOTE: The maximum gap between pipe ends is 0.300 inch (7.62 mm) for Deutsch CRES dual swage unions unless a Deutsch part number D10399, extended length fitting is used. For Aeroquip dual swage unions the maximum gap between pipe ends is 0.300 inch (7.62 mm) for sizes to 3/8 inch, 0.350 inch (8.89 mm) for sizes to 1/2 - 3/4 inch, and 0.400 inch (10.16 mm) for sizes 1 - 1 1/2 inch. For CryoFit unions the maximum gap between pipe ends is 0.120 inch (3.05 mm).

CAUTION: CHIPS MUST NOT BE ALLOWED TO ENTER PIPING SYSTEM.

(6) Remove burrs from pipe ends, using plug-type deburring tool as follows:

NOTE: Proper deburring is a vital part of permanent piping repair and chamfering, as a result of deburring, must not reduce wall thickness by more than one third.

(a) Depress button of deburring tool to stretch plug and insert tool into pipe.

(b) Release button of deburring tool to expand plug inside of pipe.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1497, CLEANER/HANDWIPE (DPM 6380-1)

HAZMAT 1499, CLEANER/HANDWIPE (DPM 6380-3)

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

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(WARNING PRECEDES)

HAZMAT 1000, REFER TO MSDS

(c) If O.D. edge of pipe requires deburring, polish with No. 320 grit aluminum oxide, and wipe clean with cloth dampened with hand wipe cleaner.

CAUTION: MAKE CERTAIN DEBURRING TOOL PLUG PRESSURE IS MAINTAINED DURING DEBURRING OPERATION.

(d) Rotate reamer portion of deburring tool with slight contact pressure to deburr I.D. edge of pipe.

(e) Pull deburring tool from pipe while maintaining outward pressure on plug.

(7) If joining is not performed immediately, install protective coverings on pipe ends.

(8) Using appropriate marking tool for piping size, apply insertion marks on each pipe to be joined, a single mark for Deutsch unions, and a double mark for Aeroquip unions.

(9) Install dual swage union as follows:

NOTE: Unions 3/16 inch through 3/4 inch (4.76 mm through 19.05 mm) can be swaged by D10000 series, D12300 series, or DLT permaswage tools and applicable Aeroquip swage tool for rynglok application.

(a) Select dual swage union required for piping material, and size as follows:

1) The Deutsch extended length swage repair union insertion/gap.

Table 205 Deutsch Extended Length Swage Repair Union Insertion/Gap

TUBE O. D. (INCHES)	MINIMUM INSERTION	MAXIMUM ALLOWABLE GAP
1/4	0.615	2.542
5/16	0.655	2.613
3/8	0.690	2.692
1/2	1.193	3.70
5/8	1.233	3.78
3/4	1.303	3.92
1	1.448	5.26
1 1/4	1.550	5.26

(10) Slide dual swage union over pipe ends, and center between insertion marks, a single mark for Deutsch type unions and a double mark for Aeroquip type unions.

NOTE: The maximum gap between pipe ends is 0.300 inch (7.62 mm) for all sizes of Deutsch dual swage unions and 0.300 inch (7.62 mm) for sizes to 3/8 inch, 0.350 inch (8.89 mm) for sizes 1/2 - 3/4 inch, and 0.400 inch (10.16 mm) for sizes 1 - 1 1/2 inch of Aeroquip dual swage unions. It is desirable to hold gap to a minimum.

NOTE: Piping must not be forced out of alignment by bend or clamping preload.

WARNING: DO NOT CONNECT AIR SUPPLY UNTIL READY TO ACTUATE TOOL.

(11) Swage union onto pipe as follows: (D10000 Series only)

NOTE: Bench swaging the unions to the replacement pipe is recommended where feasible.

(a) Select applicable size swaging tool for fitting being swaged.

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(b) Select matching swage tool die blocks according to size of union being installed.

(c) Insert bottom die block into swage tool.

NOTE: When properly positioned, locator adapter of die block will be on side of tool opposite safety latch slots.

(d) Position safety latch in swage tool so that curved end of latch faces away from side of tool, on D10001 tool only. On D10002 and D10003, push safety latch up to lock upper die block into position over lower die block.

(e) Place dual swage union in swage tool over bottom die block. Adjust bottom die block until end of union not being swaged butts against shoulder of locator adapter on bottom die block.

(f) Position top die block in swage tool over union so that end of die block with metallic insert is on safety latch side of tool.

CAUTION: MAKE CERTAIN SAFETY LATCH IS POSITIONED TO ITS FULL LIMIT OF TRAVEL.

(g) Push safety latch up to lock top die block into position over bottom die block.

(h) Adjust swage tool along pipe until end of fitting not being swaged butts against locator adapter.

(i) Connect air supply to pneumatic pump.

(j) Pressurize swage tool to 5500(±250) psig.

(k) Release pressure and remove top die block by sliding block out end of swage tool or up through slotted housing.

(l) Check each swaged fitting for following unacceptable defects:

1) Evidence that swaging was performed with die segment inserted backward in block.

2) Any detectable cracks.

3) Creasing or folding of fitting metal.

4) Nicks, dents, gouges or grooves with a depth in excess of .005 inch (0.13 mm).

a) Use up to 10X magnification as required.

b) Longitudinally oriented ridges produced by swaging operation are acceptable.

c) Longitudinally oriented breaks in Teflon coating on aluminum fittings produced by swaging operation are acceptable.

(m) Check swaged end with appropriate size go/no-go gauge.

(n) Check each braze-to-swage fitting for proper "float in" distance.

(o) Check each dual swage fitting for proper "float in" distance.

(12) Swage union onto pipes with D12000 series or DLT series swage tooling as follows:

(a) Refer to Deutsch D12000 series or DLT series swage tool operating instructions.

NOTE: It is permissible to reswage new or existing Deutsch swage fitting installations to correct hydraulic leaks. Fittings that cannot be sealed must be replaced.

(13) Piping repair using CryoFit fittings and Cryolive sleeves:

NOTE: CryoFit fittings and Cryolive sleeves that have shrunk (recovered) prior to installing on tubing shall be rejected. Fittings shall not be re-expanded other than by fitting manufacturer.

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WARNING: LIQUID NITROGEN IS AN AGENT THAT IS AN ASPHYXIANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN LIQUID NITROGEN IS USED.

- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET LIQUID NITROGEN IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

WARNING: WEAR PROTECTIVE GLOVES WHEN HANDLING COLD TOOLING (TOOLING CHILLED IN LIQUID NITROGEN). DO NOT SUBMERGE GLOVES IN LIQUID NITROGEN. REMOVE CLOTHING OR SHOES SATURATED WITH LIQUID NITROGEN. LIQUID NITROGEN CAN CAUSE FROSTBITE UPON CONTACT WITH SKIN.

WARNING: WEAR EYE PROTECTION WHEN HANDLING LIQUID NITROGEN.

CAUTION: CRYOFIT FITTINGS MUST NOT BE USED ON 6061-T6 ALUMINUM TUBING.

(a) Prepare tubing for installation of CryoFit fittings as follows:

1) Clean tubing and cut the damaged section from piping.

2) Deburr inner and outer edges of tube ends.

NOTE: Proper deburring is a vital part of permanent piping repair and chamfering, as a result of deburring, wall thickness must not be reduced by more than one third.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1497, CLEANER/HANDWIPE (DPM 6380-1)

HAZMAT 1499, CLEANER/HANDWIPE (DPM 6380-3)

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

3) Clean O.D. of tube end with a clean wiper dampened with hand wipe cleaner (for CryoFit unions).

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4) For CryoFit unions: use appropriate marking gauge for piping size, position marking gauge on the tube. Use marking pen to mark tube through slot in a minimum of one place. Make sure the complete area of the slot is marked on tube.

(b) Install Cryolive sleeves as follows:

NOTE: Bench assemble of Cryolive sleeves is recommended where feasible.

1) Using tongs, pick sleeve/cap/coupling nut assembly out of liquid nitrogen and place in gloved hand.

2) Slide assembly onto tube end until tube end bottoms against inside of end cap. Leave unit in position until sleeve has shrunk onto tube end.

3) Check Cryolive sleeve tube extension from end of tube after shrinking.

4) When installing individual components to tubing, assemble as follows:

a) Cool the end of the appropriate Cryolive installation tool and tube chiller(s) in liquid nitrogen until the boiling stops.

b) Slide the appropriate coupling nut onto the tube with the threaded side facing the tube end.

c) Apply the cold tube chiller to the tube end for approximately one minute, or when practical, chill the tube end directly in the liquid nitrogen.

NOTE: Some sizes may not require chilling of tube ends.

d) Slip the Cryolive sleeve onto the tube using the appropriate size installation tool, until the tube ends bottoms against the stop inside tool. Leave the tool in position until the sleeve has shrunk onto the tube.

e) Check Cryolive sleeve tube extension from end of tube after shrinking.

(c) Install CryoFit unions as follows: .

CAUTION: PRE-CHILL ALL TOOLING IN LIQUID NITROGEN THAT WILL COME IN CONTACT WITH A CRYOFIT COUPLING. THIS WILL PREVENT PREMATURE WARMING AND SHRINKING (RECOVERING) OF THE COUPLING.

1) Cool the end of the appropriate installation tool and the tube chiller(s) in liquid nitrogen until the boiling stops.

2) Apply the cold tube chiller(s) to the tube ends for approximately two minutes.

3) Grasp the appropriate coupling with the chilled installation tool. Remove the tube chiller(s) from tubing and turn one end to allow the union coupling to slip over the end. Slide the coupling, with the installation tool, onto the opposite tube until both coupling ends align in the location band.

NOTE: An O-ring or a band of masking tape may be used on one tube as a stop for the coupling.

(d) Install CryoFit shaped fittings as follows:

1) Slip an O-ring on each fitting leg and butt O-ring against fitting.

2) Position the fitting so that all legs are aligned with the tubing. Slip the appropriate test coupling over each fitting leg. The test coupling should slide freely.

3) Butt the test fitting against the O-ring on the fitting leg. Make sure the opposite end of fitting falls within the installation band and that both tube ends are visible in the test coupling window. Do not proceed until proper insertion is met.

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4) Using the installation tool or extended time tool, and the test coupling, practice the installation to determine the fastest and easiest method.

5) Cool the end of the installation tool and tube chiller(s) in liquid nitrogen until the boiling stops.

6) Remove the test coupling from one fitting leg and apply the tube chiller(s) to the fitting leg and tube for two minutes, "rewetting" the tube chiller(s) in liquid nitrogen every 20-30 seconds. Leave the remaining test coupling(s) in position to maintain proper tube/fitting alignment.

7) Remove the tube chiller(s) from the fitting leg to be joined.

8) Grasp the coupling with the chilled installation tool. Turn the tube and slide the coupling over the tube end. Realign the tube and slide the coupling against the O-ring.

9) Check that the coupling is within the insertion marks on tube and fitting. Remove the installation tool and allow coupling to shrink into position.

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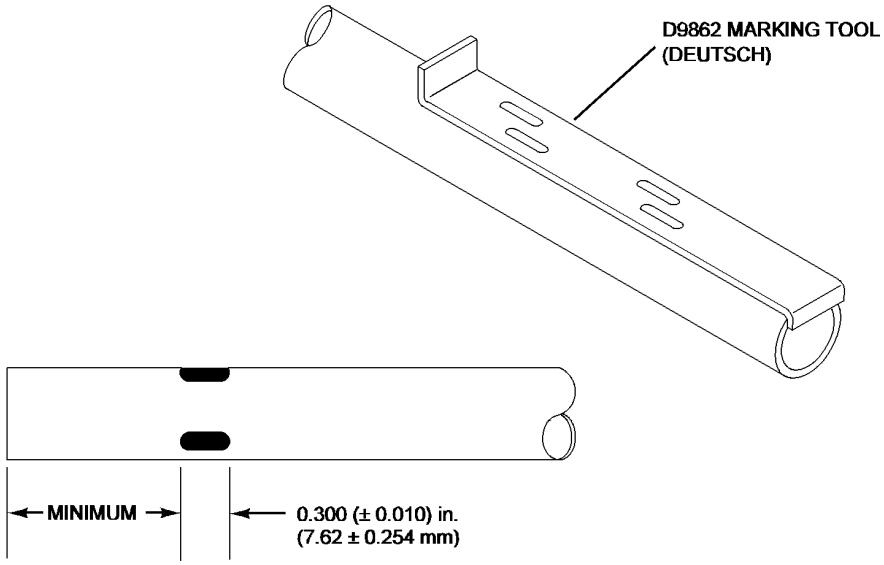

NOTES:

1. USE D9862-1 MARKING TOOL FOR 3/16 THROUGH 3/8 in. (4.76 mm THROUGH 9.53 mm) OD TUBING.
2. USE D9862-2 MARKING TOOL FOR 1/2 THROUGH 3/4 in. (12.7 mm THROUGH 19.05 mm) OD TUBING.
3. USE D9862-3 MARKING TOOL FOR 1 THROUGH 1-1/2 in. (25.4 mm THROUGH 38.1 mm) OD TUBING.
4. IF MARKING TOOL IS BENT AND RIPPLED, TOOL MUST BE REPLACED.

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Marking Tool and Insertion Marks
Figure 204/20-12-04-990-905

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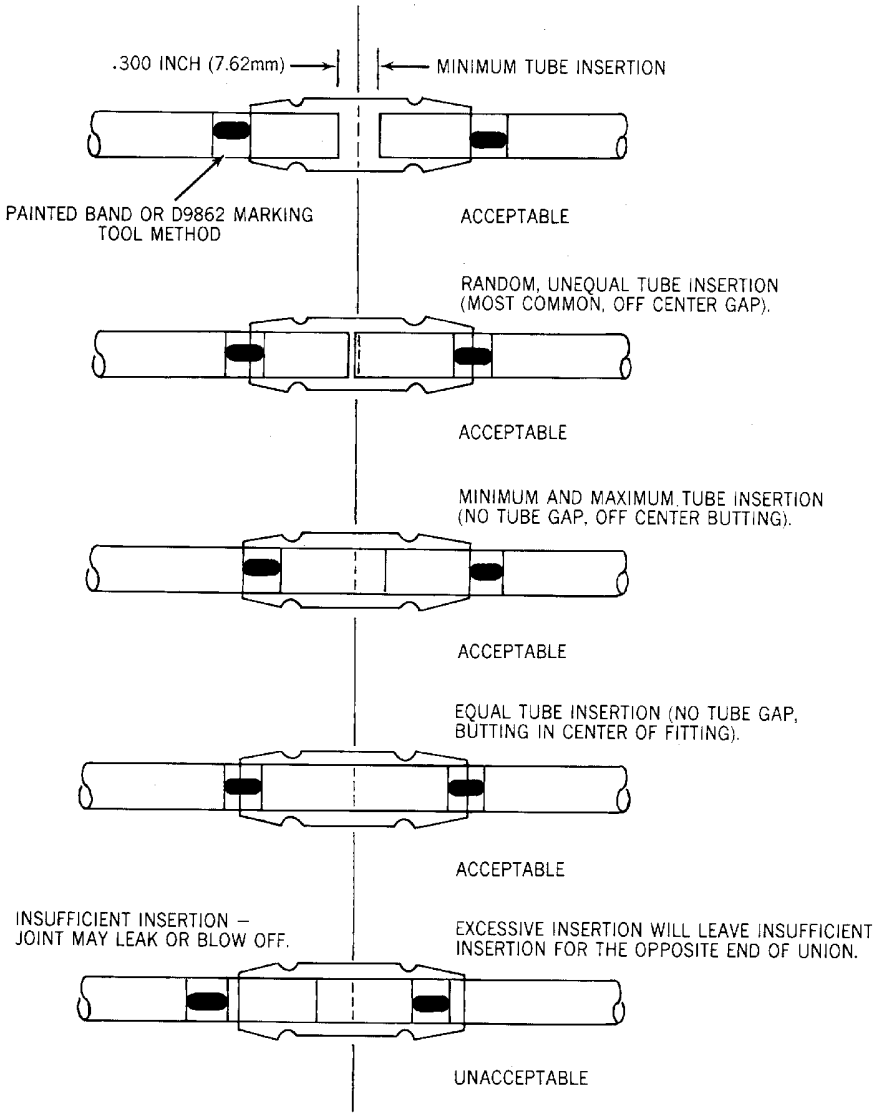

NOTE: PAINTED BAND OR D9862 MARKING TOOL METHOD MAY BE USED.

BBB2-20-77B

(Deutsch) Dual Swage Unions - Installation
Figure 205/20-12-04-990-906

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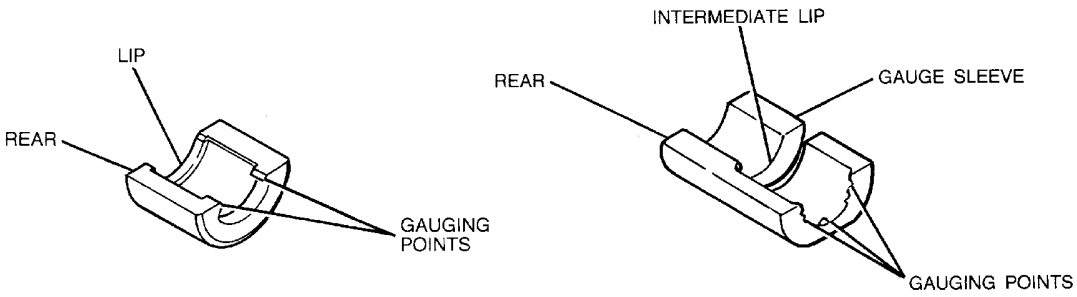
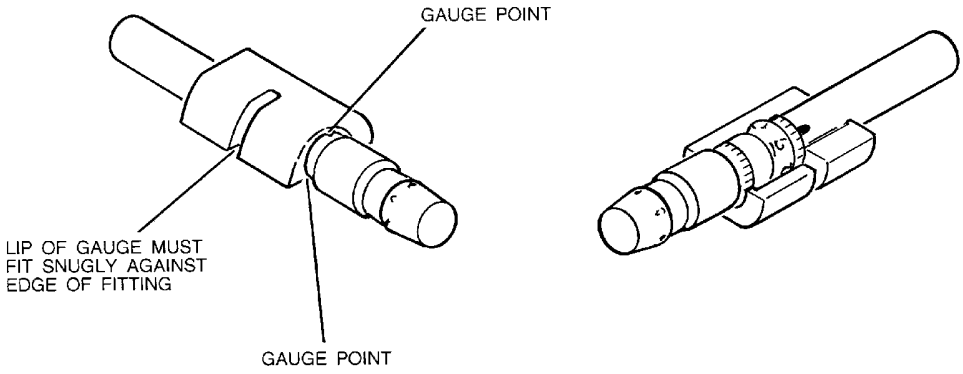


INSPECTION GAUGE FOR SWAGED FITTINGS



NOTE:

1. POSITION GAUGE CIRCUMFERENTIALLY SO THAT GAUGING POINTS ARE BETWEEN ANY LONGITUDINAL RIDGES PRODUCED BY SWAGING OPERATION.
2. GAUGE NEED NOT BE FREE TO TURN ON FITTING BUT IT MUST FIT OVER FITTING IN THREE CIRCUMFERENTIAL POSITIONS AT APPROXIMATELY 60 DEGREE INTERVALS.

BBB2-20-79A

(Deutsch) Dual Swage Union Check Gauge
Figure 206/20-12-04-990-908

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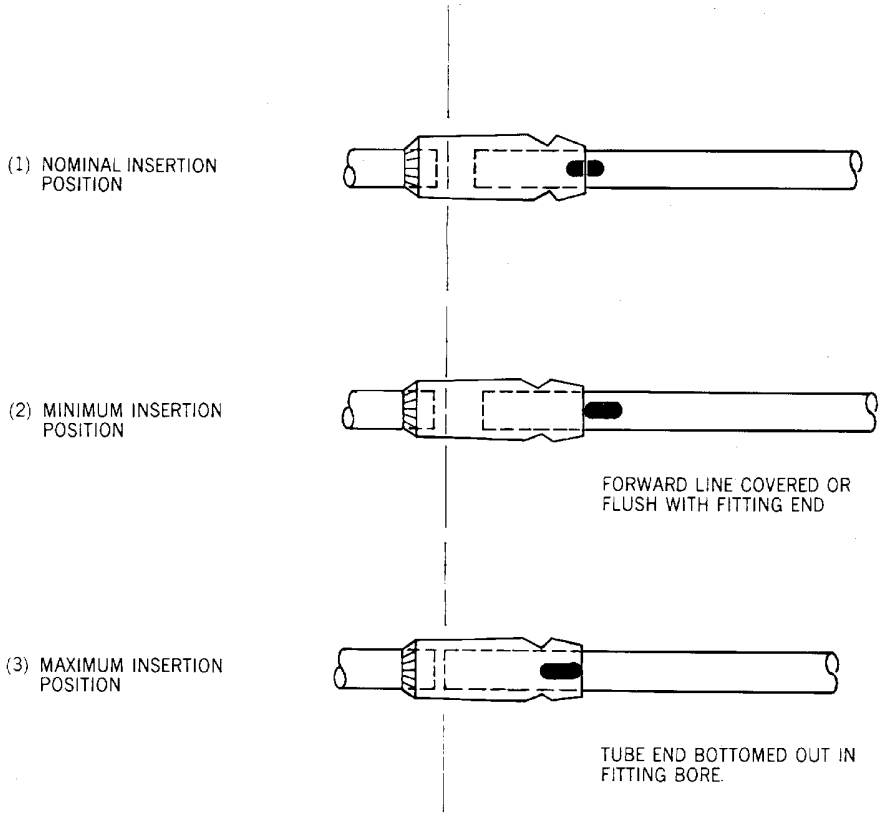

NOTES:
1. AN ACCEPTABLE JOINT MAY RANGE FROM MINIMUM INSERTION TO MAXIMUM (BOTTOMED OUT) INSERTION.
2. IN A PIPING RUN WITH SEVERAL UNIONS, ALL JOINTS SHOULD BE ENGAGED AS NOMINALLY AS PRACTICAL PRIOR TO SWAGING.
3. MINIMUM INSERTION FOR SWAGE TO BRAZE FITTINGS IS THE SAME AS FOR SWAGE TO SWAGE FITTINGS. TUBE INSERTION INTO SWAGE TO BRAZE FITTINGS MAY BE MORE THAN INSERTION INTO SWAGE TO SWAGE FITTINGS.
4. INSERTION MARKS ON TUBING 3/4 INCH (19.05mm) OD AND LARGER WILL BE COVERED COMPLETELY WHEN IN MAXIMUM INSERTION POSITON (3). MINIMUM INSERTION SHOULD BE CHECKED PRIOR TO SWAGING.

BBB2-20-80B

Piping Insertion in Braze to Swage Unions
Figure 207/20-12-04-990-909

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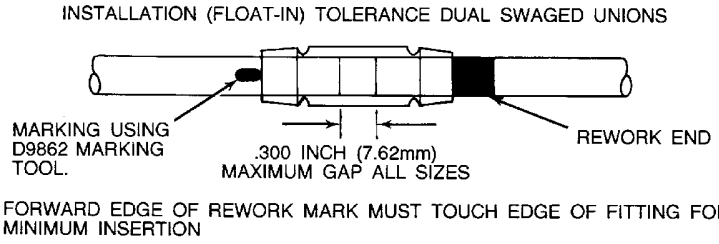
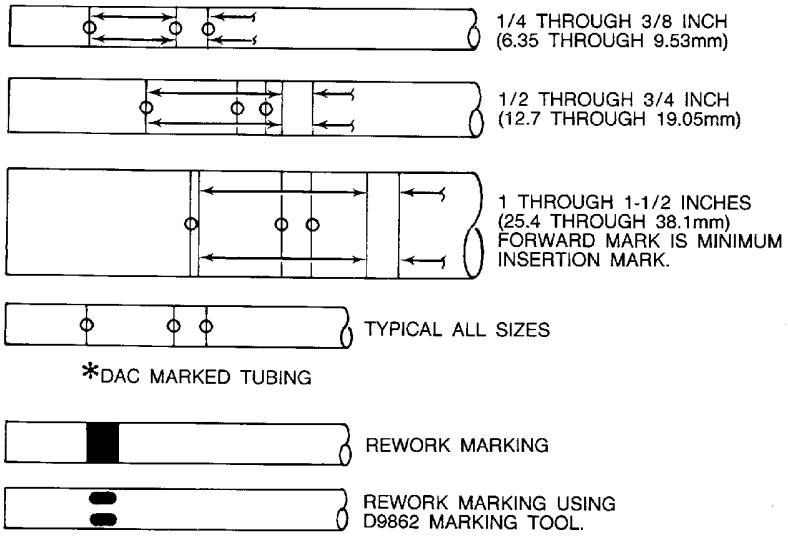


Dual Swage Union Insertion
Figure 208/20-12-04-990-910



Piping End Markings
Figure 209/20-12-04-990-911

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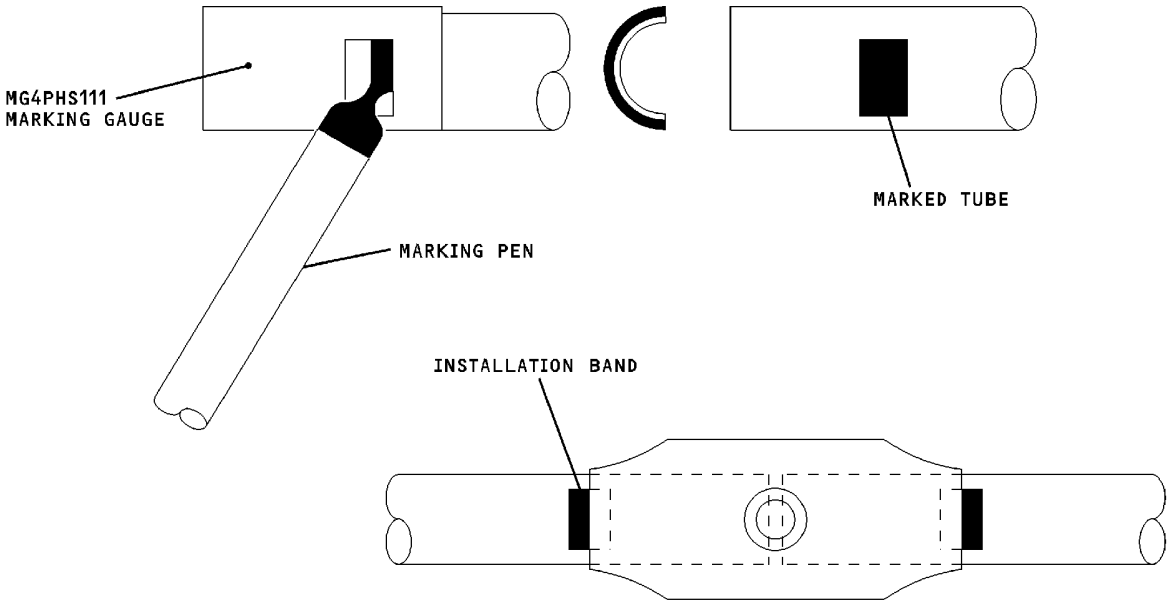

CAG(IDGS)

NOTE: PAINTED BAND OR MARKING GAUGE METHOD MAY BE USED

BBB2-20-133

CryoFit Union Marking Gauge
Figure 210/20-12-04-990-914

TUBE SIZE INCHES (MM)	INSTALLATION TOOL	TUBE CHILLER
1/4 (6.35)	UT920979-4	910415-01
5/16 (7.94)	UT920979-5	910415-01
3/8 (9.53)	UT920979-6	910415-01
1/2 (12.7)	UT920979-8	910415-01
5/8 (15.8)	UT920979-10	910415-02
3/4 (19.05)	UT920979-12	910415-02
7/8 (22.23)	UT920979-14	910415-02
1 (25.4)	UT920979-16	910415-02
1 1/4 (31.75)	UT920979-20	910415-02
1 1/2 (38.1)	UT920979-24	910415-02

CAG(IDGS)

BBB2-20-140

Cryolive Sleeve Installation Tools Figure
Figure 211/20-12-04-990-915

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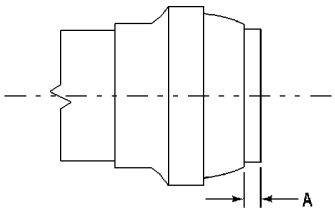

TUBE O.D. INCHES (MM)	A DIMENSION INCHES (MM)
1/4 (6.35)	0.030 ± 0.010 (0.76 ± 0.25)
3/8 (9.53)	0.030 ± 0.010 (0.76 ± 0.25)
1/2 (12.7)	0.030 ± 0.010 (0.76 ± 0.25)
5/8 (15.8)	0.100 ± 0.010 (2.54 ± 0.25)
3/4 (19.05)	0.120 ± 0.010 (3.05 ± 0.25)
7/8 (22.23)	0.140 ± 0.010 (3.56 ± 0.25)
1 (25.4)	0.160 ± 0.010 (4.06 ± 0.25)
1 1/4 (31.75)	0.200 ± 0.010 (5.08 ± 0.25)
1 1/2 (38.1)	0.250 ± 0.010 (6.35 ± 0.25)

CAG(IGDS)

BBB2-20-134

Cryolive Sleeve Extension Limits
Figure 212/20-12-04-990-916

TUBE SIZE (INCHES)	INSTALLATION TOOL	TEST COUPLING	EXTENDED TIME TOOL	MARKING GAUGE	TUBE CHILLER
1/4	UT4PHS111-4	TC4PHS111-4	ET4PHS111-4	MG4PHS111-4	910415-01
3/8	UT4PHS111-6	TC4PHS111-6	ET4PHS111-6	MG4PHS111-6	910415-01
1/2	UT4PHS111-8	TC4PHS111-8	ET4PHS111-8	MG4PHS111-8	910415-01
5/8	UT4PHS111-10	TC4PHS111-10	ET4PHS111-10	MG4PHS111-10	910415-02
3/4	UT4PHS111-12	TC4PHS111-12	ET4PHS111-12	MG4PHS111-12	910415-02
7/8	UT4PHS111-14	TC4PHS111-14	ET4PHS111-14	MG4PHS111-14	910415-02
1	UT4PHS111-16	TC4PHS111-16	ET4PHS111-16	MG4PHS111-16	910415-02
1 1/4	UT4PHS111-20	TC4PHS111-20	ET4PHS111-20	MG4PHS111-20	910415-02
1 1/2	UT2PHS111-24	TC2PHS111-24	ET2PHS111-24	MG2PHS111-24	910415-02

CAG(IDGS)

BBB2-20-135

CryoFit Unions and Shaped Fitting Installation Tools
Figure 213/20-12-04-990-917

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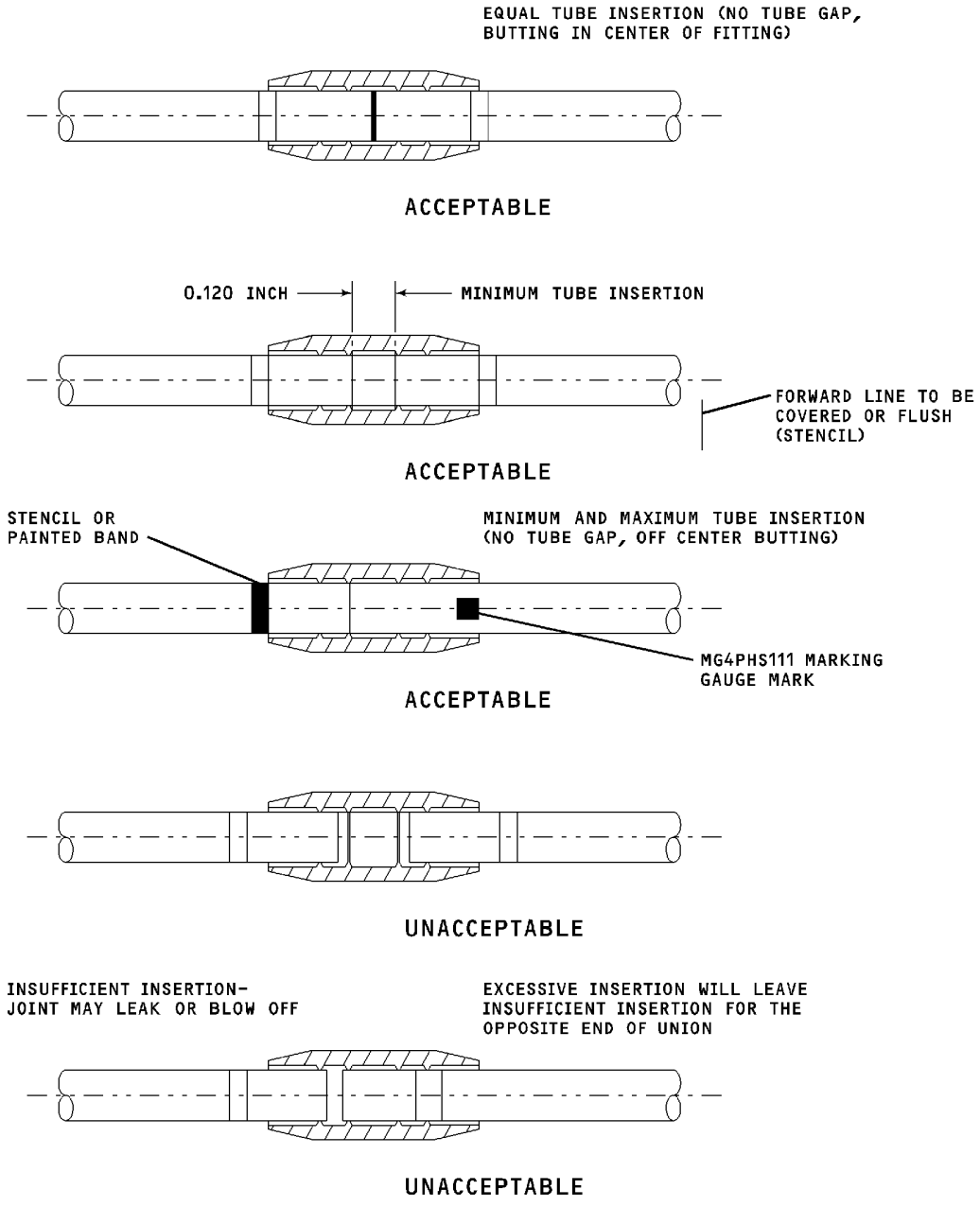

CryoFit Union - Installation
Figure 214/20-12-04-990-918

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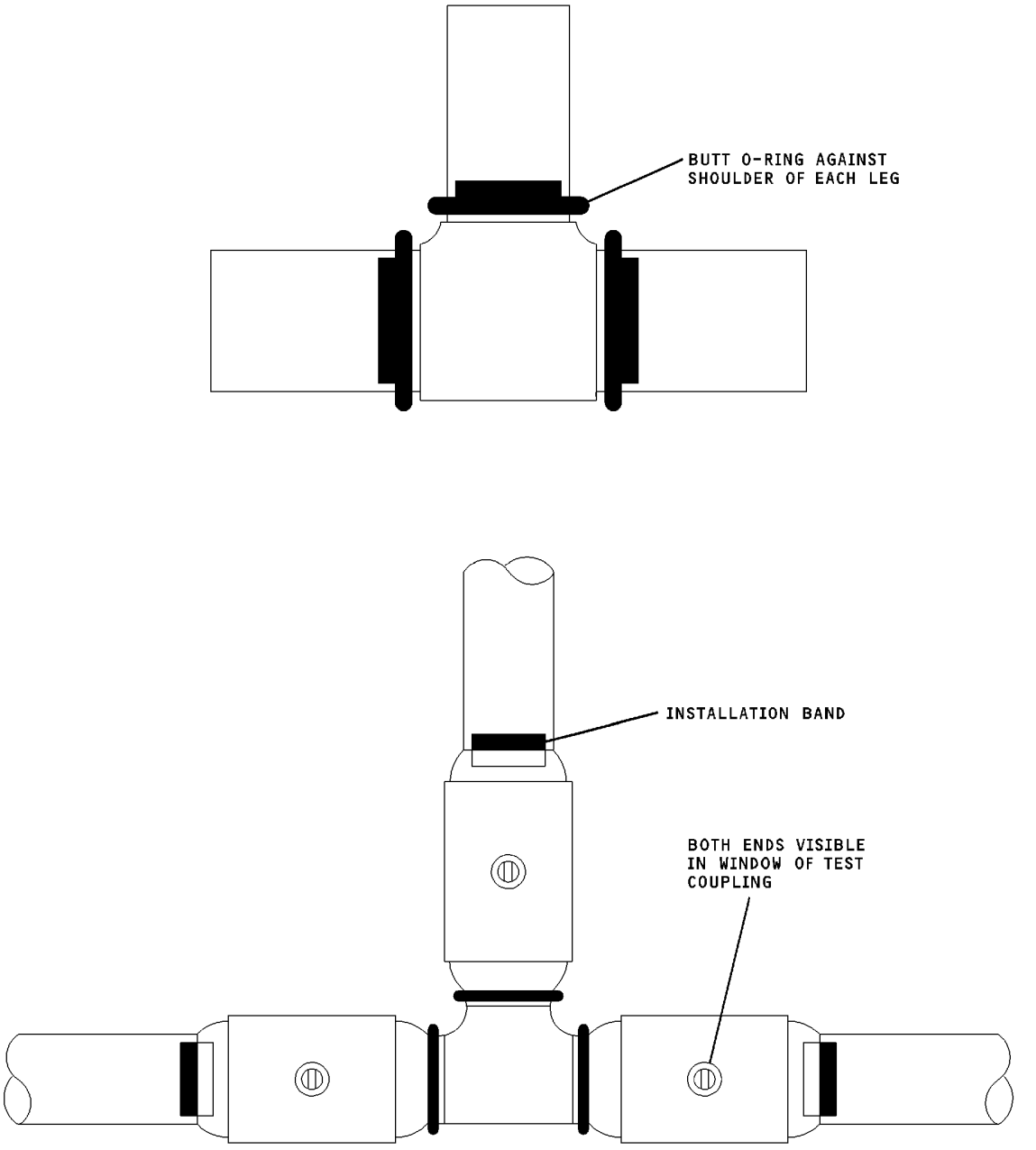

Shaped Fittings (CryoFit Unions) - Installation
Figure 215/20-12-04-990-919 (Sheet 1 of 2)

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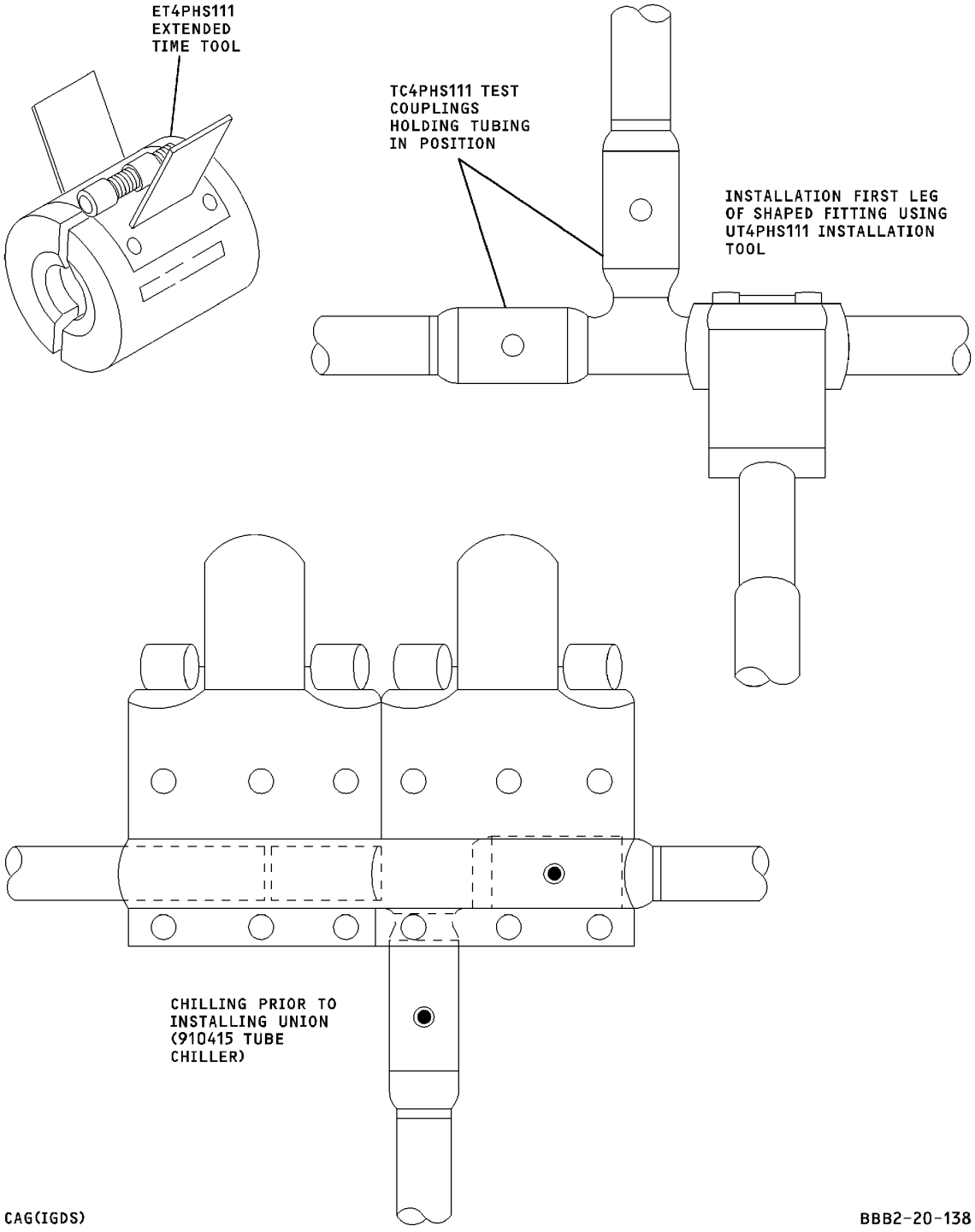

Shaped Fittings (CryoFit Unions) - Installation
Figure 215/20-12-04-990-919 (Sheet 2 of 2)

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5. Piping Damage and Defect Limitations

A. Piping Damage Limitations

(1) Following are dent and surface defect limitations for damaged piping. Piping damaged in excess of allowable limits shall be replaced or reworked by, cut and splice, segment repair method.

NOTE: Surface defects are discontinuities such as nicks, scratches, seams, die tears, grooves, folds, pits, die lines, or mandrel lines.

(a) Replace tubing which has nicks, scratches, chafing, galling, or fretting damage deeper than 10 percent of tube wall thickness with working pressures less than 500 psi.

(b) Replace tubing which has nicks, scratches, chafing, galling, or fretting damage deeper than 5 percent of tube wall thickness with working pressures of 500 psi (3450 kPa) and greater.

(c) Sharp bottomed dents not deeper than two percent of nominal pipe diameter.

(d) Round bottomed dents not deeper than five percent of nominal pipe diameter.

NOTE: When surface defect is present in combination with dent, each imperfection must be evaluated with regard to the applicable criteria for that type of deficiency.

NOTE: Sharp bottomed dents are those which have an included angle of 90 degrees or less at the bottom. All others are round bottomed.

(e) For aluminum alloy piping only, dent or dents where total length is not greater than 10 percent of length of pipe.

NOTE: When surface defect is present in combination with dent, each imperfection shall be evaluated with regard to applicable criteria for that type of deficiency.

NOTE: Sharp bottomed defects or dents are those which have an included angle of 90 degrees or less at the bottom. All others are round bottomed.

B. Piping Defect Limitations

NOTE: Installation quality is vital to the service endurance or life-span of the piping systems. The skill and care exercised by the installer will determine the quality and visual acceptability of the installations.

(1) Check piping identification banding for function and description, continuity with matching pipe identity, and flow arrow direction.

(2) Rework of piping installation will be necessary when one or more of following conditions exist.

(a) Damaged pipe; nicked, scratched, kinked, dented, flattened, etc.

(b) Piping misalignment or cocked fittings in excess of limits.

(c) Pipes rubbing due to mislocated brackets, components, or improper installation adjustment prior to swaging permanent connections.

6. Pipe Connection Alignment

A. B-nut Connection Alignment

(1) Fitting connections must align within measurable allowances.

NOTE: These acceptable mismatches are based on the amount of preload or stress that piping can safely tolerate. Misalignment or mismatch beyond these specified limits will degrade the piping endurance strength and cause fatigue cracking of the piping installations during the service life of the aircraft.

(2) Brazed sleeve B-nut connections shall not misalign more than two degrees maximum when coupling pipe to threaded fitting or component.

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(3) Lengthwise and radial mismatches of pipe end to threaded fitting seat shall not exceed 1/32-inch (0.79 mm) maximum per 10 inches of pipe length.

B. Swaged Union Alignment

NOTE: Installation adjustments are provided through the use of swaged run-unions which allow piping to axially engage or float into proper installation position without a precision match of the pipe ends, and screw attachment slots in brackets and supports which mate the clamps to the pipe position without inducing preload or misalignment of the pipes. All piping is developed to the nominal or mid-travel position of these adjustments which absorb conventional manufacturing tolerances or normal fabrication variations of the aircraft structure, components, and piping.

(1) Provide tool accommodation deflection where required.

NOTE: Deep insertion of piping into precision bore of swaged union actually prohibits misalignment of joint. However, small cluster bundled runs may require deflection of pipes to engage swaging tool on union. Adjacent piping clamps must be loose and must not constrain tool access while swaging.

(2) Springback of piping after swaging will cause slight axial growth, approximately 1/16-inch (1.59 mm) per foot (304.8 mm) of two degree deflection, of pipes joined. This can be easily absorbed at next joint or at bends in run without affecting installation. Deflect pipe adjacent to pipe being swaged if possible.

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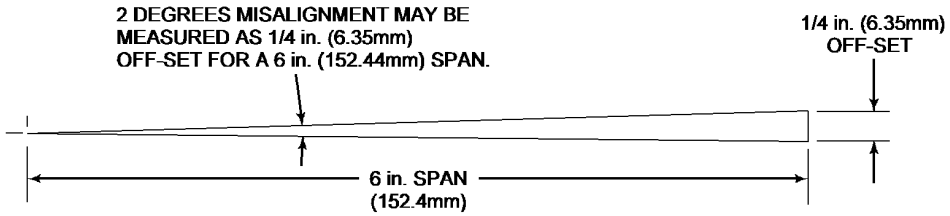

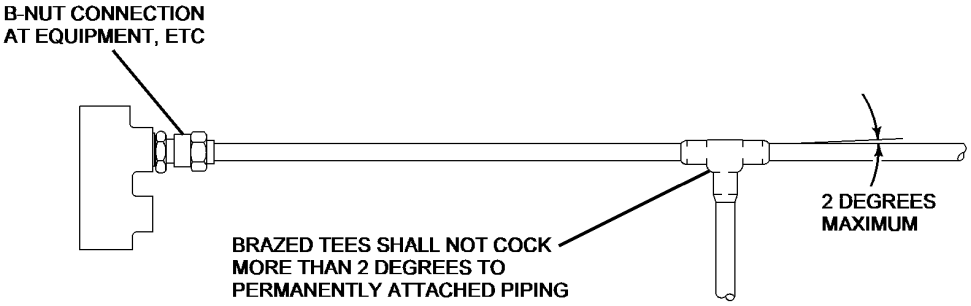

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B-Nut Connection Alignment
Figure 216/20-12-04-990-920

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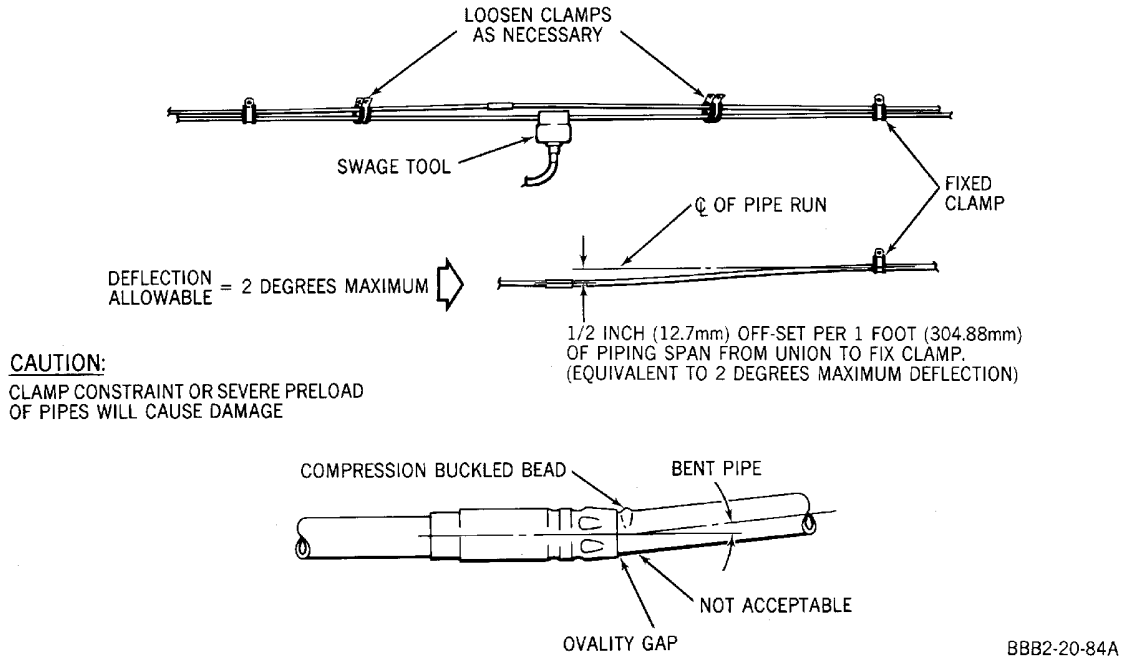

Swaged Union Alignment
Figure 217/20-12-04-990-921

7. Piping Clearance and Separation

CAUTION: RUBBING OF PIPES OR ANY OTHER METAL-TO-METAL CONTACT ON PIPES IS NOT ACCEPTABLE. VIBRATION WILL CAUSE CHAFING AND WEAR OF PIPING IN SERVICE.

A. Piping Clearance

(1) A minimum of 3/32-inch (2.38 mm) clearance must be provided between pipes.

NOTE: Clearance is normally obtained by adjusting the pipes into proper position prior to swaging the run-unions. The swaged connections permanently fix the piping into the aircraft structure.

B. Piping Separation

CAUTION: THESE METHODS MUST NEVER BE USED TO COVER UP PIPING ABRASIONS, NICKS, OR OTHER DAMAGE; OR TO CORRECT PRELOAD CONDITION.

CAUTION: PIPING ATTACHMENTS SHOULD BE ADJUSTED TO OBTAIN MAXIMUM CLEARANCE BETWEEN PIPES PRIOR TO USING STA-STRAP SEPARATORS.

(1) To maintain adequate piping separation and prevent chaffing, following standard repairs can be applied.

(2) Installation of sta-strap separators must be within limits and must not induce preload for acceptable installation.

8. Permanent Repair of the Aircraft Tubing With Rynglok Fittings

NOTE: The Rynglok repair is an accepted Boeing permanent repair procedure.

NOTE: Aeroquip R80000 series Titanium fitting material (6AL-4V) can be used for repair of CRES (21-6-9 or 304 1/8 HD), aluminum alloy (6061-T6), and titanium tubing.

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CAUTION: NO PERMANENT HYDRAULIC PIPING REPAIRS ARE PERMITTED ON COILED OR FLEXIBLE HYDRAULIC TUBING. THE HYDRAULIC TUBE CAN BECOME DAMAGED AND FAIL DUE TO TUBE FLEXURE AT THE REPAIR.

CAUTION: TUBING SHOULD NOT BE CUT WITH A SAW OF ANY TYPE. CHIPS WILL DAMAGE SYSTEM.

A. Do the Rynglok swage repair with the instructions found in the Rynglok repair kit.

(1) Examine the repair and make sure the repair is per the Rynglok kit's instructions.

(2) Do a leak check of the applicable system.

(a) No leaks are permitted.

9. Harrison Expanded Pipe Sleeve Fittings

A. Harrison 35000 flareless sleeves are swaged to piping using portable hand swagers.

(1) Install flareless sleeve fittings as follows:

NOTE: Portable hand swager 5175 is used for piping sized from 0.250 inch to 0.625 inch (6.35 to 15.88 mm) O.D. (-4 to -10) inclusive. Portable hand swager 5720 is used for piping sizes from 0.625 to 1.5 inches (15.88 to 38.10 mm) O.D. (-10 to - 24) inclusive.

NOTE: Operation of the 5720 portable hand swager is identical to the 5175 swager except the 5720 swager retainer ring is secured in place by tightening two nuts prior to swaging.

(2) Ascertain material O.D. and wall thickness.

(3) Make certain that correct jaws, anvil and drawbolt are used for pipe O.D. and wall thickness.

CAUTION: MAKE CERTAIN THAT CORRECT DRAWBOLT IS USED ACCORDING TO WALL THICKNESS TO ENSURE MINIMUM INTERNAL TOOLING CLEARANCE WITH INSIDE DIAMETER OF PIPE.

(4) Unscrew retainer ring, check adapter for drawbolt to be used and insert anvil. Install retainer ring fingertight only.

(5) Screw drawbolt into adapter through bore of anvil. Tighten fingertight only, but make certain drawbolt bottoms in adapter.

(6) Lightly lubricate expander and seal rings with lubricant (Antiscoring Extreme Pressure No. 3).

(7) Select required sleeve.

(8) Place sleeve on pipe to be swaged. Ensure pipe O.D. is free of lubricant.

(9) Place pipe and sleeve over drawbolt and push into anvil until sleeve and pipe seat against their respective stops.

(10) Place jaws around anvil, pipe and sleeve.

(11) Position retainer ring firmly over jaws. If pipe being swaged is in aircraft and only one end is accessible, place retainer ring over pipe before inserting drawbolt in pipe.

NOTE: Jaw and retainer ring mating surfaces should be free from lubricant and foreign matter.

(12) Check required swage pressure.

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WARNING: DO NOT STAND IN DIRECT LINE WITH DRAWBOLT. IF WRONG SWAGING PRESSURE IS ACCIDENTALLY APPLIED DRAWBOLT FAILURE IS POSSIBLE AND INJURY TO PERSONNEL COULD RESULT.

CAUTION: DO NOT ACTIVATE SWAGING CYLINDER WITH DRAWBOLT ASSEMBLY IN SWAGER UNLESS PIPE SLEEVE, JAWS, AND RETAINER RING ARE IN POSITION.

CAUTION: DO NOT EXCEED RECOMMENDED SWAGING PRESSURE.

(13) Apply swage pressure and hold for a minimum of 2 seconds.

(14) Remove retainer ring and jaws.

B. Check Swaged Grooves as follows:

(1) Check inside of pipe in swaged area to determine if swage is adequate.

(2) If required, check depth of grooves with gage (Mueller 5919) as follows.

NOTE: For acceptable swage measurements, twice the pipe wall thickness should be subtracted from the groove diameters. Because the groove farthest from the pipe end is deepest, it is normally sufficient to measure this area only. If the fitting is adequately swaged, the other grooves will be satisfactory.

(a) Loosen Allen screws on side of gage and adjust jaws by sliding lower jaw up or down to 0.050 (±.010) inch (1.27(±0.254) mm) larger than nominal I.D. of piping to be checked. Use micrometers when setting jaws.

(b) Use thumb screw on top of lever arm of upper jaw for fine adjustment. After adjustment is made, lock thumb screw with lock nut.

Examples:

1) Assuming piping is 1/2 x .026 inch wall, find nominal I.D. by subtracting twice wall thickness (2 x .026 inch = .052 inch) from pipe O.D. or .050 inch. This gives nominal I.D. of .448 inch. Add .050(±.010) inch to .448 inch, which equals .498(±.010) inch. Adjust gage jaws to .498(±.010) inch.

2) If piping is 1.00 x .049 inch wall, then 2 x .049 inch equals .098 inch which subtracted from 1.00 inch, equals .902 inch nominal I.D. Add .050(±.010) inch to .902 inch and adjust gage jaws to .952(±.010) inch.

(c) Close gage jaws by lifting thumb lever sufficiently to insert jaws tips into piping so that they position 1/8 to 1/4 inch (0.125 50 0.25 mm) behind groove edge. When in position, release thumb lever.

(d) Turn black thumb screw on side of gage counterclockwise just enough to turn dial face.

(e) Keeping jaws parallel with pipe turn dial ring so that zero is under pointer.

(f) Keeping jaws parallel with pipe, slowly draw gage toward end of pipe until jaw tips fall into swaged groove farthest in tube. At this point, dial gage will read some number; this number is total I.D. expansion into groove or twice actual depth of pipe expansion into sleeve groove.

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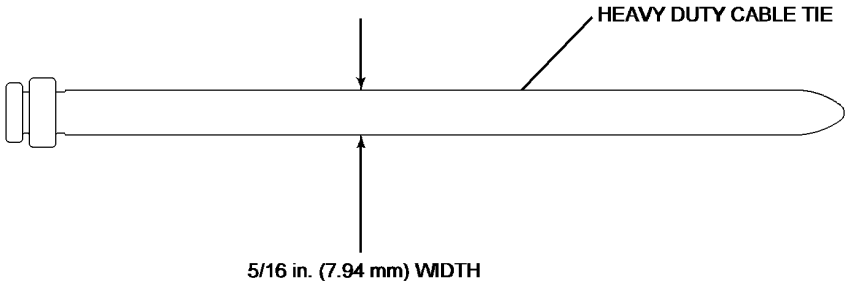
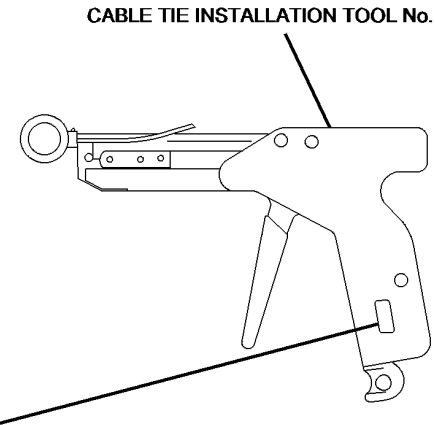
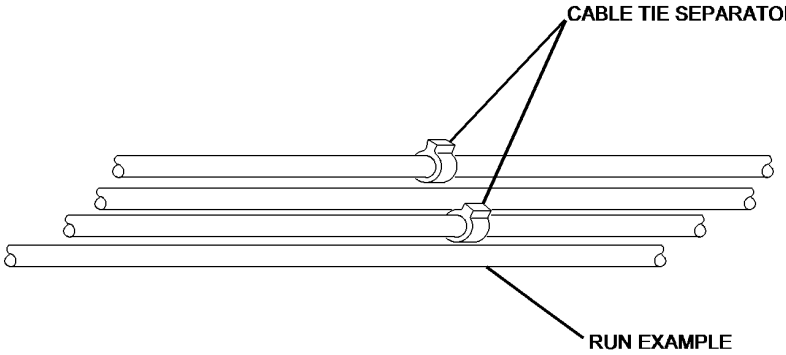




NOTES:

1. DO NOT PRY PIPING APART FOR INSTALLATION OF CABLE TIE.
2. INSTALL WITH TOOL No. GS4H.
3. PAY PARTICULAR ATTENTION TO TENSION SETTING; IF INSTALLED TOO LOOSELY, THE WRAP WILL NOT STAY IN DESIRED POSITION, USE MAXIMUM TENSION SETTING.
4. ADJUST CLAMP ATTACHMENTS TO OBTAIN MAXIMUM CLEARING BETWEEN PIPES PRIOR TO USING CABLE TIE.



ALTERNATE ONE CABLE TIE ON EVERY OTHER LINE.

NOTE:
WHEN SEPARATOR IS USED BETWEEN ALUMINUM AND STEEL PIPING, APPLY CABLE TIE ON ALUMINUM PIPE.

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Sta-Strap Separator Installation
Figure 218/20-12-04-990-922 (Sheet 1 of 3)

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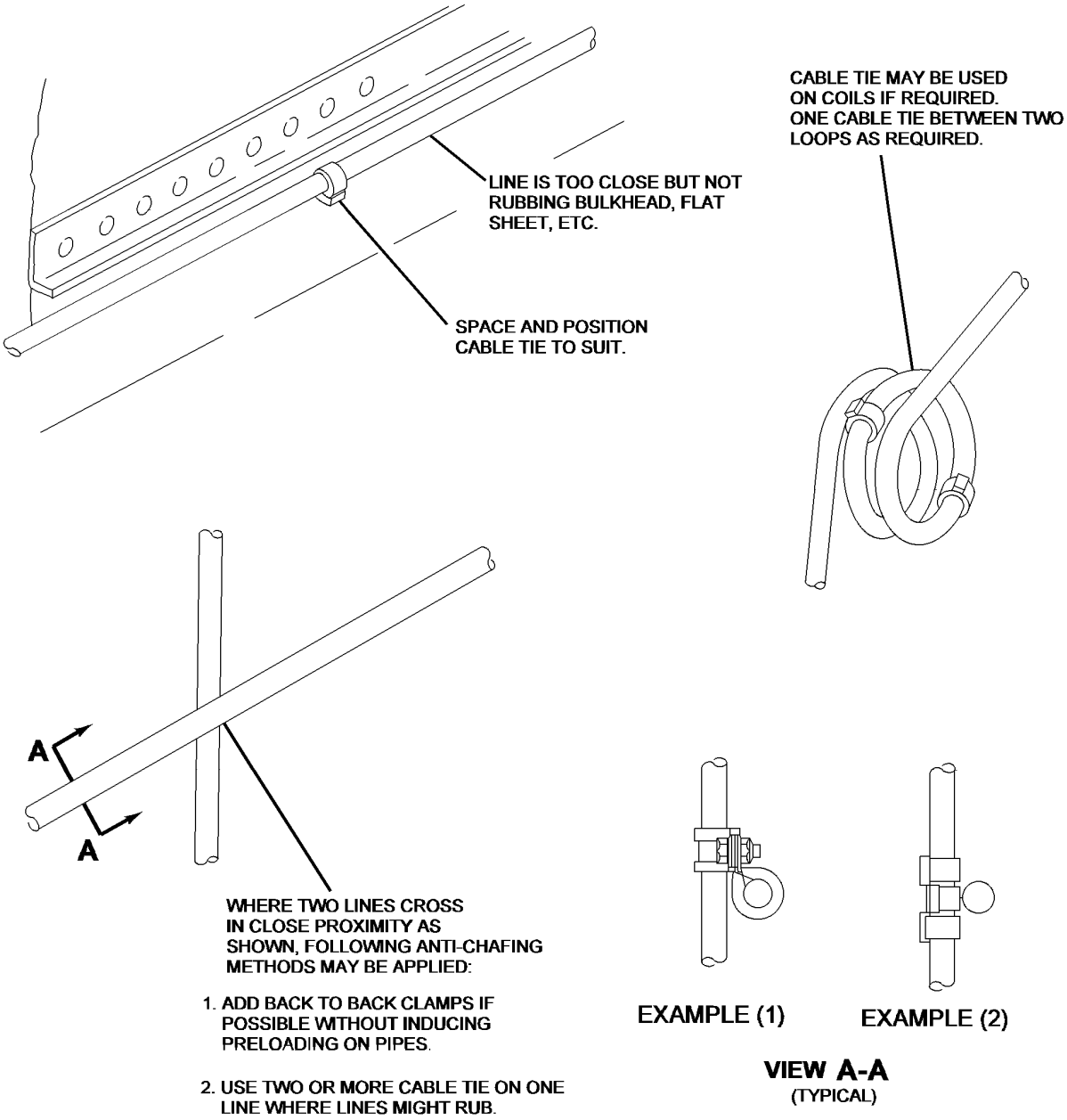

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Sta-Strap Separator Installation
Figure 218/20-12-04-990-922 (Sheet 2 of 3)

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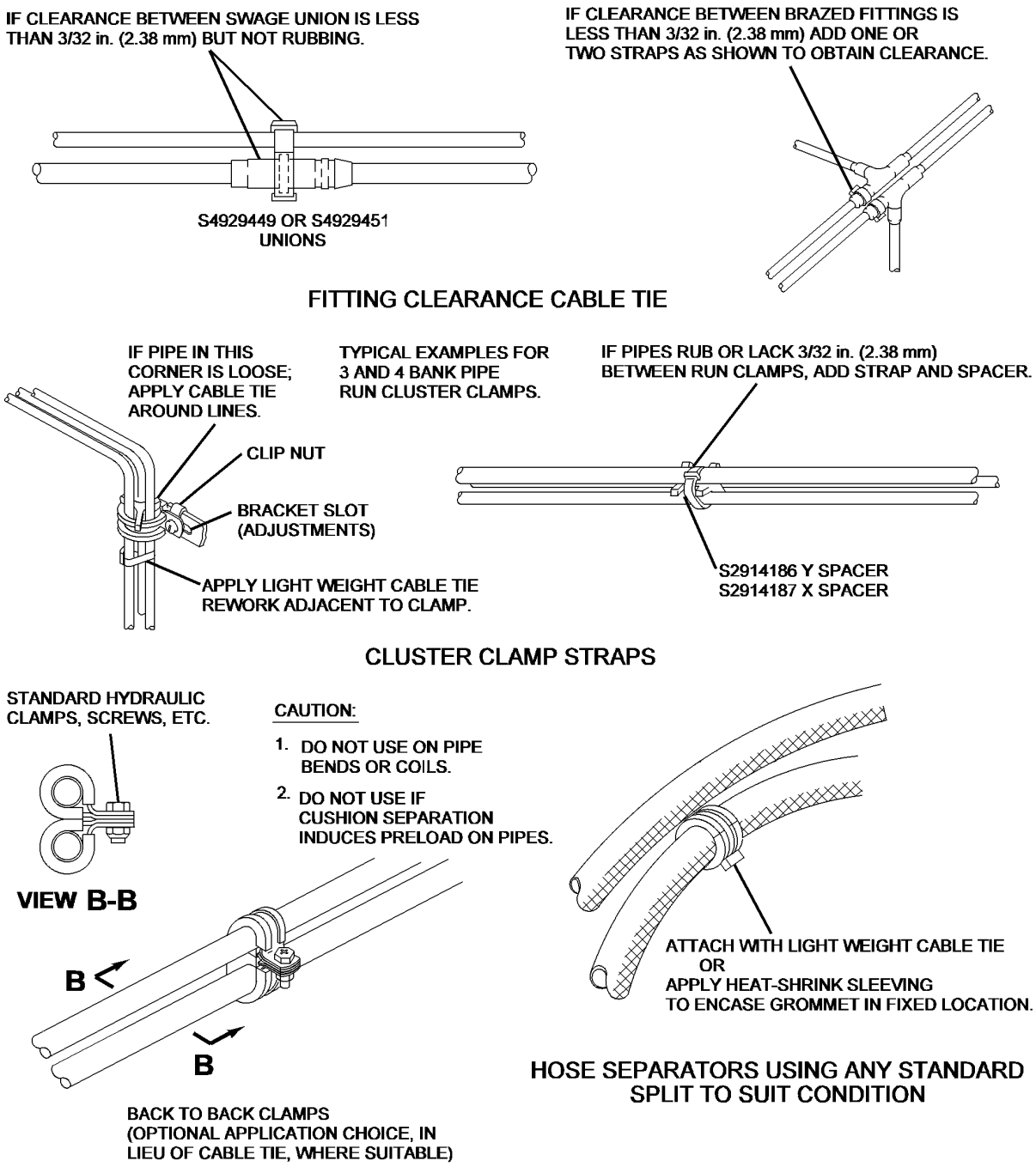

Sta-Strap Separator Installation
Figure 218/20-12-04-990-922 (Sheet 3 of 3)

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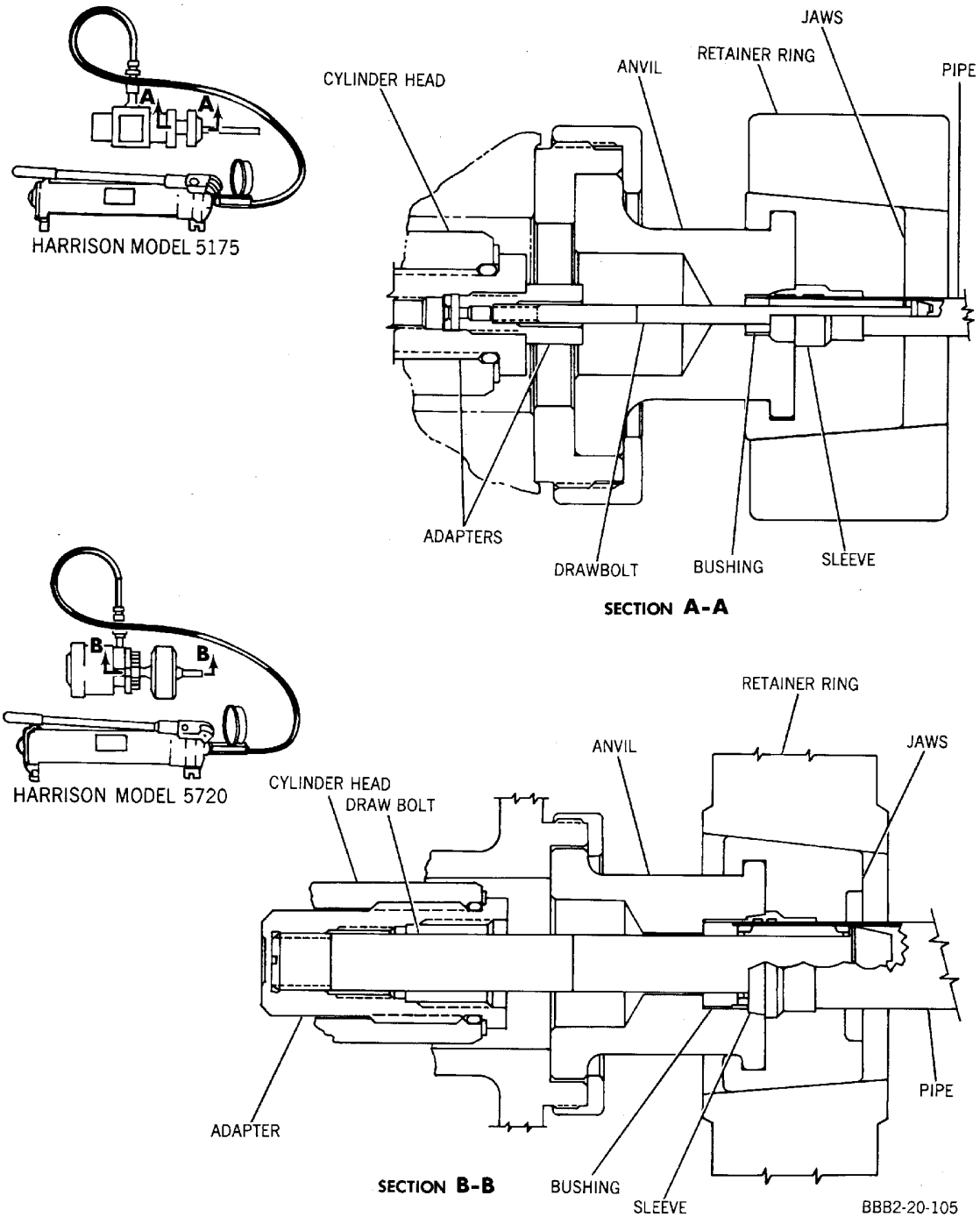

Harrison Portable Hand Swagers
Figure 219/20-12-04-990-923

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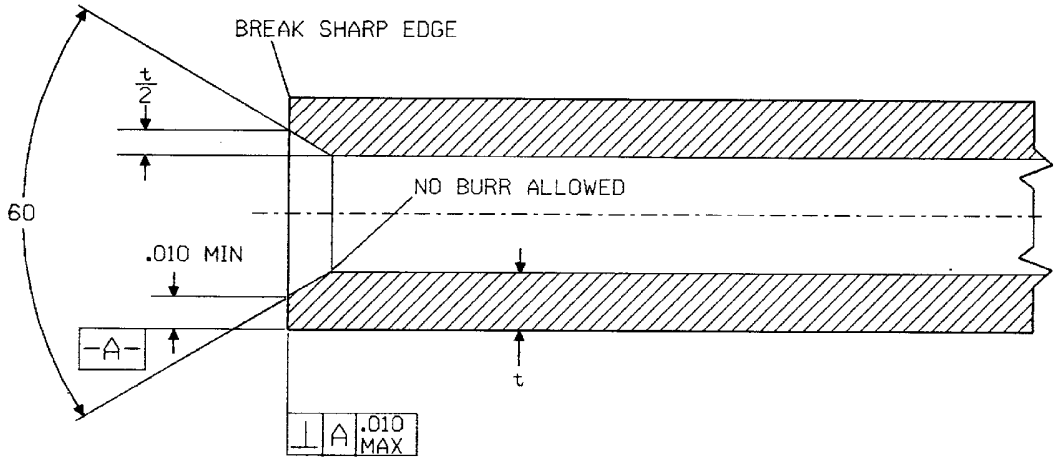

NOTE:

COUNTERSINKING SHALL NOT CAUSE EXPANSION OF THE TUBE END.

TUBE ROUNDNESS MUST BE MAINTAINED TO ACCEPT INTERNAL TOOLING.

BBB2-20-106

Pipe End Preparation
Figure 220/20-12-04-990-924

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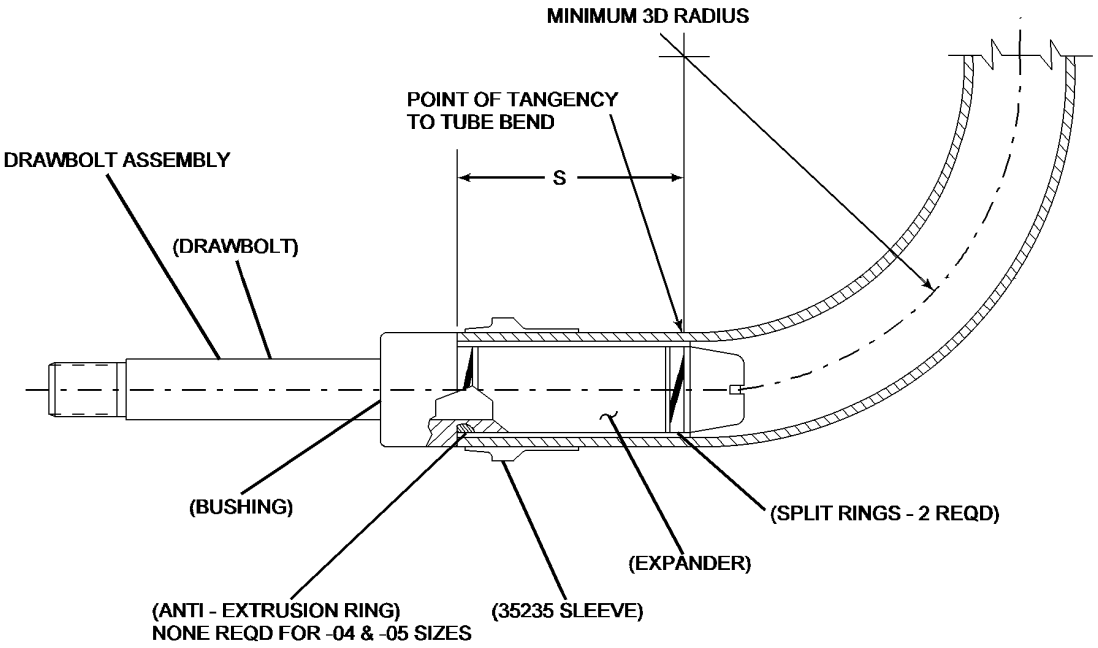

35235 SLEEVE, FLARELESS - SHORT SWAGE (MINIMUM TUBE PROTRUSION)

SIZE	-04	-05	-06	-08	-10	-12	-16
"S" SHORT SWAGE	.91	.94	.94	1.00	1.06	1.13	1.06

DIMENSIONS ARE IN INCHES

35235 SLEEVE, FLARELESS - LONG SWAGE

SIZE	-04	-05	-06	-08	-10	-12	-16
"S" LONG SWAGE	1.23	1.25	1.28	1.39	1.48	1.51	1.47

DIMENSIONS ARE IN INCHES

BBB2-20-107A
S0006557619V2

Minimum Straight Pipe End Length
Figure 221/20-12-04-990-925

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5175 HAND SWAGER

TOOLING CHART FLARELESS SLEEVE (35000 SERIES)

PIPE SIZE INCH	WALL THICK-NESS INCH	DRAWBOLT PART NO.	EXPANDER PART NO.	SEAL RING PART NO. (2 REQ'D)	BUSHING PART NO.	ANTI EXTRUSION RING PART NO.	ANVIL PART NO.	JAWS PAIR PART NO.	ADAPTER
1/4 (04)	.016 THRU .035	5642-1016 THRU 5642-1035	5945-04016 THRU 5945-04035	5937-04016 THRU 5937-04035	6150-04016 THRU 6150-04305	NONE REQ'D	5284-2	5598	5329 AND 5930
5/16 (05)	.016 THRU .035	5643-1016 THRU 5643-1035	5945-05016 THRU 5945-05035	5937-05016 THRU 5937-05035	6150-05016 THRU 6150-0535	NONE REQ'D	5285-2	5599	5329 AND 5930
3/8 (06)	.016 THRU .035	5902-1016 THRU 5902-1035	5945-06016 THRU 5945-06035	5937-06016 THRU 5937-06035	6150-06016 THRU 6150-06035	5942-06	5286-2	5600	5930
1/2 (08)	.016 THRU .049	5645-1016 THRU 5645-1049	5945-08016 THRU 5945-08049	5937-08016 THRU 5937-08049	6150-08016 THRU 6150-08049	5942-08	5288-2	5601	5930
5/8 (10) △1	.016 THRU .049	5646-1016 THRU 5646-1049	5945-10016 THRU 5945-10049	5937-10016 THRU 5937-10049	6150-10016 THRU 6150-10049	5942-10	5999	5998	5994

△1 SPECIAL #6000 JAW RETAINER RING REQUIRED TO SWAGE 5/8 INCH PIPING ON 5175 MODEL SWAGER.

5930 ADAPTER IS INTEGRAL WITH HYDRAULIC SWAGING CYLINDER AND IS NOT REMOVED EXCEPT IN SWAGING 5/8 INCH O.D. (−10) PIPES WHEN IT IS REPLACED BY 5994 ADAPTER.

BBB2-20-108

Tooling - 5715 Portable Hand Swager (For Long Tooling)
Figure 222/20-12-04-990-926

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5720 HAND SWAGER

TOOLING CHART FLARELESS SLEEVE (35000 SERIES)

PIPE SIZE INCH	WALL THICK-NESS INCH	DRAWBOLT PART NO.	EXPANDER PART NO.	SEAL RING PART NO. (2 REQ'D)	BUSHING PART NO.	ANTI EXTRUSION RING PART NO.	ANVIL PART NO.	JAWS PAIR PART NO.	ADAPTER
5/8 (10)	.016 THRU .049	5646-1016 THRU 5646-1049	5945-10016 THRU 5945-10049	5937-10016 THRU 5937-10049	6150-10016 THRU 6150-10049	5942-10	5310-2	5602	5307 AND 5990
3/4 (12)	.016 THRU .049	5647-1016 THRU 5647-1049	5945-12016 THRU 5945-12049	5937-12016 THRU 5937-12049	6150-12016 THRU 6150-12049	5942-12	5311-2	5603	5307 AND 5990
1 (16)	.016 THRU .065	5986-1016 THRU 5986-1065	5945-16016 THRU 5945-16065	5937-16016 THRU 5937-16065	6150-16016 THRU 6150-16065	5942-16	5312-2	5604	5990
1-1/4 (20)	.016 THUR .072	5649-1016 THRU 5649-1072	5945-20016 THRU 5945-20072	5937-20016 THRU 5937-20072	6150-20016 THRU 6150-20072	5942-20	5313-2	5605	5990
1-1/2 (24)	.016 THRU .076	5650-1016 THRU 5650-1076	5945-24016 THRU 5945-24076	5937-24016 THRU 5937-24076	6150-24016 THRU 6150-24076	5942-24	5314-2	5606	5990

NOTE: 5990 ADAPTER IS INTEGRAL WITH HYDRAULIC SWAGING CYLINDER AND DOES NOT HAVE TO BE REMOVED.

BBB2-20-109

Tooling - 5720 Portable Hand Swager (For Long Tooling)
Figure 223/20-12-04-990-927

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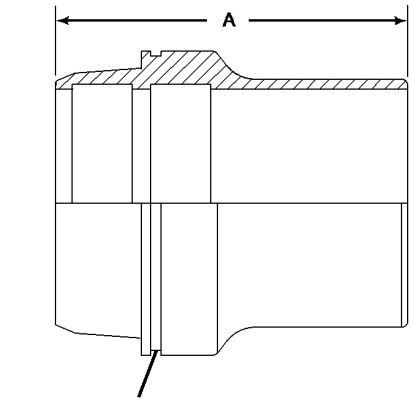

35235 TWO GROOVE SLEEVE *[1], *[2]		
UNION SIZE	PIPE OD	DIMENSION "A" MAXIMUM
-04	0.25 in. (6.35 mm)	0.554 in. (14.072 mm)
-05	0.312 in. (7.925 mm)	0.637 in. (16.180 mm)
-06	0.375 in. (9.525 mm)	0.672 in. (17.069 mm)
-08	0.500 in. (12.700 mm)	0.774 in. (19.660 mm)
-10	0.625 in. (15.875 mm)	0.824 in. (20.930 mm)
-12	0.750 in. (19.050 mm)	0.748 in. (18.999 mm)
-16	1 in. (25 mm)	0.800 in. (20.320 mm)
-20 *[3]	1.250 in. (31.750 mm)	0.792 in. (20.117 mm)
-24 *[3]	1.500 in. (38.100 mm)	0.787 in. (19.990 mm)

*[1] FORMERLY SERRACIN/HARRISON NOW EATON AEROSPACE
EXAMPLE 35235()XX
35235 =BASIC P/N
() MATERIAL CODE V = 15-5PH CRES PER AMS 5659, PASSIVATE PER ACES 7178
VN=15-5PH CRES PER AMS 5659, CADMIUM PER ACES 7178
VJ = 15-5PH CRES PER AMS 5659, ION VAPOR DEPOSIT PER MIL-C-83488 CLASS 3, TYPE 1
VG = 15-5PH CRES PER AMS 5659, PASSIVATE PER ACES 7178, FOR OXYGEN SYSTEM USE ONLY
XX= UNION SIZE

*[2] SERRACIN/HARRISON BOEING PART No. BACS138BX()()
EXAMPLE BAC138SBX()XX
BAC138BX =BASIC P/N
() MATERIAL CODE V = 15-5PH CRES PER AMS 5659, PASSIVATE PER ACES 7178
VN = 15-5PH CRES PER AMS 5659, CADMIUM PER ACES 7178
VJ = 15-5PH CRES PER AMS 5659, ION VAPOR DEPOSIT PER MIL-C-83488 CLASS 3, TYPE 1
VG = 15-5PH CRES PER AMS 5659, PASSIVATE PER ACES 7178, FOR OXYGEN SYSTEM USE ONLY
XX= UNION SIZE

*[3] CROSS REFERENCE FOR BOEING P/N BAC138SBX-20 AND -24 ARE EATON P/N 35044-20 AND -24

BBB2-20-110A
S0006525723V2

Harrison Two Groove Flareless Fittings
Figure 224/20-12-04-990-928

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10. Harrison H Repair Fitting

A. Harrison H repair fittings are used for immediate in-field repair.

(1) Repair piping as follows:

NOTE: Harrison H repair fitting is used for piping sized from 0.250 to 1 inch O.D.

(a) Ascertain pipe O.D. and required fitting for repair.

(b) Make certain pipe ends are deburred.

NOTE: Maximum gap between pipe ends is 0.250 inch.

(c) Use template to establish tape position and location of insertion mark.

(d) Mark dot on pipe opposite template dot.

NOTE: Use one layer of tape only.

(e) Position fitting components onto pipe ends with union against tape.

(f) Hold coupling end to prevent turning and start nut onto coupling.

(g) Tighten nut until great torque increase is felt as slide and coupling bottom against union. Check that pipe insertion mark is visible.

(h) Unscrew nut and check that slide and coupling are bottomed against shoulder of union.

NOTE: Union must contact tape and edge of coupling must intersect pipe mark.

(i) Hold coupling and tighten nut.

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SWAGE PRESSURES – 5175 PORTABLE HAND SWAGER							
PRESSURE IN PSIG FOR 2-GROOVE SLEEVES							
PIPE SIZE INCH	WALL THICK-NESS INCH	ALUMINUM 5052-0	ALUMINUM 6061-T6	CRES 304 & 321 ANNEALED	CRES 304 (1/8 HARD)	CRES 21-6-9	MAX. SAFE PRES-SURE
		WW-T-700/4	MIL-T-7081 WW-T-700/6	MIL-T-8504 MIL-T-8808	MIL-T-6845	BMS7-185 C08-1173	
1/4 (04)	.016	65		395	415	485	580
	.020	80		460	485	510	
	.022			480	510		
	.035	240	380	510			
5/16 (05)	.016	80		440		700	1050
	.020	100		480	600	750	
	.028			615	750	925	
	.035	310	380	750	925		
3/8 (06)	.020	125		545	800	1120	1900
	.022	140		615	880	1230	
	.028	185	460	765	1120	1550	
	.035	255	530	940	1500		
	.042			1120	1670		
1/2 (08)	.020			685	1230	1735	2700
	.026	230		860	1400	2070	
	.028	240	545	920	1585	2230	
	.035	325	785	1190	2070		
	.042			1565	2375		
	.049			2070			
5/8 (10)	.016	265		930	1365	1890	6700
	.020	310		1340	1970	2730	
	.028	405		1670	2465	3520	
	.033	480		2010	2960	4140	
	.035	550	1410	2375	3495	4930	
	.042			2815	4135		

BBB2-20-111

Portable Hand Swager 5715 - Swage Pressures
Figure 225/20-12-04-990-929

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SWAGE PRESSURES – 5720 PORTABLE HAND SWAGER							
PRESSURE IN PSIG FOR 2-GROOVE SLEEVES							
PIPE SIZE INCH	WALL THICK-NESS INCH	ALUMINUM 5052-0	ALUMINUM 6061-T6	CRES 304 & 321 ANNEALED	CRES 304 (1/8 HARD)	CRES 21-6-9	MAX. SAFE PRES-SURE
		WW-T-700/4	MIL-T-7081 WW-T-700/6	MIL-T-8504 MIL-T-8808	MIL-T-6845	BMS7-185 C08-1173	
5/8 (10)	.020	80		335	495	680	1650
	.028			420	620	880	
	.033	125		500	740	1010	
	.035	140	335	595	875	1230	
	.042			700	1010	1440	
3/4 (12)	.020	90		400	590	820	2500
	.028			635	940	1310	
	.035	220	380	880	1295	1800	
	.039			1010	1490	1980	
	.042	310		1120	1645	2200	
	.049			1350	1980		
1 (16)	.028			1100	1275	1520	6500
	.035	320	880	1275	1630	1940	
	.042			1320	1950	2320	
	.049	390		1560	2290	2730	
	.052			1665	2455	2900	
	.058			1860	2730	3250	
	.065			1935	2820	3350	
	.083			1980	2900	3460	
1-1/4 (20)	.035	400	1010	1620	2380	3050	8600
	.042			1935	2820	3760	
	.049			2220	3260	4340	
	.058			2510	3700	4930	
	.065						
	.083						
1-1/2 (24)	.028		790	2000	2950	4090	10550
	.035	360	1100	2160	3170	4400	
	.042			2310	3390	4710	
	.049	600	1400	2485	3650	5100	
	.058			2730	4010	5570	
	.065			2900	4270	5930	
	.083		5100				

BBB2-20-112

Portable Hand Swager 5720 - Swage Pressures
Figure 226/20-12-04-990-930

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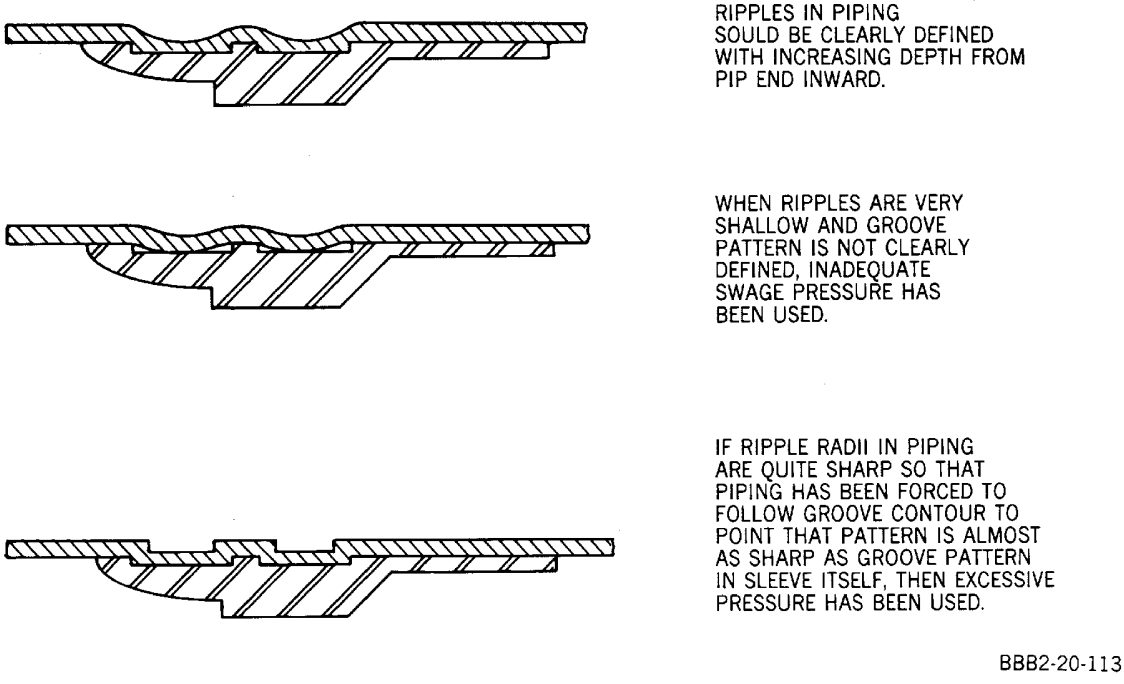

Swage Grooves - Check
Figure 227/20-12-04-990-931

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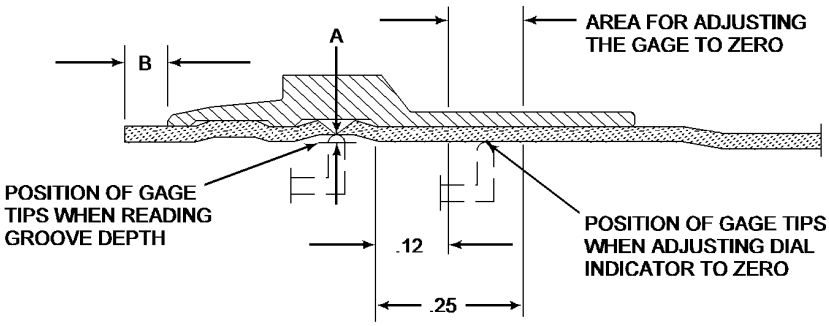

AFTER SWAGE GROOVE DEPTHS FOR P/N 35235 FLARELESS SLEEVE (LONG SWAGE)

SIZE	GROOVE DEPTH DIM "A", *[1] *[2]		TUBE PROTRUSION DIM. "B" ± .010 *[2]
	MIN	MAX	
-04	.020	.032	.079
-05	.020	.032	.095
-06	.020	.032	.098
-08	.020	.032	.100
-10	.022	.034	.140
-12	.026	.038	.140
-16	.028	.040	.202
-20 *[3]	.032	.046	.200
-24 *[3]	.032	.047	.275

*[1] TOTAL DIAMETER INCREASE DUE TO SWAGING.
*[2] ALL DIMENSIONS ARE IN INCHES.
*[3] THESE TUBE SIZES USE EATON P/N 35044 FLARELESS SLEEVE (SHORT SWAGE)

BBB2-20-114A
S0006525727V2

Swage Groove - Depth Limits
Figure 228/20-12-04-990-932

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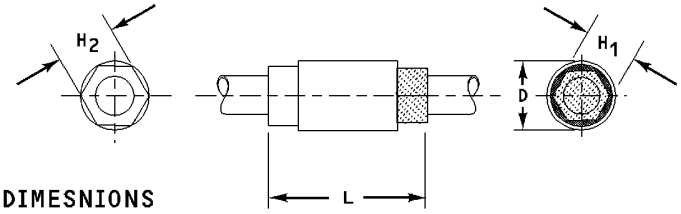
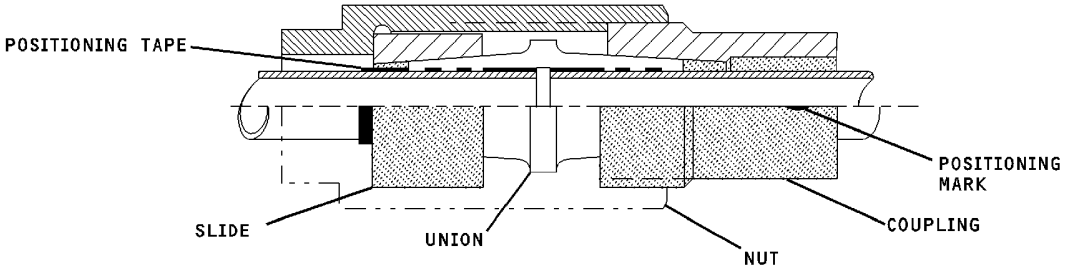


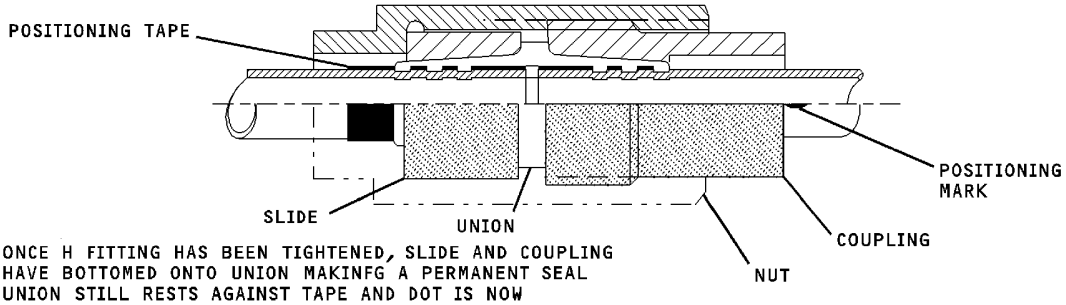
PART NUMBER AND DIMESNIONS

COMPANY PART NO.	PART NO.	TUBE O.D.	"D" DIA.	"H "	"H_2"	"L"
5816233	36011V04	.250	.780	.438	.688	2.35
5916232	36011V05	.3125	.900	.500	.750	2.35
5929498	36011V06	.375	.950	.625	.750	2.35
5829497	36011V08	.500	1.125	.750	.875	2.35
5816236	36011V10	.625	1.300	.875	1.063	2.35
5816235	36011V12	.750	1.420	.938	1.250	2.95
5816234	36011V16	1.000	1.700	1.187	1.500	2.95

H FITTING BEFORE AND AFTER INSTALLATION



WHEN NUT, SLIDE, UNION, AND COUPLING ARE IN POSITION ON PIPE GAP BETWEEN CUT PIPE ENDS IS IN CENTER OF UNION. ONE END OF UNION RESTS AGAINST TAPE.



ONCE H FITTING HAS BEEN TIGHTENED, SLIDE AND COUPLING HAVE BOTTOMED ONTO UNION MAKINFG A PERMANENT SEAL UNION STILL RESTS AGAINST TAPE AND DOT IS NOW INTERSECTED BY HEX-END OF COUPLING.

CAG(IGDS)

BBB2-20-131

Piping "H" Repair Fitting
Figure 229/20-12-04-990-933

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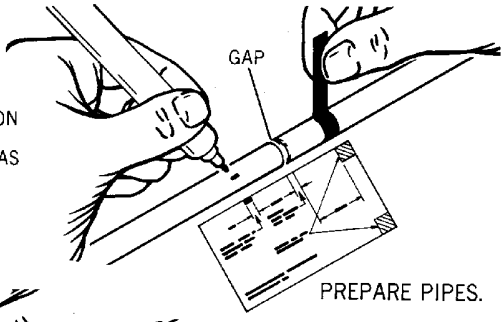
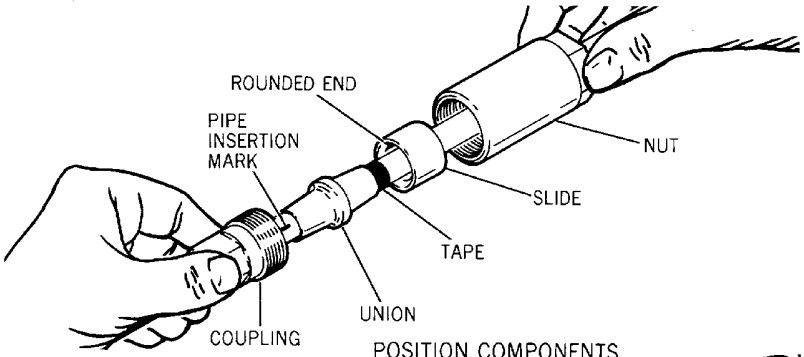
1. DEBURR PIPE ENDS. MAXIMUM GAP OF 0.250 INCH BETWEEN PIPE ENDS. USE TEMPLATE AS SHOWN TO ESTABLISH TAPE POSITION AND LOCATION OF PIPE INSERTION MARK. WRAP TAPE AS SHOWN. USE ONE LAYER OF TAPE ONLY AND CUT OFF EXCESS. MARK PIPE AS SHOWN OPPOSITE TEMPLATE INDICATOR (0.250 INCH LONG).



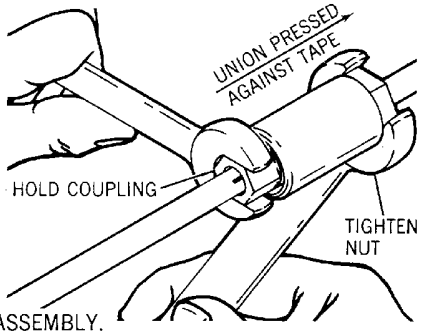
PREPARE PIPES.



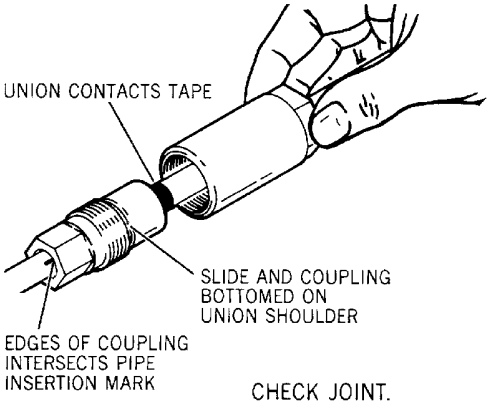
POSITION COMPONENTS.

2. POSITION FITTING COMPONENTS ONTO PIPE ENDS WITH UNION AGAINST TAPE.

3. START NUT ONTO COUPLING AND TIGHTEN WITH UNION AGAINST TAPE. HOLD COUPLING END – TO PREVENT TURNING! CONTINUE TIGHTENING NUT UNTIL GREAT TORQUE INCREASE IS FELT AS SLIDE AND COUPLING BOTTOM AGAINST UNION. CHECK FOR VISIBILITY OF PIPE INSERTION MARK.



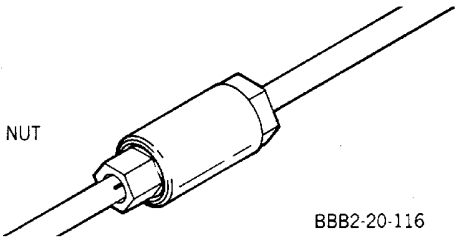
TIGHTEN ASSEMBLY.



CHECK JOINT.

4. UNSCREW NUT AND CHECK THAT SLIDE AND COUPLING ARE BOTTOMED AGAINST SHOULDER OF UNION. UNION MUST CONTACT TAPE AND EDGE OF COUPLING MUST INTERSECT PIPE MARK.

5. TIGHTEN NUT



BBB2-20-116

Piping Repair Sequence-H Fitting
Figure 230/20-12-04-990-934

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WJE 401-411, 415-427, 429, 861-866, 868, 869, 871-881, 883, 884, 886, 887, 891-893

11. Tubing Repair Techniques with Deutsch Permaswage Unions

A. Prepare for Tubing Repair Techniques with Deutsch Permaswage Unions

(1) For tubing repair use Permaswage field repair kit that follows:

- Tooling Kit Sizes -3 through -12 PN DLTFRPSKT3008
- Tooling Kit Sizes -16 through -24 PN DLT40PSKT3000

(2) Types of tubing repairs are as follows:

NOTE: There are four basic types of tubing faults that can be repaired by Permaswage technique. Tubing system failures are categorized by the types and sizes of cracks and holes, the type of fitting (elbow, tee, cross fitting), and the type of damage and fitting.

(a) Type 1 repair - One or two tubing cuts and one Permaswage union fitting are necessary to repair damaged pipe. Do Type 1 repair when conditions are as follows:

1) Damage area is in straight section of tube and damage is small hole or crack no larger than 0.30 in. (7.62 mm) in length.

2) There is sufficient clearance for you to cut and swage tubing.

3) Make one or two cuts as necessary to remove damaged section of tube.

NOTE: If two cuts are required, and the distance between the cuts is more than 0.30 in. (7.62 mm), do a Type 2 repair.

4) Identify size of tube and repair it with correct swage size fitting.

5) Inspect swaged connections.

(b) Type 2 repair - Two tubing cuts, two Permaswage union fittings, and/or tube splices are necessary to repair damaged tube. Do Type 2 repair when conditions are as follows:

1) Damage area is in straight section of tube and damage is hole or crack larger than 0.30 in. (7.62 mm) in length.

2) There is sufficient clearance for you to cut and swage tubing.

3) Make two cuts to remove damaged section of tube.

4) Assemble tube splice and two swage fittings on tube to be repaired before you swage fittings.

5) Swage each end of fitting.

6) Inspect swaged connections.

(c) Type 3 repair - This type of repair is for damaged elbow, tee, cross fitting, or straight length of tube adjacent to tee fitting. Do Type 3 repair when conditions are as follows:

1) This repair requires Permaswage D9855 tee fitting, one or more swage fittings, and one or more tube splices.

2) Damaged area is in tee section or straight section adjacent to tee.

3) Assemble new tee section, tube splice(s), and swage fittings.

4) Swage each end of fitting.

5) Inspect swaged connections.

(d) Type 4a repair - This type repair is for damaged female type flared end fitting. Do Type 4a repair as follows:

1) Remove original female flared MS-type flared sleeve from tube end fitting.

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2) This repair requires Permaswage D10010 flared sleeve (1) (or D10610 for aluminum fitting sizes -04 and -06) and D10006 coupling nut (2) (or D10600 for aluminum fitting sizes -04 and -06).

	FITTING P/N L	CRES	NUT P/N ALUMINUM	TITANIUM
Size -04	D10007 D10010	D10600J D10600J	N/A N/A D10600W	D10600T
	D10609 D10610	D10600J D10600J	D10600W	D10600T
				D10600T
				D10600T
Size -06	D10007 D10010	D10006J D10006J	N/A N/A D10600W	D10006T
	D10609 D10610	D10006J D10006J	D10600W	D10006T
				D10006T
				D10006T

3) Damaged area is tube end fitting.

4) Use Table that follows to determine length of tube to be cut off.

Table 206 TYPE 4A REPAIR - TUBE CUT OFF LENGTH

TUBE OUTSIDE DIAMETER		FITTING SIZE	CUT OFF LENGTH ± 0.010 in. (0.254 mm)	
0.1875 in.	(4.7625 mm)	-3	0.282 in.	(7.163 mm)
0.25 in.	(6.35 mm)	-4	0.275 in.	(6.985 mm)
0.3125 in.	(7.9375 mm)	-5	0.275 in.	(6.985 mm)
0.375 in.	(9.525 mm)	-6	0.226 in.	(5.740 mm)
0.50 in.	(12.70 mm)	-8	0.243 in.	(6.172 mm)
0.625 in.	(15.875 mm)	-10	0.204 in.	(5.182 mm)
0.75 in.	(19.05 mm)	-12	0.234 in.	(5.944 mm)
1.0 in.	(25.4 mm)	-16	1.647 in.	(41.834 mm)
1.25 in.	(31.75 mm)	-20	1.035 in.	(26.289 mm)
1.50 in.	(38.10 mm)	-24	1.045 in.	(26.543 mm)

NOTE: New tubing does not have to be spliced into damaged end fitting when you use the above cut off length.

5) Cut off end of tube.

6) Put Permaswage D10006 coupling nut (2) (or D10600 for aluminum fittings sizes -04 and -06) on tube.

7) Put Permaswage D10010 flared sleeve (1) (or D10600 for aluminum fittings sizes -04 and -06) on tube and center it between insertion marks.

8) Swage end of D10010 flared sleeve (1) (or D10610 for aluminum fittings sizes -04 and -06).

9) Inspect swaged connections.

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(e) Type 4b repair - This type repair is for damaged female type flareless end fitting. Do as follows for conditions mentioned:

1) Remove original female flareless MS-type end fitting.

2) This repair requires D10006 coupling nut (2) (or D10600 for aluminum fittings sizes -04 and -06) and D10007 flared sleeve (3) (or D10609 for aluminum fittings sizes -04 and -06).

3) Damaged area is tube end fitting.

4) Use Table that follows to determine length of tube to be cut off.

TYPE 4A REPAIR - TUBE CUT OFF LENGTH

TUBE OUTSIDE DIAMETER		FITTING SIZE	CUT OFF LENGTH ± 0.010 in. (0.254 mm)	
0.1875 in.	(4.7625 mm)	-3	0.432 in.	(10.973 mm)
0.25 in.	(6.35 mm)	-4	0.541 in.	(13.741 mm)
0.3125 ft.	(95.250 mm)	-5	0.557 in.	(14.148 mm)
0.375 in.	(9.525 mm)	-6	0.508 in.	(12.903 mm)
0.50 in.	(12.70 mm)	-8	0.588 in.	(14.935 mm)
0.625 in.	(15.875 mm)	-10	0.600 in.	(15.240 mm)
0.75 in.	(19.05 mm)	-12	0.628 in.	(15.951 mm)
1.0 in.	(25.4 mm)	-16	2.110 in.	(53.594 mm)
1.25 in.	(31.75 mm)	-20	1.456 in.	(36.982 mm)
1.50 in.	(38.10 mm)	-24	1.504 in.	(38.202 mm)

NOTE: New tubing does not have to be spliced into damaged end fitting when you use the above cut off lengths.

5) Put Permaswage D10006 coupling nut (2) (or D10600 for aluminum fittings sizes -04 and -06) on tube to be repaired.

6) Put Permaswage D10007 flared sleeve (3) (or D10609 for aluminum fittings sizes -04 and -06) on tube.

7) Swage end of D10007 flared sleeve (3) (or D10609 for aluminum fittings sizes -04 and -06).

8) Inspect swaged connections.

B. Inspection of Permanent Tubing with Deutsch Permaswage Unions

WARNING: PERMASWAGE UNIONS USE VERY HIGH PRESSURE DURING THE SWAGING PROCESS. ONLY PERSONS APPROVED ON DEUTSCH METAL COMPONENTS CAN USE THE 10,000 PSI (68,947.57 KPA) MANUAL PUMP ASSEMBLY. THIS WILL PREVENT INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(1) Prepare for splice repair of permanent tubing with Deutsch Permaswage unions as follows:

(a) Inspect tubes and manual pump assembly before you swage prepared tubes as follows:

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1) Inspect Inside Diameter (I.D.) and Outside Diameter (O.D.) of tube ends to be joined for burrs.

NOTE: If the ends have not been properly deburred, the ends will cut the silicone seal and scratch the I.D. of the swage fittings.

2) Make sure that swage dies are correct size.
   a) Make sure there is no unwanted material between slots.
   b) Make sure that two halves of fitting are matched set.
3) Inspect manual pump assembly model number.
   a) Make sure that you have correct manual pump model assembly for Permaswage.
4) Make sure that head and dieblock are in correct position with die and fitting.
5) Use Deutsch marking tool to check insertion mark for correct position.
   a) Make sure that part of insertion mark is shown with fitting in place.
6) Make sure that stop endplate on head assembly is adjacent to fitting.
7) Before swaging, make sure that fitting you install is correct part number, size, and has internal silicone seal.
8) Make sure that manual pump assembly builds 10,000 psi (68,947.57 kPA) and that air pressure is minimum of 100.00 psi (689.48 kPA) ± 20.00 psi (137.90 kPA).

(b) Align distance between two tubes that are to be connected.

(c) If B-nuts are involved, tighten B-nuts before you swage tube ends.

(2) Prepare tooling as follows.

(a) Use Table that follows to make selection for correct head assembly:

Table 207 SELECT HEAD ASSEMBLY: 0 - 3000.00 psi (20,684.27 kPA) MAXIMUM

TUBE OUTSIDE DIAMETER		PERMASWAGE PN	NATIONAL STOCK NUMBER
0.1875 in.	(4.7625 mm)	DLT05PSHA3003	NOT YET ASSIGNED
0.25in.	(6.35mm)	DLT05PSHA3004	
0.3125 in.	(7.9375 mm)	DLT10PSHA3005	
0.375in.	(9.525mm)	DLT10PSHA3006	
0.5in.	(12.7mm)	DLT20PSHA3008	
0.625in.	(15.875 mm)	DLT20PSHA3010	
0.75in.	(19.05 mm)	DLT30PSHA3012	
1.0in.	(25.4mm)	DLT40PSHA4016	
1.25in.	(31.75 mm)	DLT40PSHA3020	
1.5in.	(38.1 mm)	DLT40PSHA3024	

(b) Position fitting on tube over most of tube insertion mark.

1) Make sure that most of insertion mark is covered, but that small amount of mark can be seen outside of fitting.

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WARNING: PERMASWAGE UNIONS USE VERY HIGH PRESSURE DURING THE SWAGING PROCESS. ONLY PERSONS APPROVED ON DEUTSCH METAL COMPONENTS CAN USE THE 10,000 PSI (68,947.57 KPA) MANUAL PUMP ASSEMBLY. THIS WILL PREVENT INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(c) Apply 10,000.00 psi (68,947.57 kPA) ± 250.00 psi (1723.69 kPA) hydraulic pressure with swage tool.

NOTE: Do not move the power unit, fitting, and tube from the positions noted above.

(3) Inspect swage connection as follows:

(a) Use Table that follows for selection of size inspection gauge required for fitting to be inspected.

INSPECTION GAUGE PART NUMBERS

SIZE FITTING	PERMASWAGE PN	NATIONAL STOCK NUMBER
-3 or 03	D12-9892-03	5220-00-005-5635
-4 or 04	D12-9892-04	5220-00-005-5636
-5 or 05	D12-9892-05	5220-00-005-5637
-6 or 06	D12-9892-06	5210-00-005-5638
-8 or 08	D12-9892-08	5220-00-004-4912
-10 or 10	D12-9892-10	5210-01-251-3823
-12 or 12	D12-9892-12	5220-00-004-4914
-16 or 16	D12-9892-016	5220-00-882-7951
-20 or 20	D12-9892-20	NA
-24 or 24	D12-9892-24	5220-00-003-0506

(b) Use inspection gauges according to following Table:

Table 208 INSPECTION GAUGE DIMENSIONS, 0 - 3000.00 psi (20,684.27kPA) MAXIMUM

INSIDE DIAMETER A ± 0.005 in. (0.127 mm)	INSIDE LENGTH B ± 0.005 in. (0.127 mm)	PERMASWAGE PN	NATIONAL STOCK NO.
0.247 in. (6.274 mm)	0.34 in.(8.64 mm)	D12-9892-03	5220-00-005-5635
0.315 in. (8.001 mm)	0.46 in.(11.68 mm)	D12-9892-04	5220-00-005-5636
0.381 in. (9.677 mm)	0.5 in.(12.7 mm)	D12-9892-05	5220-00-005-5637
0.447 in.(11.354 mm)	0.584 in.(14.834 mm)	D12-9892-06	
0.606 in.(15.392 mm)	1.02 in.(25.91 mm)	D12-9892-08	5220-00-004-4912
0.735 in.(18.669 mm)	1.02 in.(25.91 mm)	D12-9892-10	5220-00-004-4914
0.863 in.(21.920 mm)	1.02 in.(25.91 mm)	D12-9892-12	
1.144 in.(29.058 mm)	1.16 in.(29.46 mm)	D12-9892-16	
1.39 in. (35.31 mm)	1.406 in.(35.712 mm)	D12-9892-20	
1.68 in. (42.67 mm)	1.42 in.(36.07 mm)	D12-9892-24	

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NOTE: Swage fittings must be inspected to make sure that they will function properly.

(c) Put inspection gauge over swaged end of fitting at three places about 60° apart.

(d) Make sure that internal shoulder of gauge touches end of fitting.

NOTE: The O.D. of the fitting must be less than the I.D. of the inspection gauge.

(e) Turn gauge another 60°.

1) Make sure that internal shoulder of gauge touches end of fitting.

NOTE: The O.D. of the fitting must be less than the I.D. of the inspection gauge.

(f) If inspection gauge does not fit properly over swaged fitting, then reswage fitting. Reinspect fitting after reswaging.

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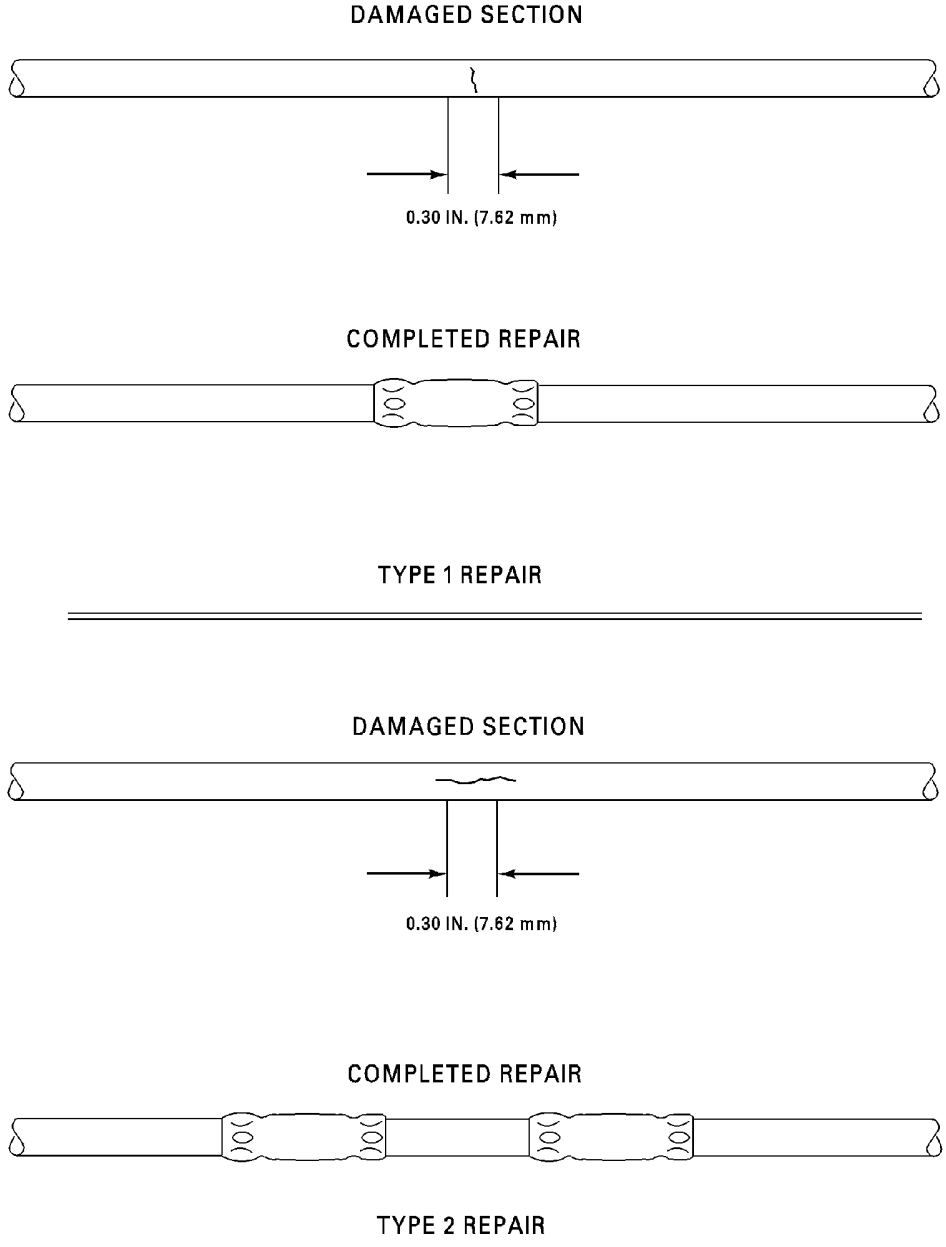

Type 1 and Type 2 Permaswage Tubing Repair Techniques
Figure 231/20-12-04-990-935

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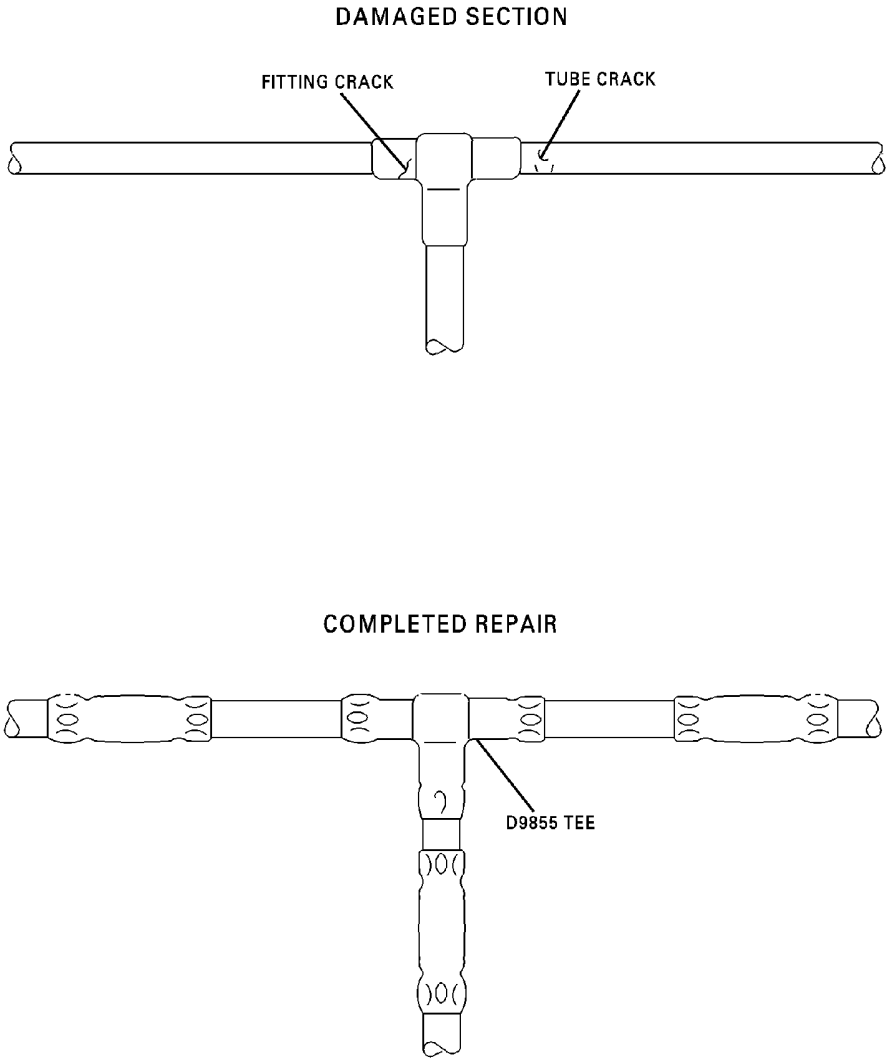

Type 3 Permaswage Tubing Repair Technique
Figure 232/20-12-04-990-936

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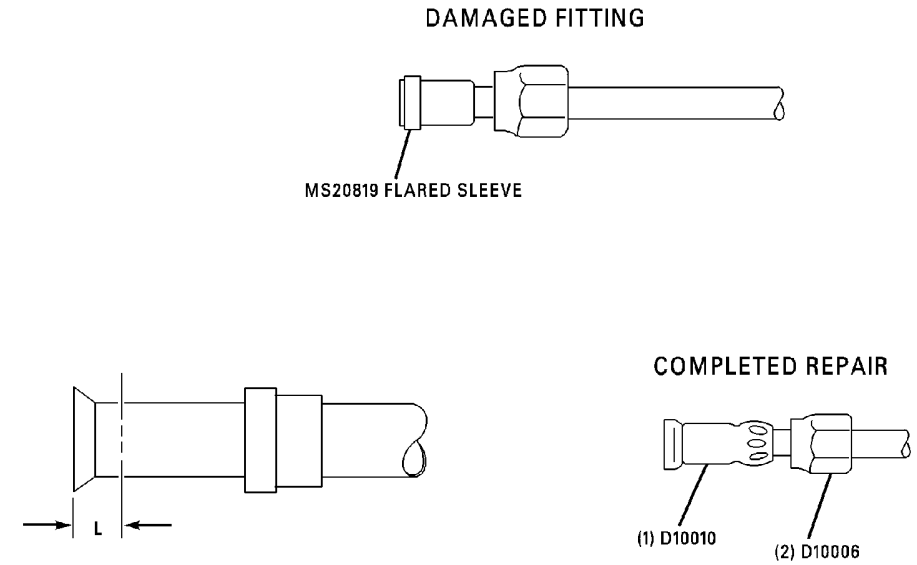

Type 4A and Type 4B Permaswage Female Flared and Flareless End Fitting Repair Techniques
Figure 233/20-12-04-990-937

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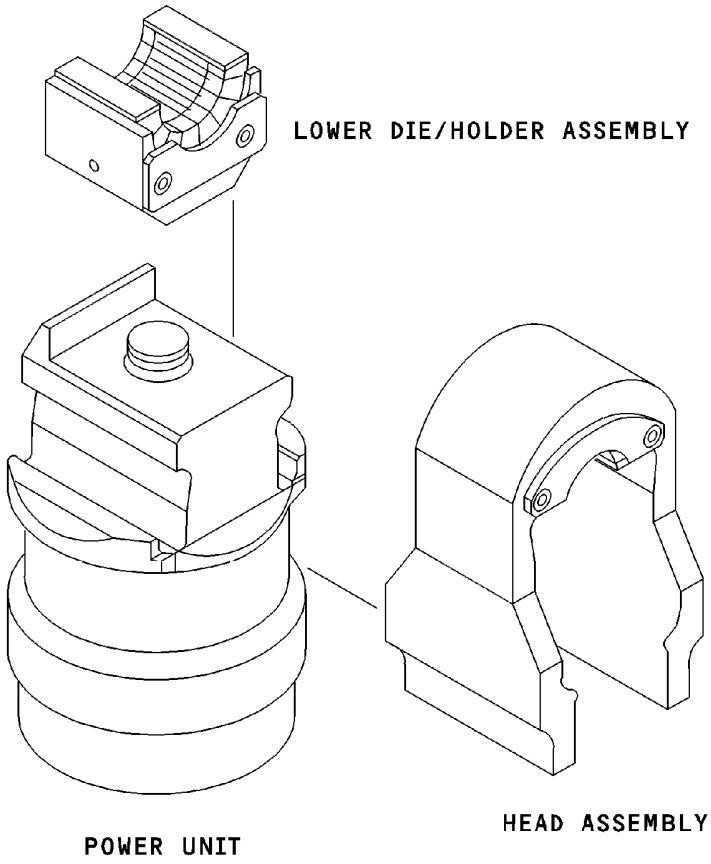

Deutsch Lower Die/Holder Assembly, Head Assembly, and Power Unit
Figure 234/20-12-04-990-938

EFFECTIVITY
WJE 401-411, 415-427, 429, 861-866, 868, 869, 871-881, 883, 884, 886, 887, 891-893

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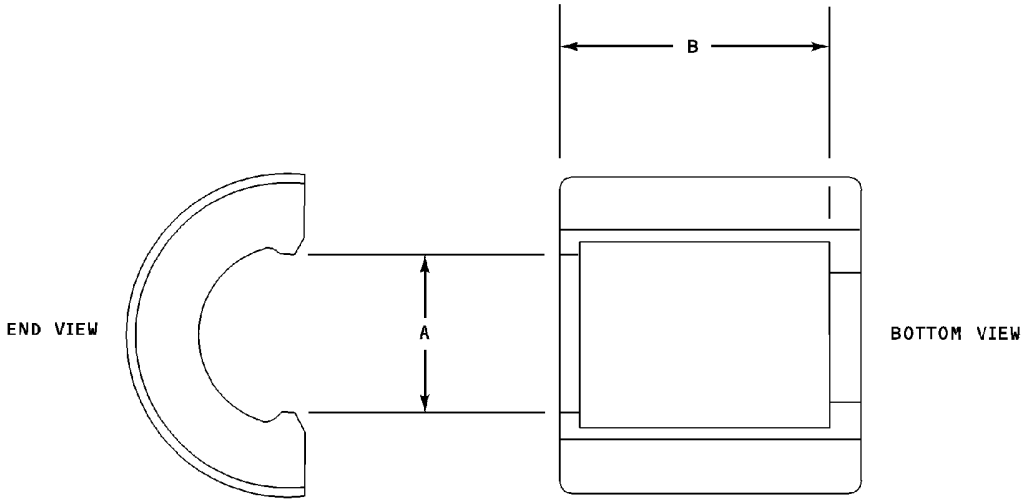

Inspection Gauge
Figure 235/20-12-04-990-939

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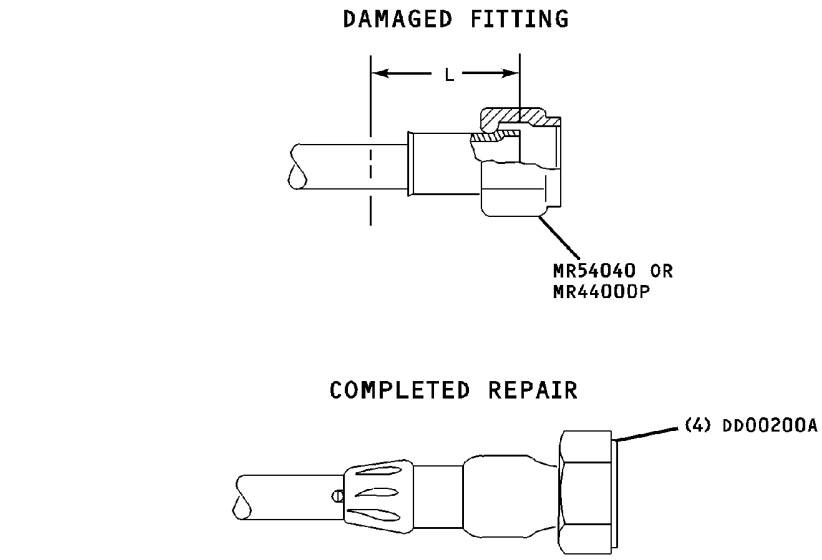

Type 4C and Type 4D Permaswage Female Lipseal End Fitting Repair Techniques
Figure 236/20-12-04-990-940

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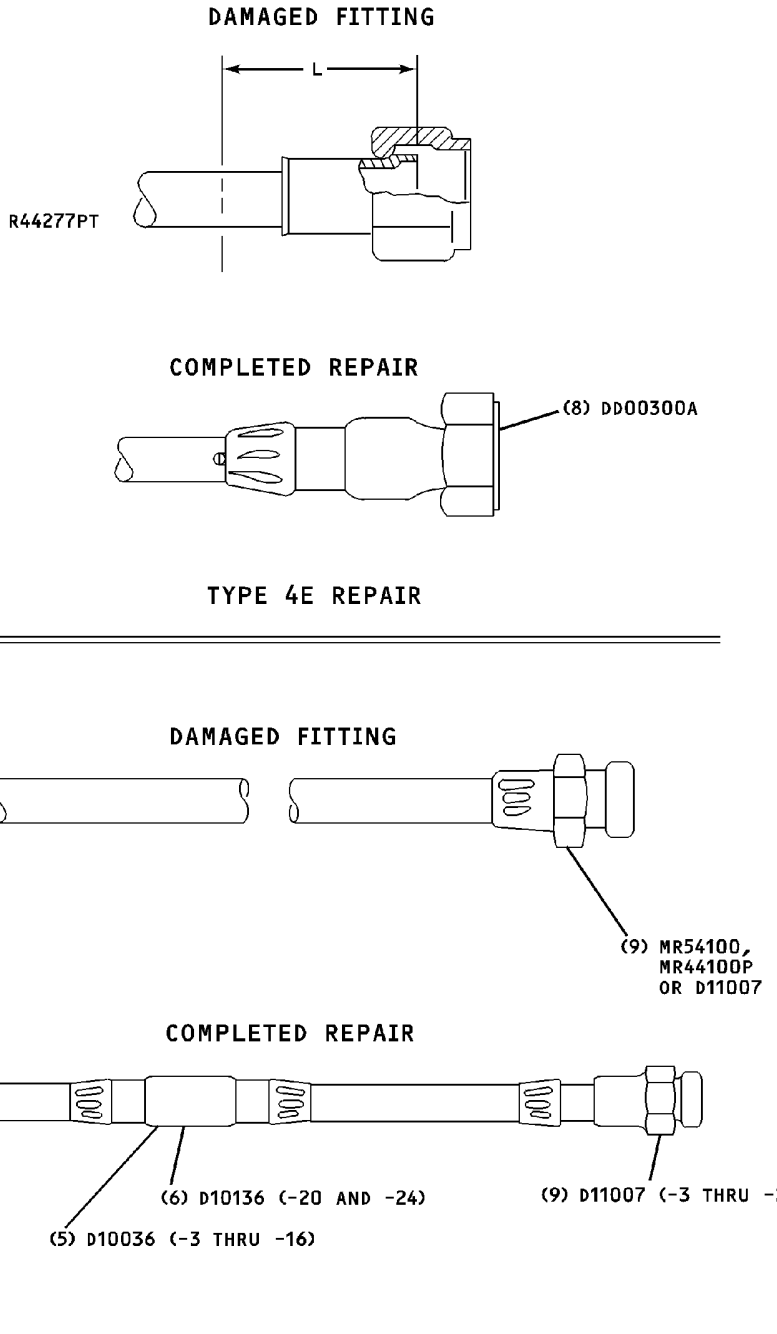

Type 4E and 4F Permaswage Female Lipseal Reducer End Fitting Repair Techniques
Figure 237/20-12-04-990-941

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CEMENTING - MAINTENANCE PRACTICES

1. General

A. Cementing as used in this section refers to the permanent joining of two overlapping surfaces. This may be performed as a sequential step in assembly, or used as a medium for salvage rework or repair.

B. Choice of cementing agent and procedure depend upon the basic material, temperature to which the bond will be subjected, and anticipated stresses to the bond. Wood, metals, rubber, and plastics have individual bonding characteristics and must, therefore, be handled individually.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

C. Cementing procedures discussed in this section are not to be used instead of repair bonding procedures in STRUCTURES GENERAL, CHAPTER 51.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

	Name and Number	Manufacturer
Adhesives	Epibond H-1337-A resin with HN9615A Gardena, CA activator DPM 3412	Wilco Associates, Inc.
	EA934NA Part A/B DPM 5535-2	Hysol Div. Dexter Corp. City of Industry, CA
	RTV-9910 Catalyst and RTV-88 adhesive DMS 1799	General Electric Co. Waterford, N.Y.
	Neoprene contact N-134 DPM 6307	Stabond Corp. Gardena, CA
	#T-150A DPM 3542	Stabond Corp.
	#N56107B DPM 6356	Stabond Corp.
	Aquabind, Low heat release DPM 6305	AMT Chico, CA
	Pressure sensitive, water based, A1694B DPM 6353	B. F. Goodrich Akron, OH
	EC-1711 DPM 845	Minnesota Mining & Mfg. Co. 900 Bush Ave. St. Paul, MN 55106
	EC-2216A with EC-2216B DPM 3279	Minnesota Mining & Mfg. Co. 900 Bush Ave. St. Paul, MN 55106
	Silastic 732 clear DPM 5614-1	Dow Corning Co. Midland, MI
	Silgrip SR-529 with SRC-18 catalyst	General Electric Co. Waterford, N.Y.

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Table 201 (Continued)

	Name and Number	Manufacturer
	C-14A resin with C-14B catalyst DPM 1132	Chrysler Cycleweld Corporation Los Angeles, CA
	Pro-Seal 501 with 501A accelerator DPM 2091	Coast Pro-Seal & Mfg. Co. 2235 Beverly Blvd. Los Angeles, CA
	Adhesive, Epoxy Crest 721, Part A/B DPM 6047	Crest Products Corp. Santa Ana, CA
	Lefkoweld 109NA with LM-52 activator DPM 6047	Leffingwell Chemical Company Whittier, CA
	Adhesive, Film, Modified Epoxy FM-123-2 DMS 1911	American Cyanamid Havre De Grace, MD
	Stabond E-154 DPM 2902	Stabond Corp. Gardena, CA
	Adhesive Film, TF-223N	National Adhesives Bridgewater, N.J.
	Film, adhesive, heat activated, low heat release, HAA 1990 DPM 6342	Schneller, Inc. Kent, OH
	Film, adhesive, heat activated, low heat release, PPF-2272 DPM 6216	Polyplastex, Inc.
	Uralane 5774A with 5774B DPM 5892	Furane Aerospace Products, Div. of Ciba-Geigy Los Angeles, CA
	RTV 730 DPM 3143	Dow Corning Midland, MI
	Cement, 18082	Swift Chemical Co. Los Angeles, CA
Sealants	PR-1422B-2 with accelerator DMS 2082	Products Research & Chemical Corp., 5426 San Fernando Rd. Glendale, CA 91209
	90-006 with 90-006-2 accelerator DMS 1799	Dow Corning Co. Midland, MI
	Glue, white #Wilhold DPM 862	Dapp, Inc.
Adhesive Primers	Bostik 1007 DPM 806	USM Corp. Middleton, MA
	RTV-1200 DPM 3202	Dow Corning Corp. Midland, MI
	RTV-3145 DPM 5156	Dow Corning Corp. Midland, MI
	Chem-on, 7707 DPM 2389	Chem Seal Corp. 11120 Sherman Way Sun Valley, CA 91352
	Black E&H 1261 DPM 5411	E & H Laminating & Slitting Co. Patterson, NJ
Solvents	Cleaning Solvent, P-D-680, Type 1	
	Douglas No. 2 DPM 518	Arco Corp. Los Angeles, CA
	MPK Blend Solvent DMS 2458	Chemetall Oakite, La Mirada, CA
	Toluene DPM 540	Shell Oil Co. Wilmington, CA
	Isopropyl Alcohol DPM 530	
	Thinner Fed-TT-T-266	Commercially available
	Denatured Ethyl Alcohol DPM 514	W.P. Fuller Co. Los Angeles, CA

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Table 201 (Continued)

	Name and Number	Manufacturer
	Methyl Alcohol DPM 532	Commercially available
	Methyl Ethyl Ketone (MEK) DPM 535	
	Cleaner/Solvent, handwipe, bulk, DPM 6380-4	BBA Fiberweb, Simpsonville, SC or Contec, Inc., Spartanburg, SC
Cleaner	Cleaner, Hand Wipe, Brulin MP 1793, DPM 6380-1	Brulin Company, Inc. Richmond, CA
	Cleaner, Hand Wipe, EPA 2000, DPM 6380-2	DPM 6380-2 is superseded by DPM 6380-4, however the DPM 6380-2 can be used until supplies are depleted.
	Cleaner, Hand Wipe, PF Degreaser, DPM 6380-3	P-T Technologies, Inc. Safety Harbor, FL
	Window, Acrylic #Anomet 471 DPM 6011	Anomet, Inc. Compton, CA
Tapes	Adhesive Transfer, Minn. Mining Co. Scotch 468 or 9568 DPM 5363	L.A., CA
	Adhesive, Foam, Double coated, #4920 DPM 6313	Minn. Mining Co. L.A., CA
	Double-faced, Polyken No. 108 DMS 1971	Polyken Division of Kendall Co. Chicago, IL
	Masking Tape, Paper, pressure sensitive, Type 2 DMS 1861	
Non-Structural	Mylar sheet, type A	E.I. DuPont de Nemours & Co.
	Sandpaper No. 180 grit No. 320 grit	Commercially available
	Wipers, white cotton, type 1	Morton Donvick Co. Gardena, CA
	Cloth, outing flannel #Wamco 101C DPM 491	WAMCO Mfg. Co. Rancho Dominguez, CA
	Nopaco AK-TBT	Noland Paper Company Buena Park, CA
	Filler, Cab-O-Sil DPM 5608	
	Pads, abrasive nylon web; Scotch-Brite, Type A, Very Fine	Minnesota Mining & Mfg. Co. Los Angeles, CA

3. **Preparation of Metal Surfaces for Cementing**

A. Preclean Surfaces

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

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(WARNING PRECEDES)

(1) Wipe faying surfaces free of foreign material using clean cotton cloth dampened with hand wipe cleaner. Wipe dry with clean cotton cloth. If metal is primed and primer is easily removed with hand wipe cleaner, remove all primer from faying surface. If removal is difficult, adhesive may be applied over primer. However, all lacquer or enamel must be removed.

(2) Wipe faying surfaces of metal with clean cotton dampened with hand wipe cleaner, and wipe dry before stripper evaporates.

4. Metal-to-Metal Bonding Low-Stress Applications

NOTE: The following procedures are to be used if the bond will be subjected to temperatures under 200°F (93°C).

- Apply adhesive transfer tape (Scotch #468 or #9568) to either faying surface.
- If adhesive is applied to the part, trim tape so edges are not exposed when part is bonded.
- Remove tape liner and join faying surfaces with firm hand or clamp pressure.
- Do not handle parts within one hour after joining.

NOTE: Firm application of pressure assures better adhesive contact and improves bond strength.

5. Metal-to-Metal Bonding High-Strength Applications

NOTE: The following procedures are to be used for higher strength bonds of approximately 200-psi shear, where no peeling forces are involved and if the bond will be subjected to temperatures under 200°F (93°C).

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

A. Mixing High Viscosity Adhesive

WARNING: EPOXY ADHESIVE IS AN AGENT THAT IS POISONOUS, CORROSIVE, A SENSITIZER, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN EPOXY ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET EPOXY ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

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(WARNING PRECEDES)

(1) Mix 100 parts by weight, of Lefkoweld 109NA with 74 parts, by weight, of LM-52 activator in clean glass or metal container until mass is of uniform viscosity. Do not use high-speed agitation, and avoid absorbent containers such as paper cups. Do not mix over one-half pound per batch, keeping in mind surface area involved and short pot life of mixed material. Pot life is 30 to 40 minutes at 77°F (25°C). Low temperature storage will increase pot life.

B. Mixing Intermediate Viscosity Adhesive

WARNING: EPOXY ADHESIVE IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN EPOXY ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET EPOXY ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Mix 100 parts, by weight, of Epibond H1337A adhesive to 100 parts, by weight, of HN9651A activator in clean glass or metal container until mass is of uniform viscosity. Do not use high-speed agitation, and avoid absorbent containers such as paper cups. Do not mix over one-half pound per batch, keeping in mind surface area involved and short pot life of mixed material. Pot life is 30 to 40 minutes at 77°F (25°C). Low temperature storage will increase pot life.

C. Mixing Low Viscosity Adhesive

(1) Mix 100 parts, by weight, of Cycleweld C14 to 7 parts, by weight, of C14A accelerator in clean glass or metal container until mass is of uniform viscosity. Do not use high-speed agitation, and avoid absorbent containers such as paper cups. Do not mix over one-half pound per batch, keeping in mind surface area involved and short pot life of mixed material. Pot life is 30 to 40 minutes at 77°F (25°C). Low temperature storage will increase pot life.

D. Application of Adhesives

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

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(WARNING PRECEDES)

(1) Apply approximately 5 to 10 mils (0.127 to 0.254 mm) of mixed adhesive to each faying surface. Spread adhesive with spatula, glue spreader, or roller. Use tool best suited to particular surface. Clean up excess adhesive with clean cotton cloth dampened with hand wipe cleaner.

(2) Immediately assemble parts in proper alignment and apply enough pressure to allow close contact and maintain approximately 0.003- to 0.010-inch (.076 to .254 mm) adhesive in joint. Do not apply high-pressure.

(3) Allow to cure at 70°F (21.1°C) until firm before handling. Adequate bond strength is attained in 24 hours (minimum temperature 70°F (21.1°C)). If faster cure is desired, cure 45 minutes at 190°F (87.8°C).

(4) Cementing doublers to longerons proceed as follows:

WARNING: EPOXY ADHESIVE IS AN AGENT THAT IS POISONOUS, CORROSIVE, A SENSITIZER, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN EPOXY ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET EPOXY ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(a) Apply adhesive Lefkoweld 109NA to faying surface of either doubler of longeron.

(b) Place doubler in position with sufficient hand pressure to form a fillet of adhesive completely around periphery of doubler.

(c) Allow to cure 2 hours before careful handling and 48 hours at room temperature before applying stress.

6. Metal-to-Metal Bonding High-Strength Applications with Moderate Peeling Forces

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

A. Mixing Dark-Colored Adhesive

NOTE: Always use lower cost dark-colored adhesive unless requirement for light-colored material exists.

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WARNING: INTEGRAL FUEL TANKS SEALING COMPOUND (POLYSULFIDE SEALANT B1/2 AND B2) IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN INTEGRAL FUEL TANKS SEALING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET INTEGRAL FUEL TANKS SEALING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Mix one part, by weight, of PR-1422A accelerator with seven and one-half parts, by weight, of PR-1422B-2 sealing compound in clean glass or metal container until mass is of uniform viscosity. Do not use high-speed agitation, and avoid absorbent containers such as paper cups. Pot life is approximately 1/2 hour at 77°F (25.0°C). Low-temperature storage will increase pot life.

B. Application of Adhesives

(1) Apply approximately 5 to 10 mils (0.127 to 0.254 mm) of mixed adhesive to each faying surface.

(2) Join faying surfaces in proper alignment and maintain only sufficient pressure to allow intimate contact.

(3) Allow assembly to cure undisturbed for minimum of 72 hours at 70°F (21.1°C) or cure at 130°F (54.5°C) for 4 hours for PR-1422B-2.

7. Metal-to-Metal Bonding High-Strength Applications With No Peeling Forces

NOTE: The following procedures are to be used for higher strength bonds of approximately 200-psi shear and where bond will be subjected to temperatures under 300°F (148.9°C).

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

A. Mixing Adhesive

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WARNING: EPOXY RESIN EA934NA ADHESIVE IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN EPOXY RESIN EA934NA ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET EPOXY RESIN EA934NA ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Mix 33 parts, by weight, of hardener (Part B) with 100 parts, by weight, of EA934NA adhesive (Part A) in clean glass or metal container until mass is of uniform viscosity. Do not use high-speed agitation, and avoid absorbent containers such as paper cups (unless polyethylene coated). Do not mix over one-half pound (0.227 kg) per batch, keeping in mind surface area involved and short pot life of mixed material. Pot life is approximately 40 minutes.

B. Application of Adhesive

(1) Apply approximately 5 mils (0.005 inch/0.127 mm) of mixed adhesive to each faying surface.

(2) Join faying surfaces in proper alignment and maintain only sufficient pressure to allow intimate contact.

(3) Allow assembly to cure undisturbed for seven days at room temperature, or one hour at 175°F (79°C) to 200°F (93°C), or fifteen minutes at 300°F (149°C) to 350°F (177°C).

8. Metal-to-Metal Bonding Low Shear and Peel Applications

NOTE: The following procedures are to be used for bonds subjected to temperature ranges of 200° to 450°F (93°C to 232°C).

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

A. Mixing Adhesive

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WARNING: SILICONE SEALANT IS AN AGENT THAT IS POISONOUS, CARCINOGENIC, CORROSIVE, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN SILICONE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE DUST OR GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Mix 100 parts, by weight, of 90-006 adhesive with 10 parts, by weight, of 90-006-2 accelerator in clean glass or metal container until mass is of uniform viscosity. Do not use high-speed agitation, and avoid absorbent containers. Do not mix more adhesive than can be used in a 2-hour period.

B. Application of Adhesive

(1) Apply approximately 5 to 10 mils (0.127 to 0.254 mm) of mixed adhesive to each faying surface.

(2) Join faying surfaces in proper alignment and maintain only sufficient pressure to allow intimate contact.

(3) Allow assembly to cure undisturbed for 24 hours at 70°F (21.1°C).

9. Metal-to-Metal Bonding for Room Temperature Usage (65° to 75°F)

A. 3° to 23.9°C)

(1) Mixing Adhesive

WARNING: EPOXY RESIN EA934NA ADHESIVE IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN EPOXY RESIN EA934NA ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET EPOXY RESIN EA934NA ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(a) Mix 33 parts, by weight, of hardener (Part B) with 100 parts, by weight, of EA934NA adhesive (Part A) in clean glass or metal container until mass is of uniform viscosity. Do not use high-speed agitation, and avoid absorbent containers such as paper cups (unless polyethylene coated). Do not mix over one-half pound per batch, keeping in mind surface area involved and short pot life of mixed material. Pot life is approximately 40 minutes.

(2) Application of Adhesive

(a) Apply approximately 5 mils (0.005 inch/0.127 mm) of mixed adhesive to each faying surface.

(b) Join faying surfaces in proper alignment and maintain only sufficient pressure to allow intimate contact.

(c) Allow to cure undisturbed for seven days at room temperature, or one hour at 175 to 200 degrees Fahrenheit (79.5°C to 93.4°C), or fifteen minutes at 300 to 350 degrees Fahrenheit (149.0°C to 176.8°C).

10. Metal-to-Metal Bonding High Peel Strength Applications

NOTE: The following procedures are to be used for bonds where temperatures are less than 300°F (148.9°C) and maximum peel strength of 20 pounds per inch (9.07 kg per 25.4 mm) of width is required.

A. Application of Adhesive

(1) Apply uniform coat of Dow Corning (No. 3145) adhesive 0.005 inch to 0.010 inch (0.127 to 0.254 mm) thick to both faying surfaces.

(2) Allow 5 to 10 minutes open time before assembling adhesive coated parts.

(3) Assemble parts with sufficient pressure to maintain contact without causing excessive squeezout. Maintain contact with tape or other mechanical means.

(4) Allow assembly to cure undisturbed for 3 hours; however, maximum adhesion is obtained after 24 hours.

(5) Cure may be accelerated by adding one-half of one percent of distilled water (2 drops of water to 0.35 ounce (10 grams) of adhesive) and mixing for 5 minutes before application.

NOTE: Dow Corning (No. 3145) cures under atmospheric conditions of 70°F (21.1°C) and humidity of 20 percent or more. Less humidity will slow cure.

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11. Cementing Rubber

A. Surface Preparation

(1) When practical, roughen faying surface of rubber or rubberized material with medium grit sandpaper. Use wire brush on rind (hard skin) faying surface of sponge rubber to roughen surface and remove talc.

WARNING: SOLVENT IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN SOLVENT IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

(2) Clean the rubber thoroughly by wiping with clean cloth dampened with Toluene. Allow to dry until odor of Toluene is gone, approximately 30 minutes.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

(3) Roughen laminated plastic or wood surfaces with No. 180 grit sandpaper. Clean surfaces by wiping with clean cloth dampened with hand wipe cleaner and wipe dry.

(4) Clean glass faying surfaces by wiping with clean cloth dampened with isopropyl alcohol or acrylic window cleaner. Wipe dry with a clean dry outing flannel cloth.

(5) Clean all bare metal surfaces with a clean cotton cloth dampened with hand wipe cleaner. Wipe dry with a clean dry cloth.

(6) Strip all primer, lacquer, or enamel from faying surfaces by wiping with clean cloth dampened with hand wipe cleaner, and wipe dry.

NOTE: FR primer need not be removed.

(7) Clean FR primer surface by wiping with clean cloth dampened with Toluene, and wipe dry before solvent evaporates.

B. Cement Neoprene Rubber, Using EC-1711 Adhesive

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WARNING: ADHESIVE PRIMER IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, AN IRRITANT, AND AN ASPHYXIANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ADHESIVE PRIMER IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ADHESIVE PRIMER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Apply brush coat of Bostik 1007 adhesive primer to all prepared metal, glass, laminated plastic, or wood faying surfaces. Allow to dry until tack free, approximately 45 minutes.

NOTE: Adhesive primer should not be applied to rubber or rubberized material.

(2) Apply uniform brush coat of EC-1711 adhesive to both faying surfaces. Allow to dry until tack free.

(3) Carefully position and join faying surfaces using maximum hand pressure or hard roller.

NOTE: EC-1711 adhesive may be allowed to dry completely and reactivated by wiping one faying surface with a cloth dampened with toluene.

C. Cement Hypalon Rubber, Syn. Light Stable (45-55)

WARNING: ADHESIVE IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

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(WARNING PRECEDES)

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(1) Mix 100 parts, by weight, of Pro-Seal 501 cement with 30 parts, by weight, of Pro-Seal 501A accelerator in clean glass or metal container. Mix thoroughly for 5 minutes. Do not use high-speed agitation and avoid absorbent containers such as paper cups.

NOTE: The mixed adhesive must be applied immediately after mixing since pot life for Pro-Seal 501 is approximately 1/2 hour at 25°C (77°F).

(2) Apply coat of adhesive approximately 5 to 10 mils (0.127 to 0.254 mm) thick to each faying surface.

(3) Position faying surfaces and join, using only sufficient pressure to allow intimate contact.

(4) Allow to cure undisturbed for minimum of 72 hours at 21°C (70°F) to cure for 24 hours at 54°C (130°F).

D. Cement Hypalon Rubber, Syn. Light Stable (65-75)

WARNING: NEOPRENE CONTACT ADHESIVE IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN NEOPRENE CONTACT ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET NEOPRENE CONTACT ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Apply uniform brush coat of #N-134 adhesive to both faying surfaces and allow to dry until tacky.

(2) Carefully position surfaces and join, using maximum hand pressure or hard roller pressure.

(3) Exercise caution when handling parts for first 8 hours.

E. Cement Butyl Rubber

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WARNING: SILICONE PRIMER IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS LISTED BELOW WHEN SILICONE PRIMER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE PRIMER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Apply uniform brush coat of RTV-1200 adhesive primer. Allow to air dry for 30 minutes.

WARNING: SILICONE RUBBER ADHESIVE IS AN AGENT THAT IS EXPLOSIVE, FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN SILICONE RUBBER ADHESIVE IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE RUBBER ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(2) Mix adhesive by adding 1 part, by weight, of SRC-18 catalyst to 100 parts, by weight, of SR-529. Mix thoroughly in clean glass or metal container until mixture is of uniform viscosity. Do not mix more than can be used in 2-hour period.

(3) Apply smooth uniform brush coat of mixed adhesive mixture to both faying surfaces and allow to air dry for 60 minutes.

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(4) Join faying surface using firm hand pressure or roller.

NOTE: Cemented parts may be handled after curing for 8 hours; however, maximum bond strength is not obtained for 7 days.

F. Cement Silicone Rubber

NOTE: Use this method only in areas that are not exposed to engine oil or jet engine oil fluids.

(1) Cement With Silastic 732 Adhesive

NOTE: Silastic 732 is a one part air cure adhesive which has no initial tack; therefore, parts that will not stay in place and ensure a 0.005-inch to 0.015-inch (0.127 to 0.381 mm) glue line must be held together during the cure period with fasteners and clamps. This adhesive is satisfactory for temperatures up 149°C (300°F) and for short periods, as high as 260° (500°F).

(a) Apply uniform coat of Silastic 732, 0.005 inch to 0.010 inch (0.127 to 0.254 mm) thick to both faying surfaces.

(b) Allow 5 to 10 minutes open time before assembling adhesive coated parts.

(c) Assembly parts with sufficient pressure to maintain con-tact without causing excessive squeezout. Fabricated parts may be handled after 3 hours; however, maximum adhesion is obtained after approximately 24 hours.

(d) Cure may be accelerated by adding one-half of one percent of distilled water (2 drops of water to 10 grams of adhesive) and mixing for 5 minutes before applying.

NOTE: This adhesive will cure under atmospheric conditions of 21°C (70°F) and humidity of 20 percent or more.

(2) Repair Silicone Door and Hatch Seals

NOTE: This procedure covers the repair of small tears or punctures in door and hatch seals fabricated from silicone rubber knit reinforced. Whenever possible, the patch should be on the pressure side of seal.

WARNING: ETHYL ALCOHOL IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, AND POISONOUS. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN ETHYL ALCOHOL IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ETHYL ALCOHOL IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

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(WARNING PRECEDES)

(a) Wipe area around puncture or tear with clean cotton cloth dampened with denatured ethyl alcohol.

(b) Sand area lightly to at least one-half inch on all sides of defect. Use medium grit sandpaper.

(c) Wipe area sanded with clean cotton cloth dampened with denatured ethyl alcohol and allow to thoroughly dry.

(d) Prepare patch from dacron treated fabric No. 4756. Allow minimum of one-half inch of material on all sides of defect.

NOTE: The seals and the patch will stretch in one direction only. The patch must be shaped to stretch in the same direction as the seal.

(e) Apply uniform coat of Silastic 732, 0.005 inch to 0.010 inch thick (0.127 to 0.254 mm), to patch, and force adhesive into puncture or tear.

(f) Wait 5 to 10 minutes before proceeding with next step.

(g) Apply patch to seal or gasket.

NOTE: Make certain that the patch is installed so that it will stretch in the same direction as the gasket or seal.

NOTE: To accelerate the cure, refer to step (1)(d).

(h) Because there is very little weight involved, it should not be necessary to clamp patch in place. Repaired part may be handled in 3 hours. Maximum adhesion will be obtained after 24 hours.

(3) Cement Silicone Rubber, Using SR-529 Adhesive and SRC-18 Catalyst

NOTE: This procedure, although taking longer to cure, may be desirable under certain conditions. Silicone SR-529 adhesive is a two-part adhesive which has initial tack; therefore, parts may not require fasteners or clamps. Do not use where temperatures exceed 93.3°C (200°F).

WARNING: SILICONE RUBBER ADHESIVE IS AN AGENT THAT IS EXPLOSIVE, FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN SILICONE RUBBER ADHESIVE IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE RUBBER ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

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(WARNING PRECEDES)

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(a) To 100 parts, by weight, of SR-529 add 1 part, by weight, of SRC-18 catalyst. Do not mix more material than will be used in 2-hour period.

(b) Mix thoroughly in glass or metal container until mixture is of uniform viscosity.

(c) Apply smooth uniform brush coat of mixed SR-529 adhesive to both faying surfaces and allow to dry until tacky, approximately 45 minutes.

(d) Join faying surfaces using firm hand pressure or roller.

(e) When parts must be slid into position, allow adhesive to dry until tack free, approximately 45 to 60 minutes. Apply light brush coat of mixed adhesive to one of previously coated surfaces and slide parts into position.

(f) Cemented parts may be handled after 8 hours or 4 hours at 54.4°C (130°F); however, maximum bond strength is not obtained for 7 days.

WARNING: FLUOROSILICONE SEALANT ADHESIVE IS AN AGENT THAT IS POISONOUS, CARCINOGENIC, A SENSITIZER, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN FLUOROSILICONE SEALANT ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET FLUOROSILICONE SEALANT ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(4) Cementing fluorosilicone rubber, using RTV-730 adhesive.

NOTE: RTV-730 adhesive is a one part adhesive with a low initial tack; therefore, parts may require fasteners or clamps during cure period. This adhesive is satisfactory for temperatures up to 204.4°C (400°F) and for short periods, as high as 260°C (500°F).

(a) Apply a uniform coat of the mixed adhesive to the faying surface of both parts.

(b) Allow five minutes open time and then assemble the parts with sufficient pressure to maintain contact without causing excessive adhesive squeeze-out.

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(c) Allow assembled parts to cure at room temperature for 24 hours. A full cure is obtained in seven days.

12. Cementing Velcro Tape

A. Surface Preparation

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

(1) Strip organic coatings from metal faying surfaces by wiping with clean cotton cloth dampened with hand wipe cleaner, and wipe dry with clean, dry, cotton cloth. FR primer need not be removed.

(2) Roughen faying surface of silicone rubber, silicone sponge rubber (hard skin), silicone rubber coated fabric, phenolic or reinforced plastic part by lightly sanding with medium grit sandpaper. Remove all surface gloss.

WARNING: CLEANING OPERATIONS USING SOLVENTS SHOULD BE PERFORMED IN A WELL-VENTILATED ATMOSPHERE. EXERCISE NORMAL SAFETY PRECAUTIONS DURING USE.

(3) Clean roughened silicone rubber, phenolic or reinforced plastic, papreg covered plywood, bare metal and FR primed faying surface by wiping with clean cotton cloth dampened with hand wipe cleaner, and wipe dry with clean, dry, cotton cloth.

(4) Clean wood faying surface by lightly sanding with medium grit sandpaper and wiping dust free with clean, dry cotton cloth.

WARNING: ADHESIVE PRIMER IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, AN IRRITANT, AND AN ASPHYXIANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ADHESIVE PRIMER IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ADHESIVE PRIMER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

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(5) Apply uniform brush coat of Bostik 1007 adhesive primer to cleaned bare or painted metal, phenolic, reinforced plastic or papreg plywood faying surface and allow to air dry at least 45 minutes.

B. Cementing Velcro Tape to Metal, Polyurethane Foam, Phenolics, Reinforced Plastics, Papreg Covered Plywood, and Wood

(1) Apply uniform brush coat of adhesive (A1694B) to both faying surfaces.

(2) Allow to air dry until adhesive has turned from white to clear in color, approximately 30 minutes.

(3) If required to ensure complete coverage of velcro tape, apply a second brush coat of adhesive to velcro tape and allow to air dry, approximately 30 minutes.

(4) Join faying surfaces with firm hand or clamp pressure. Make certain sufficient pressure is applied to complete contact between faying surfaces.

NOTE: Firm application of pressure assures better adhesive contact and improves bond strength.

(5) Allow assembled parts to air dry 24 hours before handling.

C. Cementing Velcro Tape to Silicone Rubber

(1) Apply a smooth coat 5 to 10 mils (0.127 to 0.254 mm) thick of silicone adhesive/sealant (Silastic 732) to both faying surfaces.

(2) Allow adhesive to air dry until tack-free, within 20 minutes.

(3) Join faying surfaces using sufficient pressure to maintain contact without causing excessive adhesive squeeze-out.

(4) Secure the parts together with masking tape, weights or temporary fastening devices during the initial cure period.

(5) Allow assembled parts to air dry at least 8 hours before handling. A full cure is obtained in seven days.

13. Cementing Laminated Plastics

A. General Types of Bonding

(1) Use Type I bonding for holding small parts in position, when weight of part only is supported. Do not use where there is an additional load on bond, or where bond will be subjected to temperatures in excess of 180°F (82.2°C).

(2) Use Type II bonding for higher strength bonds where peeling forces are involved, approximately 20 pounds per inch (9.07 kg per 25.4 mm) of width.

(3) Use Type III bonding for higher strength bonds where no peeling forces are involved. Do not use for temperatures above 200°F (93°C).

B. Surface Preparation for All Types of Bonding

(1) Roughen faying surfaces of plastic laminates with medium-grit sandpaper, until all surface gloss is removed. Pre-clean faying surfaces of plastic or metal as described inParagraph 3..

C. Application of Type I Bonding

(1) Apply double coated adhesive foam tape (#4920) or adhesive transfer tape (Scotch 468 or 9568) to the faying surface of the small part.

(2) Trim the tape so edges are not exposed when the part is bonded.

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(3) Remove the tape liner and join the faying surfaces with firm, hard hand or clamp pressure.

NOTE: Firm application of pressure assures better adhesive contact and improves bond strength.

D. Application of Type II Bonding

WARNING: INTEGRAL FUEL TANKS SEALING COMPOUND (POLYSULFIDE SEALANT B1/2 AND B2) IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN INTEGRAL FUEL TANKS SEALING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET INTEGRAL FUEL TANKS SEALING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Add 1 part, by weight, of accelerator to 7.5 parts, by weight, of PR-1422B-2 sealing compound and mix thoroughly.

(2) Apply thin film of mixed PR-1422B-2 mixture, approximately 5 to 10 mils, (0.127 to 0.254 mm) to each surface. Use spatula.

(3) Join faying surfaces in proper alignment and maintain only sufficient pressure to allow close contact.

(4) Allow assembly to cure undisturbed for minimum of 72 hours at 70°F (21.1°C) minimum temperature. If faster cure is desired, cure for 1 hour at 70°F (21.1°C), then cure for 8 hours at 145°F (62.8°C).

E. Application of Type III Bonding (Thick Adhesive)

WARNING: EPOXY ADHESIVE IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN EPOXY ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET EPOXY ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(1) Mix 7 parts, by weight, of C-14B hardener with 100 parts, by weight, of C-14 adhesive in clean glass or metal container until mass is of uniform viscosity.

NOTE: If a higher viscosity is desired adhesive may be thickened by adding a maximum of 5 parts, by weight, of CAB-O-SIL FILLER to 100 parts, by weight of adhesive.

(2) Mix adhesive in clean glass or metal container until mass is of uniform viscosity. Do not use high-speed agitation and avoid absorbent containers such as paper cups. Maximum quantity to be mixed must be established, keeping in mind surface area involved and short pot life of mixed material. Pot life is 30 to 40 minutes at 25°C (77°F).

(3) Apply thin coat, approximately 5 to 10 mils, (0.127 to 0.254 mm) of mixed adhesive to each faying surface. Spread with spatula, glue spreader, or tool best suited to particular surface.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

(4) Clean up excess adhesive with clean cloth dampened with hand wipe cleaner.

(5) Immediately assemble parts in proper alignment and apply sufficient pressure to allow close contact. Do not apply high-pressure.

(6) Allow to air dry for 5 to 6 hours before handling. Maximum bond strength is attained in 24 hours. If faster cure is desired, cure at 82.2° to 98.9°C (180° to 210°F) for 45 minutes.

F. Application of Type IV Bonding

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WARNING: EPOXY ADHESIVE IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN EPOXY ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET EPOXY ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(1) Mix 100 parts, by weight, of EC-2216B accelerator to 140 parts by weight, of EC-2216A adhesive in clean glass or metal container until mass is of uniform viscosity. Pot life of mixed adhesive is approximately 2 hours.

(2) Apply thin coat of mixed adhesive to each faying surface and spread with spatula, glue spreader, or roller.

(3) Assemble parts in proper alignment immediately and apply sufficient pressure to allow close contact.

(4) Allow assembled parts to cure at room temperature for 24 hours. If faster cure is desired, cure for 1 hour at room temperature, then cure for 45 minutes at 185° to 215°F (85° to 101.7°C).

14. Cementing Plastic Foams

A. Cementing Polyvinyl Chloride and Vinyl Nitril Foams to Themselves, Bare or Primed Metal, Molded Plastics, and Plastic Laminates.

(1) Dry scuff sand-molded plastic and glass fiber plastic laminates, using medium grit sandpaper. Wipe off residue. Wipe sanded surface with clean cotton cloth dampened with Douglas No. 2 solvent, followed by wiping with a clean cloth dampened with isopropyl alcohol. Wipe dry with clean cotton cloth.

NOTE: All traces of mold release must be removed or subsequent adhesion will be impaired.

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WARNING: P-D-680 TYPE 1 SOLVENT IS AN AGENT THAT IS FLAMMABLE AND POISONOUS. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN P-D-680 TYPE 1 SOLVENT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET P-D-680 TYPE 1 SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: ISOPROPYL ALCOHOL IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN ISOPROPYL ALCOHOL IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ISOPROPYL ALCOHOL IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(2) Wipe all metal faying surfaces with clean cotton cloth dampened with Douglas No. 2 solvent, followed by wiping with a clean cloth dampened with isopropyl alcohol. Wipe dry with clean cotton cloth.

(3) Apply brush coat of Swift 18082 adhesive to both faying surfaces.

(4) Allow to dry until tacky (approximately 3 minutes).

(5) Join faying surfaces with hand pressure.

(6) Dry at least 8 hours before subjecting to severe handling.

15. Cementing Metallic Nameplates

A. Surface Preparation

(1) Form nameplates to contoured surfaces before cementing.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

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(WARNING PRECEDES)

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

(2) Strip all paint and primer from faying surfaces with clean cotton cloth dampened with hand wipe cleaner. Special care should be taken to protect face of nameplate during stripping operation. FR primer or FR topcoat need not be stripped.

(3) Wipe faying surfaces with clean cotton cloth dampened with hand wipe cleaner, immediately wipe dry with a clean cotton cloth. Follow with hand wipe cleaner, and again wipe dry with clean cotton cloth.

(4) Roughen faying surfaces of fiber glass laminate using medium grit sandpaper.

(5) Clean fiberglass laminate thoroughly by wiping with clean cotton cloth dampened with hand wipe cleaner. Wipe dry with clean, dry, cotton cloth.

(6) Mask with masking tape around area where nameplate is to be placed allowing border of one-sixteenth of one-eight inch beyond the size of the nameplate.

(7) On cadmium-plated parts, except ultra-high heat-treated parts, apply pre-treatment coating as described in Paragraph 17..

B. General Purpose Application (Temperature Range -53.9° to 121.1°C (-65° to 250°F))

WARNING: ADHESIVE IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(1) Mix 100 parts of 501 adhesive to 30 parts 501A accelerator, by weight, in glass or metal container.

(2) Apply medium coat of mixed sealant (approximately 0.010 inch thick) to both faying surfaces, using spatula.

(3) Join coated surfaces and apply sufficient pressure to squeeze out sealant in small fillet around all edges of nameplate. Remove as much of squeezed-out material as possible with clean cloth.

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(4) Allow assembly to air cure for 24 hours minimum.

NOTE: Do not handle assembly while curing by either method unless nameplate is securely held in place by tape.

C. Skydrol Resistant Application Temperature Range -53.9° to 232.2°C (-65° to 450°F)

WARNING: SILICONE PRIMER IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS LISTED BELOW WHEN SILICONE PRIMER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE PRIMER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(1) Apply brush coat of silicone 1200 primer to surface and allow to dry for 30 minutes.

WARNING: SILICONE RTV IS AN AGENT THAT IS POISONOUS, CARCINOGENIC, CORROSIVE, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN SILICONE RTV IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE RTV IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(2) Mix 10 parts, by weight, of RTV-9910 catalyst to 100 parts, by weight, of RTV-88 adhesive in glass or metal container.

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(3) Apply uniform coat of mixed adhesive (approximately 0.010 inch (0.25 mm) thick) to both surfaces using spatula.

(4) Join coated surfaces and apply sufficient pressure to squeeze out adhesive around edges.

(5) Remove excess adhesive leaving small fillet.

(6) Allow to air-cure for approximately 24 hours.

D. Metallic Nameplates to Vinyl Foam Temperature Range -53.9° to 121.1°C (-65° to 250°F)

(1) Apply adhesive transfer tape (Scotch 468 or 9568) to either faying surface.

(2) Trim tape so edges are not exposed when foam is bonded.

(3) Remove tape liner and join faying surfaces with firm hand or clamp pressure. Press firmly around edges so that moisture cannot penetrate.

(4) Do not handle parts within one hour after joining.

NOTE: Firm application of pressure assures better adhesive contact and improves bond strength.

(5) Cure time may be accelerated by applying heat of 60°C (140°F) for 40 minutes.

NOTE: Assembled parts should not be handled during cure time or during cooling period.

E. Adhesive and Strap Application - Skydrol Resistant, Temperature Range -53.9° to 232.2°C (-65° to 450°F)

WARNING: SILICONE PRIMER IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS LISTED BELOW WHEN SILICONE PRIMER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE PRIMER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(1) Apply brush coat of silicone 1200 primer to surface and allow to dry for a minimum of 30 minutes before applying adhesive.

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WARNING: SILICONE RTV IS AN AGENT THAT IS POISONOUS, CARCINOGENIC, CORROSIVE, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN SILICONE RTV IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE RTV IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(2) Mix 10 parts, by weight, of RTV-9910 catalyst to 100 parts, by weight, of RTV-88 adhesive in glass or metal container.

(3) Apply uniform coat of mixed adhesive (approximately 0.010 inch (0.25 mm) thick) to both surfaces using spatula.

(4) Cut strap to length required from 0.020 x 3/16 inch (0.51 x 4.76 mm) coil. Apply adhesive per steps 1, 2, and 3.

(5) Insert ends of strap into slots provided on nameplate, fold ends back 180° and cut off at outer edge of nameplate.

NOTE: There should be no voids between adhesive and name-plate or strap and mating surface.

16. Cementing Nylon

NOTE: The following procedures are to be used for cementing Nylon parts to each other, or Nylon parts to metal or plastic laminates.

A. Surface Preparation

(1) Roughen faying surfaces with sandpaper (No. 320 grit) until surface gloss is removed.

WARNING: P-D-680 TYPE 1 SOLVENT IS AN AGENT THAT IS FLAMMABLE AND POISONOUS. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN P-D-680 TYPE 1 SOLVENT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET P-D-680 TYPE 1 SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: ISOPROPYL ALCOHOL IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN ISOPROPYL ALCOHOL IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ISOPROPYL ALCOHOL IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(2) Wipe surfaces thoroughly with clean, white, cotton cloth dampened with solvent (Douglas No. 2, or equivalent); followed by a clean wiper dampened with isopropyl alcohol to remove Douglas #2 residue. Dry surfaces immediately with a clean cotton cloth.

(3) Remove grease and/or dirt from metal surfaces with clean, cotton cloth dampened with solvent Douglas No. 2; or equivalent; followed by a clean wiper dampened with isopropyl alcohol to remove Douglas #2 residue. Dry metal surfaces immediately with clean, cotton cloth.

B. Application of Type I Bonding

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

WARNING: URETHANE ADHESIVE IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN URETHANE ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET URETHANE ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

(1) Add 60 parts by weight of adhesive (Uralane 5774, part B) to 100 parts by weight of adhesive (Uralane 5774, part A); mix adhesive in a nonabsorbent container (glass, metal, or polyethylene coated paper) until mass attains a uniform color and viscosity.

NOTE: The pot life of mixed adhesive (approximately 100 grams) is 1 1/2 hours at room temperature 70° to 80°F (21.1°C to 26.7°C).

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(2) Apply approximately 3 to 10 mils (0.076 to 0.254 mm) of mixed adhesive to each faying surface; join faying surfaces in proper alignment and maintain sufficient pressure to allow intimate contact.

(3) Cure adhesive at room temperature (21.1° to 26.7°C (70° to 80°F)) for 24 hours, or at 60° to 71.1°C (140° to 160°F) for 2 to 3 hours.

(4) Cured adhesive color is yellow-white.

C. Application of Type III Bonding

WARNING: EPOXY ADHESIVE IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN EPOXY ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET EPOXY ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(1) Add 100 parts by weight of adhesive (EC-2216B) to 140 parts by weight of adhesive (EC-2216A).

(2) Mix adhesive in a nonabsorbent container (glass, metal, or polyethylene coated paper) until mass attains a uniform color and viscosity.

NOTE: The pot life of the mixed adhesive is 1/2 hours at room temperature (21.1° to 26.7°C (70° to 80°F)).

(3) Apply approximately 3 to 10 mils (0.076 to 0.254 mm) of mixed adhesive to each faying surface.

(4) Join faying surfaces in proper alignment and maintain sufficient pressure to allow intimate contact.

(5) Cure adhesive at room temperature (21.1° to 26.7°C (70° to 80°F)) for 24 hours, or at 60° to 71.1°C (140° to 160°F) for 2 to 3 hours.

(6) Cured adhesive color is dark grey.

D. Application of Type IV Bonding

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(1) Apply adhesive film FM123-2 to bond surfaces.

NOTE: The adhesive film may be heat tacked to details using heat irons with Teflon separator sheets, or heat tables. During heat tacking, the allowable temperature of the heat-tack table shall not exceed 110°C (230°F), and exposure to heat should not exceed 1 minute.

(2) Control adhesive film application as follows:

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1588, SOLVENT/MPK BLEND (DMS QPL 2458)

HAZMAT 1000, REFER TO MSDS

(a) Keep Teflon separator sheets free of contaminants by wiping with MPK Blend Solvent, DMS 2458 at least once each 8-hour period, or as frequently as necessary.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1588, SOLVENT/MPK BLEND (DMS QPL 2458)

HAZMAT 1000, REFER TO MSDS

(b) Keep table top areas which come in contact with adhesive film, free of contaminants by wiping with MPK Blend Solvent, DMS 2458.

(c) Make certain each bonded assembly contains adhesive film from one batch.

(d) After heat tacking film to detail part, trim excess film, leave sufficient film to take up any shrinkage.

(e) No more than 1/8-inch (3.175 mm) excess film should remain after curing.

(f) Avoid moving assembly, with applied film, from environment controlled area for more than 45 minutes before beginning of cure.

(g) Avoid contact of taped areas of details with untaped or unprimed areas of other details.

(3) Cure assemblies for 60 minutes minimum at 107.2° to 126.7°C (225° to 260°F); use adequate pressure to ensure satisfactory bond.

E. Application of Type V Bonding

(1) Apply adhesive transfer tape (Scotch 4920) to either faying surface.

(2) Trim tape so edges are not exposed when the part is bonded.

(3) Remove the tape liner and join faying surfaces with firm hand or clamp pressure.

(4) Do not handle parts within one hour after joining.

NOTE: Firm application of pressure assures better adhesive contact and improves bond strength.

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F. Application of Skydrol Resistant Bonding

NOTE: The following procedure is used for bonding Nylon grommets on the main and nose landing gearwheel well areas, and used generally in the empennage, wing rear spar area from the wing root outboard, and wing from spar in vicinity of the slot installation.

WARNING: ALUMINIZED NYLON COATING IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ALUMINIZED NYLON COATING IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ALUMINIZED NYLON COATING IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(1) Mix 100 parts by weight of Nylon coating (two part, clear, Chem-On 7707) with 6 parts by weight catalyst; shake vigorously. Allow mixture (Chem-on 7707) to stand for 15 minutes before use.

(2) Apply two brush coats of mixed Nylon coating (Chem-on 7707) over entire area within 4 hours after mixing; allow 1/8-inch (3.175 mm) overlap.

NOTE: Allow 30 minutes drying time between brush coats.

17. Cementing Felt to Itself, Metal, Plywood, Papreg-covered Plywood, and to Back Side of Glass or Plastic Mirror

A. Surface Preparation

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

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(WARNING PRECEDES)

(1) Roughen glass fiber laminates and wood surfaces with medium grit sandpaper. Glass fiber laminates shall be sanded removing all surface gloss, prior to cleaning with solvent. Wipe surface with clean wiper dampened with hand wipe cleaner, then wipe dry with clean, dry, white cotton cloth.

(2) Clean back side of glass or plastic mirrors by wiping with a clean dry wiper.

(3) When cementing felt to metal or papreg-covered plywood, clean bare or primed metal or papreg surface with clean cloth dampened with Douglas No. 2 solvent, followed by wiping with a clean cloth dampened with isopropyl alcohol. Follow immediately with clean, dry, cotton cloth wipe.

B. Applications Where Temperatures Do Not Exceed 160°F (71°C)

(1) Stir adhesive well before using.

WARNING: WATER BASE PRESSURE SENSITIVE ADHESIVE IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN WATER BASE PRESSURE SENSITIVE ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET WATER BASE PRESSURE SENSITIVE ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(2) Apply uniform brush coat of A1694B adhesive to both faying surfaces.

(3) Allow to dry until adhesive turns from white to opaque in color, approximately 30 minutes.

(4) If required, apply second brush coat.

(5) Allow to air dry until adhesive turns from white to opaque in color, approximately 30 minutes. Parts may be left open 1 hour prior to joining.

(6) Join faying surfaces with firm hand or roller pressure.

NOTE: On glass or plastic mirrors, apply uniform brush coat of A1694B adhesive to back side of mirror and apply felt while adhesive is still wet. Allow to dry approximately 2 hours before handling.

C. Applications for Temperatures up to 250°F (121°C) and Where Fuel and Oil Resistance is Required

(1) Apply uniform brush coat of N-134 adhesive to both faying surfaces.

(2) Allow to dry until tacky, approximately 5 minutes.

(3) Join faying surfaces with firm hand or roller pressure.

D. Applications for Slip-Positioning Felt

(1) Apply a uniform brush coat of #Wilhold Glue to both faying surfaces.

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(2) Join the faying surfaces and, if necessary, slip the felt into position while the adhesive is in a wet state.

(3) Apply contact pressure (3 to 5 psi) for 30 minutes at 70° to 85°F (21.1° to 29.4°C). Maintain pressure for 30 minutes.

(4) Allow to air dry for 24 hours before handling.

18. Cementing Leather to Itself, Metal, Fabric (All Vinyl-coated or Rubberized Felt, and Plywood

NOTE: Oil-tanned leather is not included. Oil-tanned leather should be attached mechanically whenever possible.

A. Surface Preparation

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

(1) Strip all paint and primer with hand wipe cleaner.

(2) Clean surfaces of metal by wiping with clean cotton cloth dampened with hand wipe cleaner, and wipe dry with clean, dry, cotton cloth.

(3) Wipe faying surface of metal with clean cotton cloth dampened with hand wipe cleaner, and wipe dry with clean, dry, cotton cloth before stripper evaporates.

(4) Scuff sand wood or plastic surfaces with medium grit sandpaper.

(5) Remove sanding dust and clean surfaces using clean cotton cloth dampened with hand wipe cleaner. Allow to air dry completely.

B. General Procedure

WARNING: ADHESIVE PRIMER IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, AN IRRITANT, AND AN ASPHYXIANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ADHESIVE PRIMER IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ADHESIVE PRIMER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

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TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Prime surfaces of wood, plastic, and metal with Bostik 1007 and allow to completely air dry before applying adhesive.

(2) Apply brush coat of E-154 adhesive to both faying surfaces and allow to completely air dry (approximately 30 minutes).

(3) Apply second brush coat to both faying surfaces.

(4) Allow to dry until tacky, approximately 15 minutes.

(5) Join faying surfaces with hand pressure or roller.

19. Cementing Mylar to Itself and to Metal

A. Surface Preparation

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

(1) Strip all lacquer, enamel, and primer from metal with hand wipe cleaner. FR primer does not have to be stripped.

(2) Wipe metal or FR primed faying surface with clean cotton cloth dampened with hand wipe cleaner, and wipe dry with clean, dry, cotton cloth.

CAUTION: MYLAR CLEANING OPERATION TENDS TO BUILD UP A STATIC CHARGE. OPEN SOLVENT CONTAINERS SHOULD BE KEPT AWAY FROM AREA.

(3) Wipe metal and Mylar faying surfaces with clean cotton cloth dampened with hand wipe cleaner, and wipe dry with a clean, dry, cotton cloth before stripper evaporates.

WARNING: ADHESIVE IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

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WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(4) To 100 parts, by weight, of Pro-Seal 501 adhesive, add 30 parts, by weight, of Pro-Seal 501A accelerator and mix thoroughly for 5 minutes. Mixed adhesive must be applied immediately after mixing. Mix adhesive only as needed. Working time for this material is approximately 30 minutes.

B. General Procedures

(1) Apply thin film of mixed adhesive to metal faying surface with spatula or spreader.

(2) Join faying surfaces and extrude any excess adhesive by means of plastic scraper.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

(3) Remove all excess adhesive with hand wipe cleaner before adhesive has cured.

(4) Allow to cure for 12 hours at 21.1°C (70°F). If faster cure is desired, cure at maximum temperature of 48.9°C (120°F) for 1 hour.

NOTE: Installation should be made when ambient temperature is between 15.6° and 32.2°C (60° to 90°F).

20. Cementing Textile Carpet, Wainscoting, and Tapestries

NOTE: For tapestry and wainscoting applications the adhesive chosen must meet applicable FAA flammability regulations. This may require that the same adhesive be used that was used when the aircraft was certified. Failure to use the same adhesive may result in non-compliance with FAA regulations. To verify adhesive use for a given aircraft contact the flammability Engineer with the aircraft carrier organization.

A. Surface Preparation

NOTE: The following procedure is used for cementing latex-backed carpet to bare or primed aluminum, papreg, and phenolic or polyester glass fiber material or laminate:

(1) Remove gloss from phenolic and glass fiber material or laminate surface with medium grit sandpaper and wipe with clean, dry, cotton cloth.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

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(WARNING PRECEDES)

(2) Clean bare of FR primed metal surfaces and sanded fiberglass surfaces with clean wiper dampened with hand wipe cleaner. Wipe dry with a clean, dry wiper.

B. Cementing Textile Carpet (Type 1)

(1) Apply Polyken No. 108 double-faced tape to floor.

(2) Position carpet over the area to be covered.

(3) Hold carpet taut and remove short sections of release liner at a time.

(4) Apply the carpet to the floor with firm pressure as release liner is removed.

C. Cement Wainscoting and Tapestries with Backcoating On Sidewalls and Partitions (Type 2, Class 1)

(1) Method 1 Application.

(a) Apply a uniform brush or roller coat of T-150A or N56107B adhesive to both faying surfaces.

(b) Allow to air dry for a minimum of 30 minutes.

(c) Apply a second coat of adhesive and allow to air dry until tacky.

(d) Trim the material with a sharp knife.

(e) Apply a fillet of adhesive (#Wilhold Glue) along all exposed edges of the material to prevent fraying.

(f) Allow adhesive to dry completely before handling.

(2) Method 2 application.

(a) Apply a uniform coat 8 to 10 mils of AMT Aquabind adhesive to one faying surface.

(b) Join the faying surfaces with firm hand pressure within 5 minutes of adhesive application.

(c) Trim the material with a sharp knife.

(d) Stabond N-56107B adhesive may be used along the edges of the material where required for extra tack, not to exceed one inch width.

D. Cement Wainscoting and Tapestries without Backcoating On Sidewalls and Partitions (Type 2, Class 2)

WARNING: ADHESIVE IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ADHESIVE IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: METHYL ETHYL KETONE IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN METHYL ETHYL KETONE IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET METHYL ETHYL KETONE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(1) Mix 1 part Stabond T-150A adhesive with 4 parts Methyl Ethyl Ketone (MEK) solvent by volume.

(2) Spray 4 to 6 passes (2 to 3 cross-coats) of the diluted adhesive on the faying surface.

NOTE: Sprayed carpet should be kept clean.

(3) Allow to air dry for a minimum of 1 hour or a maximum of 7 days before joining.

NOTE: Cobwebbing of the adhesive on the material is acceptable.

(4) Apply one brush coat T-150A of adhesive (undiluted) to the faying surface of the panel.

(5) Allow to air dry completely, a minimum of 30 minutes.

(6) Follow with a second brush coat of adhesive on the panel and allow to dry until tacky.

(7) Join the faying surfaces with firm hand pressure.

(8) Apply a fillet of adhesive (#Wilhold Glue) along all exposed edges of the material to prevent fraying.

21. Cementing Decorative Hard Floor Coverings

A. Install Hard Floor Coverings

(1) Apply pressure sensitive adhesive film (Scotch 428) to one faying surface by rolling it down with a rubber roller or using a plastic squeegee.

NOTE: Take care not to contaminate adhesive film during application.

(2) Remove release liner, and assemble faying surfaces together. Apply sufficient pressure to assure complete contact between faying surfaces.

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(3) Apply a fillet of #Pro-seal 735 adhesive in galley area and PR-1422 sealant in other areas to seal edges of faying surfaces. Avoid getting adhesive on the front face.

22. Installing Floor Patch

A. Patch called out in following procedure should be circular in shape and 2 1/2 inches (63.5 mm) in diameter. It should be made from .025 (0.64 mm)-clad sheet 2024-T3 or equivalent material. Edge of patch should be beveled so that when installed it will be flush with floor. This patch may be used to repair floor where a cleaned-out hole does not exceed a 1-inch (25.4 mm) diameter.

B. A Tinnerman washer may be used to patch a cleanout hole in floor that does not exceed a 3/8-inch (9.53 mm) diameter.

C. General Procedures

(1) Remove damaged area.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

(2) Wipe floor area to be patched and surface of patch with clean cotton cloth dampened with hand wipe cleaner.

WARNING: EPOXY ADHESIVE IS AN AGENT THAT IS POISONOUS, CORROSIVE, A SENSITIZER, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN EPOXY ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET EPOXY ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

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(WARNING PRECEDES)

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(3) Using clean glass or metal container as receptacle, add 74 parts, by weight, LM-52 activator to 100 parts, by weight, Lefkoweld 109NA and mix thoroughly until mass has uniform viscosity. (Epibond H-1337-A epoxy adhesive and resin HN9615A activator may be used as substitute for Lefkoweld 109NA with LM-52 activator.)

(4) Apply thin coat of freshly mixed adhesive to bare surface of metal patch and press firmly into place on damaged area.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

(5) Wipe off excess adhesive with clean cotton cloth dampened with hand wipe cleaner.

(6) Apply thin coat of 1200 primer to metal patch and to area at least 2 inches (50.8 mm) beyond edge of patch and allow primer to dry minimum of 30 minutes.

(7) Cut circular patch of Mylar sheet, 2 inches (50.8 mm) larger in diameter than metal patch.

(8) Wipe Mylar patch with clean cotton cloth dampened with hand wipe cleaner.

WARNING: ADHESIVE IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

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(WARNING PRECEDES)

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(9) Using clean glass or metal container as receptacle, add 30 parts, by weight, Pro-Seal 501A accelerator to 100 parts, by weight, Pro-Seal 501 and mix thoroughly for 5 minutes.

(10) Apply film of mixed Pro-Seal adhesive to patch area and to area 1 inch (25.4 mm) beyond edge of patch.

(11) Center Mylar patch and press firmly into place.

(12) Using plastic scraper, extrude any excess adhesive.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

(13) While adhesive is still in soluble condition, remove excess adhesive with handwipe cleaner.

(14) Permit patch adhesives to cure for minimum of 12 hours at 70°F (21.1°C).

NOTE: A faster curing time may be obtained by applying 120°F (48.9°C) heat for 2 hours.

(15) When Tinnerman washer is used to patch small holes, perform Paragraph 22.C.(7) through Paragraph 22.C.(15).

(16) When areas are to be covered with Mylar corrosion shield, perform Paragraph 22.C.(1) through Paragraph 22.C.(6).

23. Cementing Interior Decorative Materials

A. The following instructions cover the use of adhesives for applying interior decorative materials. The method of application will depend on the type of material being applied, the area being covered in a single operation, and the type of surface to be covered. The following list of materials are given with the adhesive and primer to be used as applicable.

NOTE: For tapestry, wainscoting, and decorative laminate applications the adhesive chosen must meet applicable FAA Flammability Regulations. This may require the use of the same adhesive that was used when the aircraft was certified. Failure to use the same adhesive may result in non-compliance with FAA regulations. To verify which adhesive should be used for a given aircraft contact the Flammability Engineer within the aircraft carrier organization.

Table 202

	MATERIALS	PRIMER	ADHESIVE
Floor Coverings	Textile Carpet		Polyken 108 tape
	Loncoin	PR-1422 for edge sealing in galley area. Pro-seal 735 for edge sealing in all other areas.	Scotch 428

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Table 202 (Continued)

	MATERIALS	PRIMER	ADHESIVE
	Abskyn	Douglas #22	N-134 or EC-2216A/B
	Durug	PR-1422 for edge sealing in galley area. Pro-seal 735 for edge sealing in all other areas.	Scotch 428
Carpet/Tapestry for Sidewalls and Partitions	Wainscoting/Tapestries with Backcoating		T-150A or N56107B
	Wainscoting/Tapestries without Backcoating		Amt Aquabind
Plastics	Parkwood		N-134
	Formica		N-134
	Textolite		N-134
Vinyl Materials	Aertrim		N-134
	Duratrim		N-134
	Durashade		N-134
	Terson	Bostik 1007	N-134
Vinyl Decorative Laminates (Polyplastex)	Panlam	E&H 1261	HAA-1990 or PPF-2272
	Panlam	Douglas #22	N-134
	Panflex		N-134
	Pancove		N-134
	Panskyn		N-134
	Leather	Bostik 1007	E-154
	Naughahyde		N-134
Decorative Laminates			
NOTE: These decorative laminates meet FAA heat release and smoke generation requirements.			
Formable	Aerlam LHR	E&H 1261	HA211
	Aerfilm LHR	E&H 1261	HA211
	FX6	E&H 1261	HAA-1990
Rigid	Panlam 3000 (meets heat release of 100/100 only)	E&H 1261	PFF-2272
	Aerglas LHR1		N-134
	GX6		N-134
	Rigidtrim - RH		N-134

B. General Instructions

(1) Adhesive containers should be tightly covered when not in use to prevent loss of solvent and contamination. Use as small a container as practical.

(2) Stir adhesive well before using. Adhesives shall not be thinned.

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(3) Use new brushes for each application. Reclaimed or shop-cleaned glue brushes should not be used for applying adhesives. A brush that has been used for one type of adhesive should not be used for different type.

(4) Spray equipment, after being used with adhesives, should be thoroughly cleaned as follows:

WARNING: SOLVENT IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN SOLVENT IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(a) Flush hoses and glue pot with Douglas #64 solvent.

(b) Rinse thoroughly with Douglas #64.

(5) Prepare surfaces for cementing as outlined in paragraph Paragraph 23.C..

CAUTION: APPLICATION OF ADHESIVES AND SOLVENT REACTIVATION SHOULD BE ACCOMPLISHED IN A WELL-VENTILATED AREA. THERE SHALL BE NO SMOKING WHILE ANY OF THESE OPERATIONS ARE IN PROGRESS.

(6) Unless otherwise specified, application of adhesives and procedures are based on minimum temperature of 65°F (18.3°C).

NOTE: Drying times of adhesives can be accelerated by means of bank of infrared heat lamps, or, if practicable, in drying oven. Temperatures should not exceed 130°F (54.4°C).

Drying times of polyplastic materials with water based adhesives such as TF-223N, or 604LT require 6 hours at 100° to 120°F (37.8°C to 48.9°C) at a maximum relative humidity of 30 percent.

(7) Use hard rubber roller when laying down cemented fabrics. Square-end metal roller will leave ridges on surfaces of vinyl fabrics.

(8) To remove air bubbles trapped in adhesive layer under vinyl fabrics, proceed as follows:

(a) Puncture bubble with sharp pin.

(b) Work down bubble from edges toward puncture to remove all air or gas.

(c) Heat locally, using heat gun or infrared heat lamp. Use caution during this operation and do not heat above 130°F (54.5°C).

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(d) Roll down immediately using hard rubber roller or rub with a dry wiper being careful not to distort fabric.

(9) Remove immediately any adhesive spilled on decorative surfaces as follows:

(a) Remove wet adhesive with clean white cotton cloth dampened (not dripping) with Douglas No. 2 solvent, followed by wiping with a clean cloth dampened with isopropyl alcohol. Rub surface gently to remove adhesive, turning cloth frequently.

NOTE: To minimize adhesive spillage onto decorative, decorative may be protected with masking tape.

C. Surface Preparation

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

WARNING: SOLVENT IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN SOLVENT IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(1) Remove all lacquer, enamel and primer except FR primer from faying surface with clean cotton cloth using hand wipe cleaner, or Douglas #64 solvent.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

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HAZMAT 1000, REFER TO MSDS

(2) Clean all bare aluminum with clean cotton cloth dampened with hand wipe cleaner. Allow to dry completely. Follow immediately with clean cloth dampened with hand wipe cleaner. Wipe dry with clean dry cloth before stripper dries.

(3) Clean papreg-covered plywood and sealed wood surfaces with clean white cotton cloth dampened with Douglas No. 2 solvent, followed by wiping with a clean cloth dampened with isopropyl alcohol. Wipe dry with clean cloth.

(4) Remove all surface gloss from phenolic and polyester or epoxy laminate surfaces by sanding with medium grit sandpaper or by lightly sandblasting. Wipe surface with clean white cotton cloth dampened with Douglas No. 2 solvent after sanding. Follow by using isopropyl alcohol to remove solvent residue. Wipe dry with clean dry cloth.

(5) Remove all foreign matter such as dirt particles, metal and wood shavings, and loose thread from fabric backing with stiff brush or vacuum cleaner, prior to applying adhesive.

(6) Clean vinyl backing and metal, wood or plastic surfaces with clean white cotton cloth dampened with Douglas No. 2 solvent, followed by wiping with a clean cloth dampened with isopropyl alcohol. Wipe dry with clean dry cloth.

(7) Where required, prime or seal surfaces as follows:

WARNING: ADHESIVE PRIMER IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, AN IRRITANT, AND AN ASPHYXIANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ADHESIVE PRIMER IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ADHESIVE PRIMER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(a) Apply uniform brush coat of Bostik 1007 adhesive primer to primed aluminum surfaces. Allow adhesive primer to dry 30 minutes prior to applying adhesive.

(b) Seal wood or other porous surface with shellac thinned with 50 percent, by volume, of methyl alcohol. Apply one coat and allow to dry 8 hours before applying adhesive.

(c) Prime all metal and vinyl surfaces with thin brush coat of thinned Douglas #22 adhesive. Allow to dry completely, at least 3/4 hour.

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(d) Prime panels to be covered with decorative laminates using heat activated film adhesives with a brush coat of E&H 1261. Air dry panels at room temperature for a minimum of 8 hours or at 160(±15)°F (71.1(±-9.4°)C) for a minimum of 4 hours.

D. Cementing Procedures

(1) N-134 Adhesive

(a) Apply smooth uniform brush coat to both faying surfaces.

(b) Allow to dry until tacky.

(c) Apply second brush coat to both surfaces.

(d) Allow to dry until tacky, 15 to 20 minutes.

(e) Join surfaces with firm hand or clamp pressure.

NOTE: For rigid decorative laminates (Aerglas LHR1, GX6, and Rigidtrim - RH) apply only one uniform brush coat to both faying surfaces.

(2) E-154 Adhesive

(a) Apply two smooth uniform brush coats of adhesive to both faying surfaces, allowing at least 30 minutes between coats.

(b) Allow to air dry until tacky.

(c) Join faying surfaces with firm hand pressure or leather working tool.

(3) #2216B/A Scotch-Weld Epoxy

WARNING: EPOXY ADHESIVE IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN EPOXY ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET EPOXY ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

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(WARNING PRECEDES)

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(a) Mix 100 parts, by weight, of component B, to 140 parts ,by weight, of component A. Mix in a nonabsorbent container until the mixture attains a uniform color and viscosity. Maximum quantity to be mixed in one batch is one pound (454 grams). Pot life is approximately 40 minutes at 77°F (25°C) in one pound batches.

(b) Apply a smooth coat 3 to 5 mils thick of epoxy adhesive to each faying surface.

(c) Position parts in alignment and join faying surfaces. Maintain sufficient pressure to assure a glue line of 5 to 10 mils. Wipe off excess glue with clean dry wiper.

(d) Allow to air dry 4 to 6 hours before handling. A full cure is obtained in 24 hours. Cure may be accelerated by heating 130(±15)°F (54.4(±-9.4)°C) for 4 hours minimum.

(4) PPF-2272, HAA-1990, and HA211 Film Adhesives (Heat Activated)

(a) Laminate film adhesive to nondecorative surface of decorative laminate at a nip roller temperature of 225(±15)°F (107.2(±-9.4)°C) and at a laminating speed of 10 to 15 feet per minute.

(b) Position the jig and part into heat vacuum applicator. Remove release paper from the adhesive on the decorative laminate and position the laminate on the part.

NOTE: To form the decorative laminate to the radius of the part, a draw ring or blocks may be used. The decorative laminate may be stapled around draw ring or to blocks in the heat lamp vacuum applicator.

(c) Tape a thermocouple wire for monitoring temperature between a piece of decorative laminate and a small identical construction of the part being covered. Position this next of the part. Place the thermocouple at the bond line on the actual part when possible.

(d) Apply a vacuum of 3 to 4 inches of mercury and smooth out any wrinkles in the decorative laminate.

NOTE: Panel may be heated to approximately 140°F (60.0°C) before applying vacuum (to soften the decorative laminate) to help smooth wrinkles around edges.

(e) Bond decorative laminates to panels as follows:

1) Flat panels at 230 ±10°F (110 ±6°C), 3 to 4 inches of mercury vacuum, for 3 to 4 minutes.

2) Curved panels at 220°F (104°C) to 290°F (143°C)), 10 to 15 inches of mercury vacuum, for 3 to 12 minutes, depending on the depth of the draw.

NOTE: The deeper the draw, the more temperature, vacuum and dwell time required.

3) P/N 5937997-403, overwing emergency exit liner, at 250 ±10°F (121 ±6°C), 5 to 6 inches of mercury, for 3 to 4 minutes.

(f) Cool the part while under vacuum to less than 100°F (37.8°C) using a floor fan or equivalent air cooling system.

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24. Cementing "Cementable Teflon" to Teflon and to Metal

A. Types of Bonding

(1) Use Type I bonding where high shear, low peel strength is required. Good at temperatures up to 200°F (93.3°C).

(2) Use Type II and III bonding where high shear, low peel strength is required. Good at temperatures up to 500°F (260°C).

(3) Use Type IV bonding where moderate peel and shear strength are required. Good at temperatures from -40° to +185°F (-40° to +85°C).

(4) Use Type V bonding where moderate peel and shear strength are required at temperatures from -65° to +275°F (-85° to +135°C).

B. Surface Preparation

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

(1) Wipe metal faying surfaces with a clean cotton cloth dampened with hand wipe cleaner All paint and primer must be stripped from surface.

NOTE: FR primer, epoxy topcoat, and fuel tank coating should not be stripped from bonding surface.

(2) Roughen metal bonding surfaces with abrasive nylon pads to remove gloss.

(3) Wipe metal faying surface with a clean cotton cloth dampened with hand wipe cleaner, and wipe dry with clean dry cloth. Repeat wet and dry wiping until all traces of abrasion residue are removed.

(4) Wipe treated surface of the Teflon or Teflon coated material with clean cotton cloth dampened with hand wipe cleaner. Treated surface can be identified by its brownish color (side of Teflon to be cemented).

(5) On FR primed surfaces, apply thin brush coat of RTV-1200 primer and allow to air dry a minimum of 30 minutes prior to application of adhesive.

C. Application of Type I Bonding Crest 721

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(1) To 100 parts by weight of Part A (resin), add 74 parts by weight of Part B (hardener).

(2) Mix in a non-absorbent, glass, metal or polyethylene coated paper container until mass is of a uniform color and viscosity. Do not use high speed agitation, and avoid absorbent containers, i.e., paper cups, etc. Maximum quantity to be mixed in one batch is approximately 1/2 pound (0.227 kg). Keep in mind surface area involved and short pot life of mixed material. Pot life is 30 to 40 minutes at 77°F (25°C) in 100 grams batches.

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WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

(3) Apply 5 to 10 mils (0.127 to 0.254 mm) of mixed adhesive to each faying surface. Spread with spatula or glue spreader. Use the tool best suited to a particular surface. Clean off excess adhesive with clean cloth dampened with hand wipe cleaner.

(4) Immediately assemble parts in proper alignment and apply and maintain just sufficient pressure to allow intimate contact. Clamps or jigs may be used. Do not apply high pressure.

(5) Allow to cure at 70°F (21°C) to 85°F (29°C). Bond should be firm before handling. Adequate bond strength is attained in 24 hours (minimum temp. 70°F (21°C)). If a faster cure is desired, cure 45 minutes at 190 ±10°F (88 ±6°C).

D. Application of Type II Bonding EA934NA

WARNING: EPOXY RESIN EA934NA ADHESIVE IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN EPOXY RESIN EA934NA ADHESIVE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET EPOXY RESIN EA934NA ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(1) Mix 33 parts, by weight, of hardener (Part B) with 100 parts, by weight, of adhesive (Part A) in a nonabsorbent clean glass, metal or polyethylene coated paper container; until mixture attains a uniform color and viscosity. Avoid high-speed agitation. Maximum quantity to be mixed in one batch is approximately 1/2 lb. (227 grams). Pot life is approximately 40 to 45 minutes at 72°F (22.2°C).

(2) Apply approximately 5 to 10 mils of mixed adhesive in a uniform coat.

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(3) Immediately assemble parts in proper alignment. Masking tape may be used to hold Teflon in place if necessary.

(4) Cure for four hours at 185 ±10°F (85 ±6°C), or for seven days at room temperature.

(5) Cool to at least 100°F (37.8°C) before handling.

(6) If not bonded within eight hours, protect Teflon by wrapping in neutral draft paper. Clean white gloves shall be worn for handling of all treated Teflon.

E. Application of Type IV Bonding T-150A Adhesive

NOTE: Adhesive and surfaces should be at 70°F (21.1°C) or above at the time of application and bonding.

WARNING: ADHESIVE IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ADHESIVE IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ADHESIVE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Apply a thin, uniform brush coat of T-150A adhesive to both faying surfaces.

(2) Allow to air dry for 15 to 20 minutes.

NOTE: Dull spots after drying indicate not enough adhesive.

(3) Position parts carefully and join the surfaces with firm contact pressure.

(4) Allow to cure for a minimum of 4 hours before handling.

F. Application of Type V Bonding PR-1422 B-2 Sealant

WARNING: ELECTRICALLY CONDUCTIVE SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ELECTRICALLY CONDUCTIVE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ELECTRICALLY CONDUCTIVE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

WARNING: WHEN MIXING ADHESIVE, USE CARE TO AVOID BREATHING VAPORS. PROVIDE ADEQUATE VENTILATION IN WORK AREAS. DO NOT USE CLEANING SOLVENTS TO REMOVE ADHESIVE FROM SKIN. USE COMMERCIAL, WATERLESS, HAND CLEANERS. ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN.

(1) Mix one part, by weight, of accelerator with 7.5 parts, by weight, of PR-1422 B-2 sealant.

(2) Apply a thin film approximately 5 to 10 mils of mixed sealant to both faying surfaces.

(3) Join faying surfaces in proper alignment and apply and maintain sufficient pressure to allow intimate contact.

(4) Allow to cure at room temperature for 72 hours minimum or 1 hour at room temperature followed by an oven cure at 145 ±15°F (63 ±9°C) for a minimum of 8 hours.

25. Cementing Heater Blankets

A. This procedure to be used for cementing laminated silicone rubber electrical heater blankets to metal to provide uniform thermal conductivity. This procedure not applicable for general cementing of silicone and fluorosilicone rubber materials.

B. Surface Preparation

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1590, CLEANER/SOLVENT/HANDWIPE (DPM 6380-4)

HAZMAT 1000, REFER TO MSDS

WARNING: ETHYL ALCOHOL IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, AND POISONOUS. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN ETHYL ALCOHOL IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ETHYL ALCOHOL IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(1) Strip organic coatings from metal faying surfaces by wiping with clean cotton cloth dampened with hand wipe cleaner, and wipe dry with clean, dry, cotton cloth. FR primer need not be removed.

(2) Clean bare metal and FR primer faying surface by wiping with clean cotton cloth dampened with hand wipe cleaner, and wiping dry with clean, dry, cotton cloth.

(3) Apply a thin brush coat of Silastic 1200 silicone primer to clean bare metal of FR primer faying surface, and allow to air dry a minimum of 30 minutes. Do not apply silicone primer to heater blanket.

(4) Clean faying surface of heater blanket by lightly wiping with a clean, cotton cloth dampened with denatured ethyl alcohol, and allow to air dry for 10 to 15 minutes.

C. Cementing Procedures

(1) Apply with a thin metal spatula or putty knife, a uniform coat, approximately 0.015 inch (0.381 mm) thick, of pressure sensitive silicone adhesive (containing 20-mesh size aluminum metal powder) to full faying surface of heater blanket, making sure that no voids or air bubbles are present in adhesive coating.

(2) Allow applied adhesive coating to air dry for one to two hours, or until surface of coating exhibits an aggressive tack.

CAUTION: SILICONE ADHESIVE WILL PREVENT ADHESION OF PAINT AND SEALANT MATERIALS. DO NOT ALLOW ADHESION COMPOUND TO CONTACT ADJACENT SURFACES THAT ARE TO BE SUBSEQUENTLY PAINTED AND/OR SEALED.

(3) Carefully position heater blanket above structural substrate. Join blanket to substrate, starting at one edge and slowly laying down while pressing parts together; using firm hand pressure to ensure full contact of surfaces. Smooth out all bubbles and wrinkles, working toward edges of heater blanket. Finally, secure heater element in place to permanent mechanical attachments.

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SEALING COMPOUNDS, TWO-PART - MAINTENANCE PRACTICES

1. General

A. This section contains information covering materials and procedures to be used for the preparation, handling and storing of two-part sealing compounds.

2. Equipment and Materials

WARNING: ITEMS IDENTIFIED WITH AN ASTERISK(*) ARE FLAMMABLE. SUPPLY ADEQUATE VENTILATION AND EXERCISE APPROPRIATE PRECAUTIONARY MEASURES. CONSULT LOCAL AUTHORITY OR REGULATORY AGENCY, FOR FIRE PREVENTION AND PERSONNEL HEALTH AND SAFETY WHEN USING THESE MATERIALS.

NOTE: Equivalent substitutes may be used instead of the following listed items.

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Air removing equipment	Commercially available
Balance scales	Commercially available
Heating pads	commercially available
Curing equipment	commercially available
Mixing machine	Semco Division of Products Research and Chem. Corp. Glendale, California
Polyethylene tubes 250-06	Semco Division of Products Research and Chem. Corp. Glendale, California.
Polyethylene plunger 250-P	Semco Division of Products Research and Chem. Corp. Glendale, California.
Polyethylene plugs Tri Seal 250-TS	Semco Division of Products Research and Chem. Corp. Glendale, California.
*MPK Blend Solvent DMS 2458	Chemetall Oakite, La Mirada, CA
Heating pads	Commercially available
Air removing equipment	Commercially available
Balance scales	Commercially available
Polyethylene screw plugs	Protective Closure Co., Inc., Buffalo, New York

3. Receiving, Storing, and Handling

A. General Procedures

(1) Store sealing materials so that matched lots of base materials and accelerator can be issued as unit.

(2) To ensure maximum storage life of noncatalytic sealing material, keep at constant temperature between 40°F (4.4°C) and 70°F (21.1°C).

(3) Store sealing materials so that oldest materials are used first.

(4) Place sealing materials that have been received in premixed and frozen condition under immediate refrigeration at temperature of -10°F (-23.3°C) or lower.

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(5) Follow manufacturer's instructions for sealing materials that require special storage conditions.

(6) Store sealing materials in original containers, and keep containers tightly closed while in storage.

4. Weighing Bulk Sealant and Accelerator

A. Procedures

(1) Keep notice board in mixing area which shows matched sealant and accelerator lot numbers, and correct mixing proportions of all base sealing materials and accelerators currently in use.

(2) Weigh sealant and accelerator accurately.

NOTE: Scales should be accurate to 1 percent. A balance scale with calibrated weights is most desirable for weighing quantities of sealant and accelerator.

(3) Balance scale and compensate for weight of container.

(4) Weigh necessary amount of base sealing compound.

(5) Weigh required amount of accelerator for weight of base sealing compound used.

NOTE: Preweighed sealant kits do not require weighing of sealant and accelerator when entire quantity is to be mixed and used. All accelerator should be removed from container.

5. Mixing Accelerator and Sealant

A. Procedures

(1) Stir accelerator thoroughly to smooth, uniform consistency. Do not use accelerator that is dried out, flaky, or lumpy.

(2) Add accelerator to base sealing compound and distribute evenly throughout sealant with spatula. Add accelerator at beginning of mixing operation.

(3) Mix sealant in mixing machine from 3 to 5 minutes. Mixing machine must scrape sides and bottom of sealant container and at least once during mixing period sealant must be scraped from mixing paddle. Adjust machine so that combined speed of container and paddle is approximately 80 rpm.

NOTE: Rapid or prolonged stirring of base sealing compound and accelerator should be avoided. Heat build up in mixture will shorten normal application time of mixed sealant.

(4) Mix sealant and accelerator at temperatures of 65° to 85°F (18.3° to 29.4°C).

(5) Remove air from mixed sealant with air-removing equipment.

(6) Mixed sealants can be used immediately or stored for future use:

(a) For immediate use:

1) Use sealant with time application of 1 hour or less.

2) Mix sufficient quantity to complete job.

3) Apply sealant within applicable time limit. Discard sealant which has time expired or unused at work completion. Do not freeze sealant with time application of 1 hour or less.

(b) For storage:

1) Use sealant with time application of more than 1 hour.

2) Prepare and store mixed sealant per Paragraph 6..

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6. Storing Mixed Sealant

A. General Precautions

(1) Add accelerator to base sealant, and place mixed sealant under refrigeration within 15 minutes.

(2) Immediately after mixing, load sealant into polyethylene tubes and install polyethylene plug in nozzle end of tube.

(3) Place filled sealant tubes in quick-freeze bath of denatured alcohol contained in mechanically refrigerated compartment operating at -85.0°F (-65.0°C) or lower, for 15 to 30 minutes.

(4) Store mixed sealant at -10°F (-23.3°C) or lower, after initial quick-freeze.

NOTE: Mixed silicone sealants should not be stored on dry ice. Adequate isolation between dry ice and silicone sealants must be maintained to prevent sponging of the sealant. Silicone sealants may be stored for 5 days at -10°F (-23°C) following quick freeze, or for 10 days when stored at -85°F (-65°C).

(5) Thoroughly mixed, preweighed sealant kits should be flash frozen and stored under refrigeration at -10°F (-23.3°C) or used immediately.

NOTE: Mixed sealant should be removed from refrigeration or first-in, first-out basis.

7. Handling Mixed Sealants

A. Procedure

(1) Thaw sealant tubes using compressed air. Do not thaw sealant with heated air. Heat will accelerate cure and shorten application time.

(2) Place frozen sealant, other than silicone sealant, from refrigeration, in a suitable container packed with dry ice and carry to job. Tubes that have been kept frozen may be returned to refrigeration.

(3) Do not apply sealant to metal that is colder than 70°F (21.1°C). For better adhesion and less flow-out of applied sealant while curing, warm metal to temperature of 80° to 100°F (26.7°C to 37.8°C).

NOTE: Sealant track-free and cure times are reduced if temperature of applied sealant or surrounding air is maintained above 70°F (21.1°C) and extended if lower temperatures exist.

(4) Discard sealant that becomes too stiff to apply or to work readily.

NOTE: Sealant used on faying surface application should be freshly mixed or removed from refrigerated storage for the first time.

8. Curing Mixed Sealants

A. Procedures

(1) Cure applied sealants at temperatures between 60° to 145°F (15.6°C to 48.9°C).

NOTE: Curing of sealants below 70°F (21.1°C) is extremely slow.

(2) To increase temperature so that it will be within limits, use infrared lamps, heated air applied to outside of sealed structure, or heating pads. Do not apply heat to any faying surface sealant installation until all work is completed.

NOTE: If heated air is applied inside of integral fuel tanks, air must be filtered to remove moisture and dirt.

9. Equipment Cleaning

A. Procedures

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WARNING: CLEANING SOLVENT IS COMBUSTIBLE AND VAPOR MAY BE TOXIC. AVOID PROLONGED BREATHING OF VAPOR AND PROLONGED OR REPEATED CONTACT WITH SKIN. AVOID CONTACT WITH EYES. CLEAN PARTS IN WELL-VENTILATED AREA, AND USE APPROVED SAFETY EQUIPMENT.

(1) Soak equipment to be cleaned in solvent-type stripper until sealant is either dissolved or loosened and can be easily scraped or wiped off.

(2) Scrape or wipe loosened sealant from equipment.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1588, SOLVENT/MPK BLEND (DMS QPL 2458)

HAZMAT 1000, REFER TO MSDS

(3) Rinse equipment in MPK Blend Solvent, DMS 2458 (or equivalent) to remove residual film.

(4) Wipe equipment dry.

NOTE: Used solvent shall be collected in a container and kept closed when not in use.

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SEALANTS - MAINTENANCE PRACTICES

1. General

A. The sealing requirements of the aircraft are divided into general classes. Only power plant sealing, air-conditioning sealing, and thermal anti-icing sealing are covered in this chapter. Refer to the Structural Repair Manual for sealing procedures not covered in this chapter.

B. Sealants prevent fluid leakage in the fuel, hydraulic, oil, water, and other fluid systems. Sealants help maintain cabin air at a selected pressure by preventing air leakage. In the air-conditioning system, sealants help prevent the loss of hot or cold air. The effectiveness of thermal barriers, such as engine firewalls, is increased by sealants. Sealants protect the exterior plating against the effects of the sun, wind, rain, ice, and salt air. It is evident that the proper use of sealants results in greater passenger comfort and more efficient operation of the aircraft.

C. The materials required, methods of application, precautions to be taken, and other information necessary to effect a good seal are described in this section. Emphasis is placed on sealing practices associated with line maintenance work.

2. Tools and Equipment Required

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Sealant, PR 1422B2 or PR 1435 with accelerator DMS 2032	Products Research & Chem Corp. Glendale, California
Sealant Silicone, RTV-88 with RTV-9910 catalyst DMS 1799	General Electric Silicone Products Dept. Mechanicsville Road Waterford, N. Y.
Sealant, MIL-S-8784, Class B-2 (PR1428, class B-2) DMS 2410	
Coating, nylon, clear, Chem-on CS 7707 DPM 2389-1	Chem Seal Corp. of America 11120 Sherman Way, Sun Valley, California
Sealant, Pro-Seal 735 DMS 1819	Essex Chemical Corp. Coast Pro-Seal Division Compton, California
Primer, No. 1200 DPM 3202	Dow Corning Co. Midland, Mich.
Stripper, TL-4119	W. P. Fuller Co. Los Angeles, Calififorniа
Cleaner, Hand Wipe, Brulin MP 1793, DPM 6380-1	Brulin Company, Inc. Richmond, CA
Cleaner, Hand Wipe, EPA 2000, DPM 6380-2 or Cleaner/Solvent, handwipe, bulk, DPM 6380-4	DPM 6380-2 is superseded by DPM 6380-4, however the DPM 6380-2 can be used until supplies are depleted. Contec, Inc., Spartanburg, SC
Cleaner, Hand Wipe, PF Degreaser, DPM 6380-3	P-T Technologies, Inc. Safety Harbor, FL
Scrapers, Plastic DPS 2.50	Commercially available

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3. Sealing Procedures

A. General Instructions

(1) Complete as many assembly operations (drilling, deburring, reaming, fitting, and cleaning) as possible in a particular area before applying sealant. Hold parts together securely during drilling to prevent breaking of faying surface seal and to prevent chips from getting between parts being drilled. Avoid drilling through wet sealant whenever possible.

(2) Use close tolerance alignment pins, permanent bolts, screws, or rivets to maintain alignment of holes that have been drilled to final size.

(3) When it is necessary to blow compressed air on an area that has zero leakage requirement or that has been designated as a critical sealed area, filter compressed air properly to remove oil, water, or other contaminant. Do not use a water trap for this filtering.

(4) Clean all areas before applying sealants. Restrict cleaned area to a size that can be kept clean until sealant is applied.

(5) When planning sealing operation, consider that some sealing compounds have short application time after being mixed with their accelerators. Install sufficient number of fasteners so that metal-to-metal contact is made within allowable application time.

NOTE: The tack-free and cure times are reduced if the temperature of the applied sealant or the surrounding air is maintained above 70°F (21.1°C) and extended if lower temperatures exist.

(6) Use either sealant or mechanical seal, or combination of both, to seal all openings through sealed area boundaries.

(7) Metal surfaces must have minimum temperature of 70°F (21.1°C) before sealant may be applied. Best results will be obtained when surfaces are at temperature of 80° to 120°F (26.6°C to 48.8°C). Use approved means to warm parts when ambient temperature is below minimum temperature.

(8) Use approved brush pens for marking on areas that have zero leakage requirements or that have been designated as critical sealed areas. Do not use grease pencil on these areas.

4. Cleaning Solvents

A. Handling Solvents

WARNING: ALL CLEANING SOLVENTS ARE HARMFUL TO SKIN. DO NOT USE CLEANING SOLVENTS TO REMOVE SEALANT FROM THE SKIN. USE COMMERCIAL, WATERLESS HAND CLEANERS.

(1) Most cleaning solvents have a low flash point and are dangerous fire hazards.

(2) Provide protection equipment and adequate ventilation for all personnel before any cleaning operation is started.

B. Types of Cleaning Solvents

(1) Solvent Type

WARNING: CLEANING OPERATIONS USING SOLVENTS SHOULD BE PERFORMED IN A WELL-VENTILATED ATMOSPHERE.

(a) This type of cleaning compound evaporates rapidly. It is best suited for cleaning surface contamination not removable with water. It can be applied with scrubbing or wiping action and is safe on primed or painted surfaces. For solvent containers, use only approved bottles.

(2) Non Flammable Solvent Type

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(a) This type of cleaning compound is a nonflammable heavy duty cleaner. It may be used in place of solvent type cleaners, in areas where fire hazards may occur (due to low flash point of solvent type cleaners). To be used only if adequate ventilation exists to maintain solvent vapor concentration at 350 ppm, or less, in and around area being cleaned.

(3) Water Type

(a) Use clean water for first cleaning operation; for removal of all foreign material and water soluble contamination, before using solvent type compounds.

C. Using Cleansing Water

(1) Where a water soluble drill lubricant has been used or water soluble contamination exists, wash parts with copious quantities of fresh, clean water. Use brushes and cloths to aid in removal of all contamination. Parts that have been contaminated with drill lubricant should be washed with water immediately after completion of drilling or reaming operations. The drill lubricant should not be permitted to dry on parts as it is very dificult to remove dried lubricant with water.

(2) Dry parts immediately after they are washed clean.

(3) After parts have been washed and dried, they must be cleaned with solvent type compounds before sealants may be applied.

D. Using Cleaning Solvents

(1) Use a plastic scraper, DPS 2.50, to scrape off as much old sealant as possible from parts to be sealed.

(2) Select right solvent, or combination of solvents, for job. If combination of solvents is required, use in proper sequence.

CAUTION: USE ONLY CLEAN, DRY, COTTON CLOTHS, TO AVOID CONTAMINATION.

(3) Pour solvent on cloth and wring out excess.

(4) Do not contaiminate solvent by dipping cloth into solvent or allowing excess to run back into fresh supply.

WARNING: CLEANING OPERATIONS USING SOLVENTS SHOULD BE PERFORMED IN A WELL VENTILATED ATMOSPHERE. EXERCISE NORMAL SAFETY PRECAUTIONS DURING USE.

(5) Apply solvent lightly or vigorously, as required by surface to be cleaned.

(6) Clean only as large an area as can be properly protected from contamination until sealant can be applied.

(7) Wipe area dry before solvent evaporates and redeposits dirt.

(8) Change both cleaning and drying cloths frequently so that contamination from cloths does not occur.

5. Priming (For Silicone Sealant Application Only)

A. Procedures

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WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, A SENSITIZER, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, A REDUCER, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, POISONOUS, A REDUCER, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: HANDWIPE CLEANER/SOLVENT IS AN AGENT THAT IS FLAMMABLE AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER/SOLVENT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER/SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

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(WARNING PRECEDES)

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(1) Clean all surfaces to be primed with solvent hand wipe cleaner. Wipe dry with clean, cotton cloth and then allow to air dry for approximately 30 minutes.

WARNING: SILICONE PRIMER IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS LISTED BELOW WHEN SILICONE PRIMER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE PRIMER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(2) Prime surfaces with silicone primer (No. 1200).

NOTE: Silicone primer (No. 1200) must be applied by brush.

(3) Allow primer to dry for minimum of 30 minutes before applying sealant. Keep primer container closed when not in use.

(4) Pour enough primer into small container for specific application. Do not use primer directly from original container to prevent contamination of rest of container. Do not return unused primer to original container.

(5) Discard primer when it turns milky.

6. Sealing

A. Sealing Requirements

(1) All seals must be continuous within sealed area.

(2) All surfaces to which sealant is applied must be completely free from moisture.

(3) Use clean warm air, heat lamps, heating pads, or other approved means when rapid-drying or fast-curing are necessary. Do not exceed temperature limits.

(4) Check that all preliminary operations have been completed before sealant is applied.

(5) Refer to Table 202 for materials required.

B. Faying Surface Seal

(1) Carefully plan and arrange work and equipment so that faying surface seals in large assemblies can be closed within specified time limit.

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(2) Use only freshly mixed sealant or sealant that has just been removed from refrigeration for first time. Extrude sealant in ribbons or bands on one faying surface. Spread sealant uniformly over one faying surface. Use sufficient sealant so that when installation is made sealant will extrude from faying surfaces of parts being joined. Work out all air bubbles.

(3) To pack voids, cracks, crevices, and joggles, apply enough sealant before joining parts to completely fill void or joggle, and show extruded sealant when parts are installed.

(4) Always use fasteners to hold faying surface sealed parts in place during assembly. Shifting of parts after they have been joined will break seal.

C. Fillet Seal

(1) Install fillet seal by spreading sealant along seam in approximately 3-foot (.9m) increments. Before proceeding to next increment, work applied portion of fillet with spatula to fill voids in seam and to eliminate as many air bubbles as possible. Examine fillet for any remaining air bubbles; if bubbles exist, fill with fresh sealant. Make cavities large enough to permit easy filling with fresh sealant.

(2) When heavy fillet is required, sealant can be applied in layers. Apply each layer as specified in step (1).

Table 202 Materials and Applications

Material	Manufacturer	Mixing Ratio (Parts by Weight)	Use
PR 1422- B2 or PR-1435 with Accelerator	Products Research & Chem Corp. 5454 San Fernando Rd. Glendale, CA	100 (base) to 13.5 (accelerator)	Fuel tanks, Pressurized cabin areas, air conditioning system, fuselage tailcones, general use.
RTV-88 with RTV-9910 Catalyst (Silicone Sealant) DMS 1799	General Electric Silicone Products Dept. Mechanicsville Road, Waterford, N.Y.	100 (base) to 10 (catalyst)	Firewall sealant and gap packing (2000°F (1093.3°C) application), pneumatic ducts, D-ducts, antiicing systems, and airconditioning system (high temperature application)
1200 primer	Dow Corning Company Midland, Mich.		Priming surfaces (for silicone sealant)
MIL-S-8784 Class B-2		100(base) to 10(catalyst)	Access Door & Removable items.
PR-1431G with accelerator	Products Research & Chem Corp. 5454 San Fernando RD. Glendale, Ca.	Per Mfg. Instructions	Faying Surface sealing only, corrosion inhibiting and fuel resistant
Chem-on 7707	Chem Seal Corp. of America, 11120 Sherman Way, Sun Valley, Calif.	100 (base) to 6 catalyst	Nylon protective coating for Skydrol area, windshield
Pro-Seal 735	Essex Chemical Corp 19451 Susana Rd. Compton, Ca.	100 (base) to 12 (accelerator)	Aluminized exterior sealant appearance items

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BOLT TORQUE DATA - MAINTENANCE PRACTICES

1. General

A. To ensure security of installation and prevent under and overstressing of components during installation, the torque values outlined in this section and other applicable chapters of this manual should be used during installation and repair of components.

B. The torque values listed in this section are standard torque values for the nut and bolt combinations as shown. Special torque values for specific installation instructions are given in maintenance practices and installation instructions applicable to the various components. Torque values and instructions for the installation of such items as lines and fittings, hose clamps, and duct clamps are given in sections that discuss their use and installation.

2. Equipment and Materials

WARNING: ITEMS IDENTIFIED WITH AN ASTERISK(*) ARE FLAMMABLE. SUPPLY ADEQUATE VENTILATION AND EXERCISE APPROPRIATE PRECAUTIONARY MEASURES. CONSULT LOCAL AUTHORITY OR REGULATORY AGENCY, FOR FIRE PREVENTION AND PERSONNEL HEALTH AND SAFETY WHEN USING THESE MATERIALS.

NOTE: Equivalent substitutes may be used instead of the following items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
*MPK Blend Solvent DMS 2458	Chemetall Oakite, La Mirada, CA

3. Removal/Installation Bolts, Nuts, and Washers

NOTE: The word bolt, also includes screws, where applicable.

A. Install Bolts

(1) Unless use of thread lubricant or antiseize compounds is specified in applicable maintenance instructions, threads should be free of lubricants other than those applied by manufacturer, check dyes, identification dyes, etc. Use of lubricants will increase preloading applied to bolt, and foreign material on threads will reduce amount of pre-load. When use of lubricant is specified, torque values must be as specified in applicable maintenance instructions.

(2) Mechanical attachments with lockwire or cotter key provisions shall not be substituted. Replacement bolts must have same locking feature, that is, drilled head, drilled shank, or self-locking nut. When substituting a hex-drive bolt or lockbolt with a bolt, bolt must be installed with correct type self-locking nut.

B. Install Nuts

(1) Type of self-locking nuts used must conform to applicable maintenance instructions. Nylon insert self-locking nuts should not be used in areas subject to temperatures over 250°F. Self-locking nuts should not be substituted for castellated nuts secured by lockwire or cotter pins. Fibre insert nuts shall not be used.

(2) Self-locking nuts should not be tapped or modified.

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(3) When tightening castellated nuts for installation of cotter pin or safety wire, align holes by tightening to low range of specified torque and continue tightening until slot aligns with hole. If slot cannot be aligned without exceeding maximum torque value, a washer of different thickness may be used, or a washer may be added, providing conditions outlined in Paragraph 3.C. are not exceeded. Nut should not be backed off from prescribed torque to align holes.

(4) Self-locking nuts must not be used on any installed bolts that are subject to rotation in aircraft high vibration environment.

NOTE: Castellated self-locking nuts can be used provided that nut is safetied with cotter pin.

(5) Certain critical bolts have double safetied nuts installed (self-locking castellated nuts with cotter pins, standard castellated nuts and cotter pins combined with anti-rotation provisions for both nut and bolt such as tabbed washers or safety wiring, etc.). Ensure that BOTH locking devices (as applicable) are properly installed whenever such installations are removed and reinstalled.

C. Install Washers

(1) Use only type and number of washers for an installation as specified in applicable maintenance instructions, except as outlined in following instructions. Use of wrong or additional washers can result in improper preloading of bolts when torqued.

(2) Washers may be added under bolt head, nut, or both, in order to install cotter pins in castellated nuts, or to counteract accumulation of tolerances for installation of self-locking nuts. Total number in either case should not exceed two washers. In cases where bolt length increments are greater than 1/16-inch (1.6mm), use of three washers is permissible.

(3) Where length of a bolt will not permit installation of correct washers as specified, a bolt of same type, or one increment longer or shorter, may be substituted providing number of washers does not exceed specification outlined above and nut does not bottom on unthreaded shank of bolt.

NOTE: Increase in bolt length shall not result in any possible interference to moving components or adjacent structure.

(4) All bolts through aluminum alloy shall have a cadmium-plated or aluminum alloy washer under bolt head or nut, whichever is turned during tightening. Lockwashers should not be used against aluminum alloy without a cadmium-plated washer under lockwasher to prevent damage to surface. On magnesium alloys, use NAS1252 flat washer under lockwasher to prevent corrosive action between dissimilar metals.

NOTE: Cadmium plated washers should not be used under titanium bolt heads or against titanium structure.

(5) For installation of nonflush close tolerance bolts, break edge of hole on head side to permit adequate seating of bolt. Where internal wrenching head bolts are specified, countersunk washers must be used with countersink cavity next to radius under bolt head. Installation of a standard washer or countersunk washer reversed may cause failure of bolt head. (Figure 201)

4. Removal/Installation Access Door Fasteners

A. Install Doors and Plates

NOTE: Access doors, cover plates, angles, or channels which are attached by a series of bolts or screws and which require tightening to a specified torque value should be tightened to load part uniformly.

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CAUTION: POWER TOOLS WITHOUT A TORQUE LIMITING DEVICE ARE PROHIBITED FOR FINAL TIGHTENING.

CAUTION: POWER TOOLS WITH TORQUE CONTROL DEVICES SHALL NOT EXCEED 500 RPM UNDER ANY LOAD WHEN INSTALLING BOLTS, NUTS, AND THREADED COLLARS. TORQUE CONTROL POWER TOOLS MUST BE IDENTIFIED AND MUST HAVE TORQUE VALUE AFFIXED TO TOOL.

(1) Start all bolts or screws fingertight.

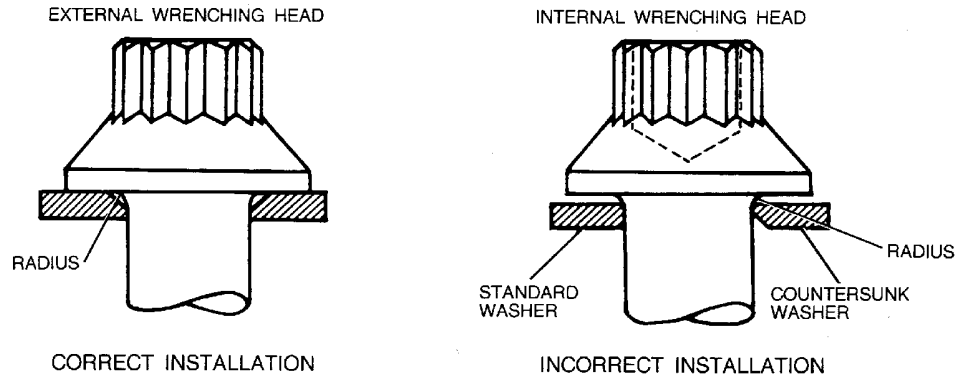
NOTE: Any access door, cover plate, angle, channel, etc., attached with a series of bolts and/or screws which subsequently require a torque, shall be tightened in such a manner as to load the part uniformly.

NOTE: The use of impact wrenches (nut runners) and hand speed wrenches are permissible for partial installation, little to no clamping force on the joint, of permanent attachments only. Final tightening must be accomplished with torque wrenches, torque control power screwdrivers or hand screwdriver tightening.

(2) Apply minimum torque to angle and channel fasteners by starting at center of part and working toward end. Tighten fasteners to final torque value by using same sequence.

(3) Oval shaped access doors in upper and lower wing surfaces shall have a minimum of six bolts removed from each end prior to loosening or removing bolts on either side.

(4) Apply minimum torque to access doors and cover plate fasteners by tightening fasteners alternately from side-to-side, corner-to-corner, or from end-to-end. Tighten to final torque value by using same sequence.



Washer Installation -- Close Tolerance Bolts
Figure 201/20-30-01-990-801

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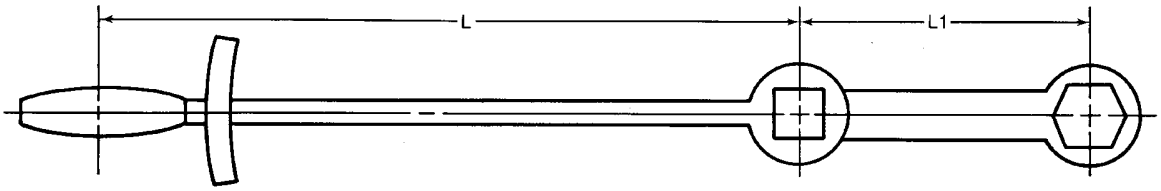

NOTE: WHEN USING EXTENDED ADAPTERS ON TORQUE WRENCHES, USE FOLLOWING FORMULA TO OBTAIN THE CORRECT TORQUE.

$$\frac{\text{ACTUAL TORQUE X WRENCH LENGTH}}{\text{WRENCH LENGTH + ADAPTER LENGTH}} = \text{ADJUSTED WRENCH VALUE}$$

EXAMPLE: $\frac{100 \times 6}{6 + 2} = \frac{600}{8} = 75$

BBB2-20-2A

Torque Wrench and Adapter Formula
Figure 202/20-30-01-990-802

5. Use of Torque Wrenches

A. General

(1) Make certain that torque wrenches are properly calibrated and adjusted before use.

CAUTION: DO NOT USE CADMIUM PLATED WRENCHES, DRIVERS, ADAPTERS, OR TOOLING FOR INSTALLATION OR REMOVAL OF TITANIUM FASTENERS OR ALLOW SUCH TOOLS TO CONTACT TITANIUM STRUCTURE.

(2) When an installation requires use of a wrench adapter for tightening, compute torque value with formula shown in Figure 202.

CAUTION: WHEN TWO OR MORE FAYING SURFACES ARE FAYING SURFACE SEALED IN A JOINT, INITIAL TIGHTENING OR TORQUING, PLUS TWO ADDITIONAL RETIGHTENING OR RETORQUING OPERATIONS, AS APPLICABLE, MAY BE NECESSARY TO EXTRUDE EXCESS SEALANT. THIS REQUIREMENT IS APPLICABLE TO BOLTS 3/16 INCH (4.8 MM) THROUGH 3/8 INCH (9.5 MM) DIAMETER. WHEN A POWER TORQUE CONTROLLED DEVICE IS USED FOR TIGHTENING OR TORQUING, TORQUE VALUE MUST BE INCREASED BY 15 PERCENT TO ENSURE EXTRUSION OF EXCESS SEALANT FROM MATING SURFACE OF JOINTS.

(3) Where faying surface sealants are used, bolts shall be tightened snugly to extrude excess sealant and obtain metal-to-metal contact followed by final tightening or torquing, as applicable.

NOTE: A minimum of not less than 5 minutes should be allowed for sealant to extrude prior to final tightening and torquing.

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(4) When a gasket or any other type of material intended as a gasket or cushion is used between removable doors, cover plates, etc., screws may be tightened or torqued, as applicable, one time only.

(5) Where possible, tighten nut end. Where installation requires tightening from head of bolt, use following procedures:

(a) Bolts that can be inserted by hand (loose fit) should be tightened from head end to high value of specified torque range.

(b) Bolts which require a driving force for installation should be tightened to torque value which is sum of minimum value of specified range and prevailing torque before head seats.

(6) Final torque readings should be taken while nut is rotating. If maximum allowable torque is applied without causing nut to rotate, nut should be backed off and retightened.

(7) A check of torque required to back off nut is of no value. Due to static friction, torque required to break nut free will be much higher than torque while rotating. Only accurate torque check is to back off nut from one-half to one full turn and retighten nut.

6. Check Nut and Bolt Installation

A. Check Nuts and Bolts

(1) Check for proper length of bolt. If installation does not meet following requirements, refer to Paragraph 3.C..

(2) To ensure proper gripping action on self-locking nuts, bolt should extend through locking portion of nut. Round or chamfered end bolts should extend at least full round or chamfer through nut. Flat end bolts or screws should extend at least 1/32-inch (0.79 mm) through nuts.

(3) Drilled hole in bolt should not extend more than one-third diameter of hole above top edge of slot in castellated nut.

(4) When requirements call for identification of bolts to indicate that bolts are tightened to specific torque values, or to detect subsequent motion after tightening, bolts or nuts may be marked as follows:

NOTE: Marking should not be applied to bolts inside integral fuel tanks.

(a) Make certain that bolt or nut and adjacent area are clean and free of grease and oil.

(b) Apply stripe one-eighth inch (3.175 mm) wide extending from one-half inch on adjacent surface and up side of nut or bolt. Red transparent marking dye or red banding lacquer may be used. Because stripe may be used to detect movement of bolt or nut, make striping as straight as possible.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1588, SOLVENT/MPK BLEND (DMS QPL 2458)

HAZMAT 1000, REFER TO MSDS

(c) When remarking bolt or nut that has been loosened and tightened, clean old marking from nut and bolt with cleaner, MPK Blend Solvent, DMS 2458 before applying torque.

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(5) Self-locking nuts may be reused providing gripping power is sufficient to ensure that nut will not loosen during operation. Nuts that can be threaded on bolt easily, indicating that self-locking feature is below strength, should be discarded. To determine if gripping power meets minimum requirements proceed as follows:

NOTE: Steel nuts should be tested with steel bolts.

(a) Screw nut on bolt until two to three threads are exposed.

(b) Apply torque wrench and slowly unscrew nut at least one complete turn. Gripping power must be above minimum value specified in Table 202. Discard any self-locking nut that falls below this value.

NOTE: Values given in Table 202 are for unscrewing the nut from the bolt. The torque required to screw the nut onto the bolt is not a dependable indication of gripping action.

7. Torque Value Figures

NOTE: The torque values given in Table 202 through Table 205 are standard values for the bolt and nut combinations indicated. Special torque values for specific installations are found in the installation instructions of the maintenance practices for each component where such special values are applicable. These torque values do not apply to brass nuts and screws. Tighten brass nuts and screws to the extent required to fully compress the lockwasher.

Table 202 Torque Values for Self-locking Nuts

Bolt Size -Threads Per Inch Inch (mm)	Minimum Breakaway Torque Value Inch-Pounds (N·m)	
0.1640-32 (4.1656)	1.5	(0.17)
0.1900-32 (4.8260)	2.0	(0.23)
0.2500-28 (6.3500)	5.0	(0.57)
0.3125-24 (7.9375)	7.0	(0.79)
0.3750-24 (9.5250)	10.0	(1.13)
0.4375-20 (11.1125)	14.0	(1.58)
0.5000-20 (12.7000)	18.0	(2.03)
0.5625-18 (14.2875)	24.0	(2.71)
0.6250-18 (15.8750)	32.0	(3.62)
0.7500-16 (19.0500)	50.0	(5.65)
0.8750-14 (22.2250)	70.0	(7.91)
1.0000-12 (25.4000)	90.0	(10.2)
1.0000-14 (25.4000)	92.0	(10.4)
NOTE: Replace and discard nuts which fall below values shown for unscrewing nut from bolts. (Paragraph 6..)		

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Table 203 Torque Values for Screws, Bolts, and Studs with MS20365, MS21042L, MS21043, NAS679, A and C, NAS1021, AN310, H39794, 52LH4367, 52LH2935, RME9868, S4933653, S4933816, TE9925, S-1117-315, S4932389, and MS21045, low height nutplates and nutstrips, and blue colored high strength aluminum nuts.

Bolt Size- Threads Per Inch Inch (mm)	Torque Value Steel and Titanium	**Torque Value Titanium Flush Shear Head Type Bolts	*Torque Value With Shear Type and Aluminum Nuts
0.138-32 (3.505)	8 to 10 (0.9 to 1.1) In.-lbs. (N·m)		5 to 7 (0.6 to 0.8) In.-lbs. (N·m)
0.164-32 (4.166)	12 to 15 (1.4 to 1.7) In.-lbs. (N·m)		8 to 10 (0.9 to 1.1) In.-lbs. (N·m)
0.190-32 (4.826)	20 to 25 (2.3 to 2.8) In.-lbs. (N·m)		12 to 15 (1.4 to 1.7) In.-lbs. (N·m)
0.250-28 (6.350)	50 to 70 (5.7 to 7.9) In.-lbs. (N·m)		30 to 42 (3.4 to 4.7) In.-lbs. (N·m)
0.313-24 (7.938)	100 to 140 (11.3 to 15.8) In.-lbs. (N·m)		60 to 80 (6.8 to 9.0) In.-lbs. (N·m)
0.375-24 (9.525)	160 to 190 (18.1 to 21.5) In.-lbs. (N·m)		96 to 114 (10.8 to 12.9) In.-lbs. (N·m)
0.438-20 (11.113)	450 to 500 (50.8 to 56.5) In.-lbs. (N·m)	350 to 450 (39.6 to 50.8) In.-lbs. (N·m)	270 to 300 (30.5 to 33.9) In.-lbs. (N·m)
0.500-20 (12.700)	480 to 690 (54.2 to 78.0) In.-lbs. (N·m)	450 to 600 (50.8 to 67.8) In.-lbs. (N·m)	288 to 414 (32.5 to 46.8) In.-lbs. (N·m)
0.563-18 (14.288)	800 to 1000 (90.4 to 113.0) In.-lbs. (N·m)	600 to 800 (67.8 to 90.4) In.-lbs. (N·m)	480 to 600 (54.2 to 67.8) In.-lbs. (N·m)
0.625-18 (15.875)	1100 to 1300 (124.3 to 146.9) In.-lbs. (N·m)		660 to 780 (74.6 to 88.1) In.-lbs. (N·m)
0.750-16 (19.050)	190 to 210 (257.60 to 284.72) ft.-lbs. (N·m)		114 to 126 (154.56 to 170.83) ft.-lbs. (N·m)
0.875-14 (22.225)	210 to 250 (284.72 to 388.95) ft.-lbs. (N·m)		126 to 150 (170.83 to 203.37) ft.-lbs. (N·m)
1.000-12 (25.400)	310 to 460 (420.30 to 623.67) ft.-lbs. (N·m)		186 to 276 (252.18 to 374.20) ft.-lbs. (N·m)
1.125-12 (28.575)	415 to 585 (562.66 to 793.14) ft.-lbs. (N·m)		249 to 351 (337.59 to 475.89) ft.-lbs. (N·m)
1.250-12 (31.750)	750 to 915 (1016.85 to 1240.56) ft.-lbs. (N·m)		450 to 549 (610.11 to 744.33) ft.-lbs. (N·m)
NOTE: * Torque Values for AN310, AN316, AN320, MS14145L ( ), MS20364, MS21043, MS21083N ( ), MS21245L ( ), NAS1022, NAS509, NAS679A and C RMITE, 3D0027, and 3D0149 shear type nuts or aluminum nuts.			
NOTE: ** When titanium alloy flush shear head bolts are used in net to clearance fit holes (NAS4907 through NAS4909).			

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Table 204 Torque Values for steel and Inconel 718 screws, bolts, and studs, with 6000, 61170, 7000, 8000, SL7072S, NAS577, EB, EWSN22, 12B, H-20, 48F1W, FN22, 2752, 42FW, LH7461T, RMLH7940T, LH7456T, LH10825T, LH3849, H16 and 52N1610 nuts.

Thread Size Inch (mm)	Torque Value	Torque Value
	Inch-Pounds	(N·m)
0.1900-32 (4.8260)	45 to 50	(5.1 to 5.7)
0.2500-28 (6.3500)	83 to 115	(9.4 to 13.0)
0.3125-24 (7.9375)	165 to 230	(18.6 to 26.0)
0.3750-24 (9.5250)	260 to 320	(29.4 to 36.2)
0.4375-20 (11.1125)	740 to 820	(83.6 to 92.6)
0.5000-20 (12.7000)	800 to 1140	(90.4 to 128.8)
0.5625-18 (14.2875)	1370 to 1640	(154.8 to 185.3)
0.6250-18 (15.8750)	1845 to 2120	(208.5 to 239.5)
	Foot-Pounds	(N·m)
0.7500-16 (19.0500)	320 to 340	(433.86 to 460.97)
0.8750-14 (22.2250)	340 to 410	(460.97 to 555.88)
1.0000-12 (25.4000)	510 to 760	(691.46 to 1030.41)
1.1250-12 (28.5750)	690 to 965	(935.50 to 1308.35)
1.2500-12 (31.7500)	1235 to 1510	(1674.41 to 2047.26)
CAUTION: DO NOT USE THESE TORQUE VALUES FOR TITANIUM BOLTS.		

Table 205 Torque Values for Installing Bolts and Screws into Nutplates, Nut Strips, and Other Blind Attachment Nuts With Torque Control Tools.

Thread Size Inch (mm)	Torque Value	
	Inch-Pounds	(N·m)
0.1900-32 (4.8260)	30 to 40	(3.4 to 4.5)
0.2500-28 (6.3500)	80 to 100	(9.0 to 11.3)
0.3125-24 (7.9375)	140 to 160	(15.8 to 18.1)
0.3750-24 (9.5250)	200 to 220	(22.6 to 24.9)

Table 206 Torque Values for Steel and Titanium Tri-Wing Screws

		Torque Values	
Tri-Wing Screw	Thread Size Inch (MM)	Steel and Titanium	*Titanium Flush Shear Head Type
		Inch-Pounds (N·m)	
NAS4402	0.1640-32 (4.1656)	12 - 15 (1.4 - 1.7)	
4403	0.1900-32 (4.8260)	20 - 25 (2.3 - 2.8)	

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Table 206 Torque Values for Steel and Titanium Tri-Wing Screws (Continued)

		Torque Values	
Tri-Wing Screw	**Thread Size Inch (MM)**	**Steel and Titanium**	***Titanium Flush Shear Head Type**
4404	0.2500-28 (6.3500)	50 - 70 (5.7 - 7.9)	
4405	0.3125-24 (7.9375)	100 - 140 (11.3 - 15.8)	
4406	0.3750-24 (9.5250)	160 - 190 (18.1 - 21.5)	
4407	0.4375-20 (11.1125)	450 - 500 (50.8 - 56.5)	350 - 450 (39.5 - 50.8)
4408	0.5000-20 (12.7000)	480 - 690 (54.2 - 78.0)	450 - 600 (50.8 - 67.8)
4409	0.5625-18 (14.2875)	800 - 1000 (90.4 - 113.0)	600 - 800 (67.8 - 90.4)
4410	0.6250-18 (15.8750)	1100 - 1300 (124.3 - 146.9)	
		Foot-Pounds (N·m)	
4412	0.7500-16 (19.0500)	190 - 210 (257.60 - 284.72)	
4414	0.8750-14 (22.2250)	210 - 250 (284.72 - 338.95)	
4416	1.0000-12 (25.4000)	310 - 460 (420.30 - 623.67)	

NOTE: * Use for titanium alloy flush shear type bolts (Tri-Wing Screws) used in net to clearance fit holes.

Table 207 Torque Values for Pozidrive Phillips Steel Screws 100° Flush Head

PHILLIPS SCREW		**THREAD SIZE Inch (mm)**	**MINIMUM TORQUE INCH-POUNDS (N·m)**
PIC	239-3	0.1900-32 (4.8260)	50 (5.7)
	239-4	0.2500-28 (6.3500)	90 (10.2)
	239-5	0.3125-24 (7.9375)	175 (19.8)
	239-6	0.3750-24 (9.5250)	250 (28.2)
	239-7	0.4375-20 (11.1125)	550 (62.1)
	239-8	0.5000-20 (12.7000)	900 (101.7)
	239-9	0.5625-18 (14.2875)	1440 (162.7)

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PIPING COUPLING NUT TORQUE VALUES - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides torque values for coupling nuts, B-nuts, used on flared piping and flareless fitting coupling nuts. (Table 209, Table 202, and Table 208)

B. To ensure security of installation and prevent overstressing of components during installation, the torque values outlined in this section and other applicable chapters of this manual should be used during installation and repair of components.

C. The tables of torque values listed in this section are standard torque values for the combinations shown in the tables. Special torque values for specific installation instructions are given in maintenance practices and installation instructions applicable to the various components.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of following items.

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Cleaning wipers, Type 1, Class A	Commercially available
Locquic primer grade T DPM 6081	Loctite Corp., Newington, CT 06111
Loctite, grade 242 DPM 6082	Loctite Corp., Newington, CT 06111
Seal, SSF1015 A24B	Voi-Shan A Division of U.S.I. Corporation
Stiff nylon or natural bristle brush	Commercially available
Cleaner, Hand Wipe, Brulin MP 1793, DPM 6380-1, -3 or -4	Brulin Company, Inc. Richmond, CA
Cleaner, Hand Wipe, EPA 2000, DPM 6380-2	Western Chemical International, Inc. Scottsdale, AZ
Cleaner, Hand Wipe, PF Degreaser, DPM 6380-3	P-T Technologies, Inc. Safety Harbor, FL

3. Piping Coupling Nut Thread Sealant Application

A. Sealant Application

WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, A SENSITIZER, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, A REDUCER, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, POISONOUS, A REDUCER, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(1) Using clean, lint-free cloth moistened with hand wipe cleaner, DPM 6380-1, DPM 6380-2, or DPM 6380-3, clean threads of male fitting (union, inline check valve, etc.) to which B-Nut will be connected.

WARNING: LOCKING & RETAINER COMPOUNDS PRIMER/CATALYST IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN LOCKING & RETAINER COMPOUNDS PRIMER/CATALYST IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET LOCKING & RETAINER COMPOUNDS PRIMER/CATALYST IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: ANAEROBIC SEALING/LOCKING COMPOUND IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ANAEROBIC SEALING/LOCKING COMPOUND IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ANAEROBIC SEALING/LOCKING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(2) Wipe same threads with clean, lint-free cloth which has been moistened with small amount of Locquic Primer-Grade T.

CAUTION: DO NOT USE EXCESSIVE AMOUNTS OF LOCTITE.

(3) Wait 15 minutes, engage B-nut one thread and coat male threads with two drops of Loctite Grade 242, blue thread Sealant.

CAUTION: B-NUT MUST BE TORQUED WITHIN 5 MINUTES OF APPLYING LOCTITE.

(4) Connect B-Nut and torque. (Table 208)

NOTE: Apply same procedure if treated B-Nut connection is disconnected to replace component, except Loctite residue should be cleaned from male threads, using stiff nylon or natural bristle brush.

Table 202 Torque Values For Coupling Nuts (Flared Tube Type)

Tube Dash Number	Tubing O.D.	Torque Values			
		Flared Tube Ends Only *[1]		Flared Machined Fittings Only *[2]	
		Aluminum	Steel or Titanium	Aluminum	Steel or Titanium
2	⅛ in. (3 mm)	20 in-lb (2 N·m) - 30 in-lb (3 N·m)	75 in-lb (8 N·m) - 95 in-lb (11 N·m)	50 in-lb (6 N·m) - 80 in-lb (9 N·m)	75 in-lb (8 N·m) - 120 in-lb (14 N·m)
3	3/16 in. (5 mm)	25 in-lb (3 N·m) - 35 in-lb (4 N·m)	95 in-lb (11 N·m) - 105 in-lb (12 N·m)	95 in-lb (11 N·m) - 105 in-lb (12 N·m)	95 in-lb (11 N·m) - 140 in-lb (16 N·m)
4	¼ in. (6 mm)	50 in-lb (6 N·m) - 60 in-lb (7 N·m)	135 in-lb (15 N·m) - 150 in-lb (17 N·m)	120 in-lb (14 N·m) - 140 in-lb (16 N·m)	135 in-lb (15 N·m) - 190 in-lb (21 N·m)
5	5/16 in. (8 mm)	70 in-lb (8 N·m) - 90 in-lb (10 N·m)	170 in-lb (19 N·m) - 200 in-lb (23 N·m)	135 in-lb (15 N·m) - 180 in-lb (20 N·m)	170 in-lb (19 N·m) - 240 in-lb (27 N·m)

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Table 202 Torque Values For Coupling Nuts (Flared Tube Type) (Continued)

Tube Dash Number	Tubing O.D.	Torque Values			
		Flared Tube Ends Only *[1]		Flared Machined Fittings Only *[2]	
		Aluminum	Steel or Titanium	Aluminum	Steel or Titanium
6	⅜ in. (10 mm)	110 in-lb (12 N·m) - 130 in-lb (15 N·m)	270 in-lb (31 N·m) - 300 in-lb (34 N·m)	190 in-lb (21 N·m) - 215 in-lb (24 N·m)	270 in-lb (31 N·m) - 300 in-lb (34 N·m)
8	½ in. (13 mm)	230 in-lb (26 N·m) - 260 in-lb (29 N·m)	450 in-lb (51 N·m) - 500 in-lb (56 N·m)	340 in-lb (38 N·m) - 380 in-lb (43 N·m)	450 in-lb (51 N·m) - 550 in-lb (62 N·m)
10	⅝ in. (16 mm)	330 in-lb (37 N·m) - 360 in-lb (41 N·m)	650 in-lb (73 N·m) - 700 in-lb (79 N·m)	380 in-lb (43 N·m) - 450 in-lb (51 N·m)	650 in-lb (73 N·m) - 745 in-lb (84 N·m)
12	¾ in. (19 mm)	460 in-lb (52 N·m) - 550 in-lb (62 N·m)	900 in-lb (102 N·m) - 1000 in-lb (113 N·m)	460 in-lb (52 N·m) - 550 in-lb (62 N·m)	900 in-lb (102 N·m) - 1055 in-lb (119 N·m)
16	1 in. (25 mm)	500 in-lb (56 N·m) - 700 in-lb (79 N·m)	1200 in-lb (136 N·m) - 1400 in-lb (158 N·m)	750 in-lb (85 N·m) - 850 in-lb (96 N·m)	1200 in-lb (136 N·m) - 1400 in-lb (158 N·m)
20	1¼ in. (32 mm)	800 in-lb (90 N·m) - 900 in-lb (102 N·m)	1520 in-lb (172 N·m) - 1680 in-lb (190 N·m)	850 in-lb (96 N·m) - 1020 in-lb (115 N·m)	1520 in-lb (172 N·m) - 1825 in-lb (206 N·m)

*[1] Use these torque values when tube material itself is flared.

*[2] Use these torque values when both mating fittings are machined flared fittings, such as brazed ends, CryoFit, Boeing, DAC, Deutsch and roller swaged on fittings.

Table 203 Torque Values For Jam Nut Universal Fittings (AN832, AN833, and AN837) And Bulkhead Fittings

BOSS Dash Number	Tube O.D. of BOSS	Torque Values		
		Aluminum	Steel or Titanium	7D0045T (P/N 15924) Titanium
2	⅛ in. (3 mm)	25 in-lb (3 N·m) - 35 in-lb (4 N·m)	40 in-lb (5 N·m) - 55 in-lb (6 N·m)	N/A
3	3/16 in. (5 mm)	50 in-lb (6 N·m) - 65 in-lb (7 N·m)	60 in-lb (7 N·m) - 75 in-lb (8 N·m)	N/A
4	¼ in. (6 mm)	75 in-lb (8 N·m) - 100 in-lb (11 N·m)	90 in-lb (10 N·m) - 110 in-lb (12 N·m)	95 in-lb (11 N·m) - 110 in-lb (12 N·m)
5	5/16 in. (8 mm)	100 in-lb (11 N·m) - 130 in-lb (15 N·m)	140 in-lb (16 N·m) - 160 in-lb (18 N·m)	120 in-lb (14 N·m) - 140 in-lb (16 N·m)
6	⅜ in. (10 mm)	120 in-lb (14 N·m) - 150 in-lb (17 N·m)	150 in-lb (17 N·m) - 200 in-lb (23 N·m)	130 in-lb (15 N·m) - 150 in-lb (17 N·m)
8	½ in. (13 mm)	180 in-lb (20 N·m) - 230 in-lb (26 N·m)	200 in-lb (23 N·m) - 250 in-lb (28 N·m)	230 in-lb (26 N·m) - 250 in-lb (28 N·m)
10	⅝ in. (16 mm)	250 in-lb (28 N·m) - 280 in-lb (32 N·m)	500 in-lb (56 N·m) - 600 in-lb (68 N·m)	380 in-lb (43 N·m) - 420 in-lb (47 N·m)

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Table 203 Torque Values For Jam Nut Universal Fittings (AN832, AN833, and AN837) And Bulkhead Fittings (Continued)

BOSS Dash Number	Tube O.D. of BOSS	Torque Values		
		Aluminum	Steel or Titanium	7D0045T (P/N 15924) Titanium
12	¾ in. (19 mm)	420 in-lb (47 N·m) - 600 in-lb (68 N·m)	700 in-lb (79 N·m) - 800 in-lb (90 N·m)	410 in-lb (46 N·m) - 450 in-lb (51 N·m)
14	⅞ in. (22 mm)	500 in-lb (56 N·m) - 700 in-lb (79 N·m)	750 in-lb (85 N·m) - 850 in-lb (96 N·m)	700 in-lb (79 N·m) - 800 in-lb (90 N·m)
16	1 in. (25 mm)	600 in-lb (68 N·m) - 800 in-lb (90 N·m)	850 in-lb (96 N·m) - 950 in-lb (107 N·m)	850 in-lb (96 N·m) - 950 in-lb (107 N·m)
20	1¼ in. (32 mm)	600 in-lb (68 N·m) - 900 in-lb (102 N·m)	900 in-lb (102 N·m) - 1000 in-lb (113 N·m)	850 in-lb (96 N·m) - 950 in-lb (107 N·m)
24	1½ in. (38 mm)	600 in-lb (68 N·m) - 900 in-lb (102 N·m)	900 in-lb (102 N·m) - 1000 in-lb (113 N·m)	900 in-lb (102 N·m) - 1000 in-lb (113 N·m)

NOTE: Apply these torques to jam nuts (AN6289, AN924, NAS509 and P/N 15924 or 7D0045T) on positionable type fittings in Bosses, and on bulkhead unions.

Table 204 Torque Values For Straight Nonpositionable Fittings

BOSS Dash Number	Tube O.D. of BOSS	Torque Values	
		Aluminum	Steel or Titanium
2	⅛ in. (3 mm)	55 in-lb (6 N·m) - 65 in-lb (7 N·m)	65 in-lb (7 N·m) - 80 in-lb (9 N·m)
3	3/16 in. (5 mm)	70 in-lb (8 N·m) - 85 in-lb (10 N·m)	85 in-lb (10 N·m) - 100 in-lb (11 N·m)
4	¼ in. (6 mm)	80 in-lb (9 N·m) - 100 in-lb (11 N·m)	115 in-lb (13 N·m) - 135 in-lb (15 N·m)
5	5/16 in. (8 mm)	100 in-lb (11 N·m) - 130 in-lb (15 N·m)	160 in-lb (18 N·m) - 180 in-lb (20 N·m)
6	⅜ in. (10 mm)	120 in-lb (14 N·m) - 150 in-lb (17 N·m)	275 in-lb (31 N·m) - 320 in-lb (36 N·m)
8	½ in. (13 mm)	200 in-lb (23 N·m) - 250 in-lb (28 N·m)	575 in-lb (65 N·m) - 625 in-lb (71 N·m)
10	⅝ in. (16 mm)	275 in-lb (31 N·m) - 400 in-lb (45 N·m)	650 in-lb (73 N·m) - 750 in-lb (85 N·m)
12	¾ in. (19 mm)	450 in-lb (51 N·m) - 600 in-lb (68 N·m)	850 in-lb (96 N·m) - 950 in-lb (107 N·m)
16	1 in. (25 mm)	600 in-lb (68 N·m) - 900 in-lb (102 N·m)	950 in-lb (107 N·m) - 1050 in-lb (119 N·m)
20	1¼ in. (32 mm)	600 in-lb (68 N·m) - 900 in-lb (102 N·m)	950 in-lb (107 N·m) - 1050 in-lb (119 N·m)

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Table 204 Torque Values For Straight Nonpositionable Fittings (Continued)

BOSS Dash Number	Tube O.D. of BOSS	Torque Values	
		Aluminum	Steel or Titanium
24	1½ in. (38 mm)	700 in-lb (79 N·m) - 1000 in-lb (113 N·m)	950 in-lb (107 N·m) - 1050 in-lb (119 N·m)

NOTE: This includes AN806, AN814, AN815, AN819, MS21902, and MS21913 type fittings.
In cases where reducers or expanders are used, torque to size of boss.
Use aluminum torque values for aluminum, steel or titanium fittings installed in aluminum bosses and aluminum fittings installed in steel or titanium bosses.
Use steel or titanium torque values for steel or titanium fittings installed in steel or titanium bosses.

Table 205 Torque Values For NAS1022 Stop Nuts On Bulkhead Fittings

Fitting Dash Number	Tube O.D.	Nut Size	Torque Values	
			Aluminum	Steel *[1]
2	⅛ in. (3 mm)	5/16 - 24	60 in-lb (7 N·m) - 85 in-lb (10 N·m)	95 in-lb (11 N·m) - 110 in-lb (12 N·m)
3	3/16 in. (5 mm)	3/8 - 24	90 in-lb (10 N·m) - 110 in-lb (12 N·m)	190 in-lb (21 N·m) - 220 in-lb (25 N·m)
4	¼ in. (6 mm)	7/16 - 20	120 in-lb (14 N·m) - 130 in-lb (15 N·m)	285 in-lb (32 N·m) - 315 in-lb (36 N·m)
5	5/16 in. (8 mm)	1/2 - 20	170 in-lb (19 N·m) - 185 in-lb (21 N·m)	285 in-lb (32 N·m) - 315 in-lb (36 N·m)
6	⅜ in. (10 mm)	9/16 - 18	290 in-lb (33 N·m) - 310 in-lb (35 N·m)	400 in-lb (45 N·m) - 440 in-lb (50 N·m)
8	½ in. (13 mm)	3/4 - 16	580 in-lb (66 N·m) - 620 in-lb (70 N·m)	680 in-lb (77 N·m) - 720 in-lb (81 N·m)
10	⅝ in. (16 mm)	7/8 - 14	680 in-lb (77 N·m) - 720 in-lb (81 N·m)	950 in-lb (107 N·m) - 1050 in-lb (119 N·m)

*[1] Do not use steel self locking nuts on aluminum fittings or valves.

Table 206 Torque Values For Lipseal (Dynamic Beam) Coupling Nuts

Tube Dash Number	Tube O.D.	Torque Values *[1] Steel or Titanium	
		3000 PSI and Under Systems	4000 PSI Systems
3	3/16 in. (5 mm)	60 in-lb (7 N·m) - 108 in-lb (12 N·m)	84 in-lb (9 N·m) - 108 in-lb (12 N·m)
4	¼ in. (6 mm)	120 in-lb (14 N·m) - 168 in-lb (19 N·m)	144 in-lb (16 N·m) - 168 in-lb (19 N·m)
5	5/16 in. (8 mm)	120 in-lb (14 N·m) - 192 in-lb (22 N·m)	156 in-lb (18 N·m) - 192 in-lb (22 N·m)
6	⅜ in. (10 mm)	180 in-lb (20 N·m) - 300 in-lb (34 N·m)	240 in-lb (27 N·m) - 300 in-lb (34 N·m)

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Table 206 Torque Values For Lipseal (Dynamic Beam) Coupling Nuts (Continued)

Tube Dash Number	Tube O.D.	Torque Values *[1] Steel or Titanium	
		3000 PSI and Under Systems	4000 PSI Systems
8	½ in. (13 mm)	360 in-lb (41 N·m) - 480 in-lb (54 N·m)	420 in-lb (47 N·m) - 480 in-lb (54 N·m)
10	⅝ in. (16 mm)	492 in-lb (56 N·m) - 660 in-lb (75 N·m)	576 in-lb (65 N·m) - 660 in-lb (75 N·m)
12	¾ in. (19 mm)	600 in-lb (68 N·m) - 840 in-lb (95 N·m)	720 in-lb (81 N·m) - 840 in-lb (95 N·m)
14	⅞ in. (22 mm)	N/A	864 in-lb (98 N·m) - 1020 in-lb (115 N·m)
16	1 in. (25 mm)	840 in-lb (95 N·m) - 1128 in-lb (127 N·m)	1200 in-lb (136 N·m) - 1380 in-lb (156 N·m)
20	1¼ in. (32 mm)	1296 in-lb (146 N·m) - 1680 in-lb (190 N·m)	N/A
24	1½ in. (38 mm)	1500 in-lb (169 N·m) - 1980 in-lb (224 N·m)	N/A

*[1] Torque lipseal fitting jam nuts to the nominal value of corresponding fitting size.

Table 207 Torque Values For AN Type And Pipe-Thread Fittings

Tube Dash Number	Tubing O.D.	B-Nut Torque Values		Pipe Thread
		Aluminum	Steel	
	⅛ in. (3 mm)	N/A	N/A	40 in-lb (5 N·m) - 150 in-lb (17 N·m)
3	3/16 in. (5 mm)	N/A	100 in-lb (11 N·m) - 125 in-lb (14 N·m)	N/A
4	¼ in. (6 mm)	50 in-lb (6 N·m) - 60 in-lb (7 N·m)	135 in-lb (15 N·m) - 150 in-lb (17 N·m)	60 in-lb (7 N·m) - 200 in-lb (23 N·m)
4	¼ in. (6 mm)	50 in-lb (6 N·m) - 75 in-lb (8 N·m) *[1]	N/A	N/A
5	5/16 in. (8 mm)	70 in-lb (8 N·m) - 90 in-lb (10 N·m)	170 in-lb (19 N·m) - 200 in-lb (23 N·m)	N/A
5	5/16 in. (8 mm)	100 in-lb (11 N·m) - 125 in-lb (14 N·m) *[1]	N/A	N/A
6	⅜ in. (10 mm)	110 in-lb (12 N·m) - 130 in-lb (15 N·m)	270 in-lb (31 N·m) - 300 in-lb (34 N·m)	100 in-lb (11 N·m) - 400 in-lb (45 N·m)
6	⅜ in. (10 mm)	200 in-lb (23 N·m) - 250 in-lb (28 N·m) *[1]	N/A	N/A
8	½ in. (13 mm)	230 in-lb (26 N·m) - 260 in-lb (29 N·m)	450 in-lb (51 N·m) - 500 in-lb (56 N·m)	200 in-lb (23 N·m) - 500 in-lb (56 N·m)
8	½ in. (13 mm)	300 in-lb (34 N·m) - 400 in-lb (45 N·m) *[1]	N/A	N/A

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Table 207 Torque Values For AN Type And Pipe-Thread Fittings (Continued)

Tube Dash Number	Tubing O.D.	B-Nut Torque Values		Pipe Thread
		Aluminum	Steel	
10	⅝ in. (16 mm)	330 in-lb (37 N·m) - 360 in-lb (41 N·m)	650 in-lb (73 N·m) - 700 in-lb (79 N·m)	N/A
12	¾ in. (19 mm)	460 in-lb (52 N·m) - 500 in-lb (56 N·m)	900 in-lb (102 N·m) - 1000 in-lb (113 N·m)	N/A
16	1 in. (25 mm)	500 in-lb (56 N·m) - 700 in-lb (79 N·m)	1200 in-lb (136 N·m) - 1400 in-lb (158 N·m)	N/A
Pressure Regulator Connection		Nut Hex (Size)	Torque	N/A
		1⅛ in. (29 mm)	450 in-lb (51 N·m) - 500 in-lb (56 N·m)	N/A
NOTE: Torque to specified minimum value and check for leakage. If additional torque is required to stop leakage, torque may be applied in 10 in-lb (1 N·m) increments up to specified maximum value.				

*[1] This torque is for MS33583 double flare tube ends.

(5) Tube connection may be placed in service after 15 minutes. However, adhesive will cure to maximum strength in 24 hours.

4. Piping Coupling Nut Torque Values

A. Torque Values

(1) Torque coupling nut on flared piping. (Table 202)

NOTE: Use the torque based on the pipe material regardless of fitting or nut material.

(2) Torque coupling nuts to mid-range of applicable size. If joint leaks after torquing, disassemble joint, clean, relubricate and torque to higher value allowed. Do not exceed maximum torque value. If joint continues to leak with maximum allowable torque, replace defective item. (Table 203, Table 204, Table 205, Table 206, and Table 208)

(3) Torque lightweight coupling nuts to values as shown in Table 209.

5. Piping Repair for Dash 24 Aluminum Alloy Hydraulic Supply Piping

A. Repair Piping

(1) A repair to dash 24 aluminum alloy piping can be accomplished when a persistent hydraulic leak continues to exist after coupling nut has been torqued 900 in-lb (102 N·m) - 1200 in-lb (136 N·m), and provided that there are no cracks in pipe flare. Repair is effected by use of a Voi-Shan seal VSF1015 A24B installed between fitting and piping flare.

(2) After installation of seal, torque coupling nut to value as shown in Table 207.

Table 208 Torque Values For Flareless Coupling Nuts

Tube Dash Number	Tube O.D.	Torque Values			
		MS21922 Bite Type Sleeves		Machined Type Sleeves	
		Aluminum	Steel or Titanium	Aluminum	Steel or Titanium
3	3/16 in. (5 mm)	95 in-lb (11 N·m) - 105 in-lb (12 N·m)	95 in-lb (11 N·m) - 105 in-lb (12 N·m)	95 in-lb (11 N·m) - 105 in-lb (12 N·m)	95 in-lb (11 N·m) - 140 in-lb (16 N·m)

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Table 208 Torque Values For Flareless Coupling Nuts (Continued)

Tube Dash Number	Tube O.D.	Torque Values			
		MS21922 Bite Type Sleeves		Machined Type Sleeves	
		Aluminum	Steel or Titanium	Aluminum	Steel or Titanium
4	¼ in. (6 mm)	120 in-lb (14 N·m) - 135 in-lb (15 N·m)	135 in-lb (15 N·m) - 145 in-lb (16 N·m)	120 in-lb (14 N·m) - 140 in-lb (16 N·m)	135 in-lb (15 N·m) - 190 in-lb (21 N·m)
5	5/16 in. (8 mm)	135 in-lb (15 N·m) - 145 in-lb (16 N·m)	170 in-lb (19 N·m) - 190 in-lb (21 N·m)	135 in-lb (15 N·m) - 180 in-lb (20 N·m)	170 in-lb (19 N·m) - 240 in-lb (27 N·m)
6	⅜ in. (10 mm)	190 in-lb (21 N·m) - 215 in-lb (24 N·m)	215 in-lb (24 N·m) - 245 in-lb (28 N·m)	190 in-lb (21 N·m) - 215 in-lb (24 N·m)	215 in-lb (24 N·m) - 280 in-lb (32 N·m)
8	½ in. (13 mm)	340 in-lb (38 N·m) - 380 in-lb (43 N·m)	470 in-lb (53 N·m) - 550 in-lb (62 N·m)	340 in-lb (38 N·m) - 380 in-lb (43 N·m)	470 in-lb (53 N·m) - 550 in-lb (62 N·m)
10	⅝ in. (16 mm)	380 in-lb (43 N·m) - 450 in-lb (51 N·m)	620 in-lb (70 N·m) - 700 in-lb (79 N·m)	380 in-lb (43 N·m) - 450 in-lb (51 N·m)	620 in-lb (70 N·m) - 745 in-lb (84 N·m)
12	¾ in. (19 mm)	400 in-lb (45 N·m) - 470 in-lb (53 N·m)	855 in-lb (97 N·m) - 945 in-lb (107 N·m)	460 in-lb (52 N·m) - 550 in-lb (62 N·m)	855 in-lb (97 N·m) - 1055 in-lb (119 N·m)
14	⅞ in. (22 mm)	N/A	900 in-lb (102 N·m) - 1100 in-lb (124 N·m)	N/A	900 in-lb (102 N·m) - 1100 in-lb (124 N·m)
16	1 in. (25 mm)	750 in-lb (85 N·m) - 850 in-lb (96 N·m)	1140 in-lb (129 N·m) - 1260 in-lb (142 N·m)	750 in-lb (85 N·m) - 850 in-lb (96 N·m)	1140 in-lb (129 N·m) - 1370 in-lb (155 N·m)
20	1¼ in. (32 mm)	N/A	1520 in-lb (172 N·m) - 1680 in-lb (190 N·m)	850 in-lb (96 N·m) - 1020 in-lb (115 N·m)	1520 in-lb (172 N·m) - 1825 in-lb (206 N·m)
24	1½ in. (38 mm)	N/A	1900 in-lb (215 N·m) - 2100 in-lb (237 N·m)	900 in-lb (102 N·m) - 1080 in-lb (122 N·m)	1900 in-lb (215 N·m) - 2280 in-lb (258 N·m)

Table 209 Torque Values For Lightweight Coupling Nuts

Tube Dash Number	Tube O.D.	Torque Values *[1]	
		Aluminum	Steel or Titanium
4	¼ in. (6 mm)	60 in-lb (7 N·m) - 96 in-lb (11 N·m)	60 in-lb (7 N·m) - 96 in-lb (11 N·m)
5	5/16 in. (8 mm)	70 in-lb (8 N·m) - 108 in-lb (12 N·m)	70 in-lb (8 N·m) - 108 in-lb (12 N·m)
6	⅜ in. (10 mm)	90 in-lb (10 N·m) - 120 in-lb (14 N·m)	90 in-lb (10 N·m) - 120 in-lb (14 N·m)
8	½ in. (13 mm)	160 in-lb (18 N·m) - 216 in-lb (24 N·m)	170 in-lb (19 N·m) - 232 in-lb (26 N·m)
10	⅝ in. (16 mm)	260 in-lb (29 N·m) - 360 in-lb (41 N·m)	260 in-lb (29 N·m) - 360 in-lb (41 N·m)
12	¾ in. (19 mm)	400 in-lb (45 N·m) - 540 in-lb (61 N·m)	400 in-lb (45 N·m) - 540 in-lb (61 N·m)
16	1 in. (25 mm)	520 in-lb (59 N·m) - 696 in-lb (79 N·m)	520 in-lb (59 N·m) - 696 in-lb (79 N·m)
20	1¼ in. (32 mm)	700 in-lb (79 N·m) - 900 in-lb (102 N·m)	700 in-lb (79 N·m) - 900 in-lb (102 N·m)

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Table 209 Torque Values For Lightweight Coupling Nuts (Continued)

Tube Dash Number	Tube O.D.	Torque Values *[1]	
		Aluminum	Steel or Titanium
24	1½ in. (38 mm) *[2]	900 in-lb (102 N·m) - 1200 in-lb (136 N·m)	900 in-lb (102 N·m) - 1200 in-lb (136 N·m)

*[1] For DMS 2014 hydraulic system tubing, lubricate O.D. of the tube flare with DPM 5073 assembly lubricant or system fluid prior to torquing.

*[2] On 1½ in. (38 mm) hydraulic suction line fittings, apply two drops of DPM 6082-4 (Loctite 242).

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PROTECTION, ELECTRICAL WIRING INTERCONNECT SYSTEM (EWIS) - MAINTENANCE PRACTICES

1. General

A. This procedure has the instructions for the protection of the aircraft Electrical Wiring Interconnect Systems (EWIS) components during maintenance.

B. The temporary installation of wire protection is to prevent damage to the wires and wire bundles from contamination during maintenance (for example repairs, cleaning, removal and installation). The frequent removal of contamination and constant observation to prevent damage will keep the EWIS components in a serviceable condition.

C. This procedure meets the EWIS requirements. The term EWIS means one or more wires, wiring devices, or a combination of these, that include termination devices installed in the aircraft for electrical energy to be transmitted between two or more termination points.

D. Not all EWIS components are resistant to all chemical contamination. It is important to install protection around all electrical wires, wire bundles and their components. This will keep the EWIS components in a serviceable condition.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Name and Number	Manufacturer
Bag - polyethylene DPM 660 MIL-B-117	
Barrier material - greaseproof, waterproof DPM 678 (MIL-B-121 Type 1 Grade A, Class 1)	
Cushioning material - plastic transparent, cellular (small cell) DPM 3196-1	
Film - polyethylene DPM 661 (PS-17-69)	
Paper - greaseproof, waterproof DPM 634 (MIL-PRF-121)	
Paper - Kraft, neutral DPM 640 (MIL-P-17667, Type 1)	
Tape - adhesive polyethylene, weather resistant DPM 871-2	

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(Continued)

Name and Number	Manufacturer
Tape - adhesive, cloth-backed waterproof DPM 871-3 (PPP-T-60, Type 4, Class 1)	
Tape - adhesive, polyester, filament form DPM 5597	
Tape, adhesive aluminum backed DPM 2215	

3. Protection of Electrical Wiring Interconnect System (EWIS) Components During Maintenance

A. Protection of Electrical Wiring Interconnect System (EWIS) Components During Maintenance

CAUTION: DO NOT LET ELECTRICAL WIRING INTERCONNECT SYSTEM (EWIS) COMPONENTS BECOME DAMAGED FROM CONTAMINATION DURING MAINTENANCE PROCEDURES. THIS WILL HELP PREVENT DAMAGE TO EWIS COMPONENTS AND THEIR CONNECTIONS.

CAUTION: DO NOT PULL, STEP ON OR USE A WIRE OR WIRE BUNDLE AS A HANDHOLD. DO NOT MOVE A WIRE OR WIRE BUNDLE TO CAUSE A STRAIN TO THE ASSEMBLY. THIS WILL HELP PREVENT DAMAGE TO ELECTRICAL WIRING INTERCONNECT SYSTEM (EWIS) COMPONENTS.

(1) Prepare the work area around the EWIS components as follows:

(a) Identify the possible source or sources of contamination in the work area. Typical sources of contamination are as follow:

- Hydraulic fluids
- Battery electrolytes
- Fuels
- Deicing fluids
- Solvents
- Corrosion Inhibiting Compounds (CIC)
- Waste system chemicals
- Cleaning agents
- Paints
- Paint strippers
- All other unwanted materials.

(b) If contamination is possible, apply the appropriate protection to the EWIS components as follows:

1) If the contamination is hydraulic fluids, battery electrolytes, fuels, deicing fluid, solvents, cleaning agents, or paints, use the greaseproof, waterproof barrier material (DPM 634) or (DPM 678) or polyethylene film (DPM 661). If you use the greaseproof, waterproof barrier material, put the polyethylene side against the component.

2) If the contamination is one or more types of oil and grease, use the greaseproof paper (DPM 634).

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3) If the contamination is paint strippers or waste system chemicals, attach the polyethylene plastic (DPM 661) with aluminum backed adhesive tape (DPM 2215).

NOTE: Paint strippers and waste system chemicals cause corrosion to EWIS components. The aluminum tape seals the edges of the polyethylene film to improve the protection.

4) If the contamination is identified as unwanted material, use the applicable protection that follows:

- neutral kraft paper (DPM 640)
- polyethylene bag (DPM 660)
- polyethylene film (DPM 661)
- cushioning material (DPM 3196-1)

5) Install the applicable protection as follows:

a) Attach the applicable protection to the aircraft structure with one or more of the materials that follow:

polyethylene masking tape (DPM 871-2)

adhesive tape (DPM 871-3)

filament form polyester adhesive tape (DPM 5597)

b) Do not attach the protection to an EWIS component, duct or sound blanket insulation, sidewall or ceiling panel surface with an adhesive tape.

NOTE: Some tape adhesives could cause damage to the applicable surface or EWIS component during removal.

c) Make sure that the protection is in a shape to collect and contain the contamination.

(c) Keep tools, tool trays, and other work items off of the wires or wire bundles.

B. Job Close-up

CAUTION: DO NOT LET THE CONTAMINATION BEING REMOVED CAUSE THE CONTAMINATION OF ADJACENT ELECTRICAL WIRING INTERCONNECT SYSTEM (EWIS) COMPONENTS. THIS WILL HELP PREVENT DAMAGE TO ELECTRICAL SYSTEMS.

(1) Collect and remove the loose contamination (solid and liquid) from around the EWIS components in the work area. Do not remove the installed protection until this is done.

(2) Remove all the installed protection from the work area as follows:

(a) Make sure that all the contamination found on the installed protection is carefully contained.

(b) Carefully control the removal of the installed protection to prevent the contamination of the other components in the area.

(3) Examine the EWIS components for damage from contamination during the removal of the installed protection. No damage to an EWIS component is permitted.

NOTE: Cuts, tears and holes can occur during the removal of the installed protection. The same cuts, tears and holes could be an indication of possible damage to an EWIS component.

(a) If necessary, clean all contamination from the wires or wire bundles with the applicable procedure. Refer to Standard Wiring Practice Manual (SWPM) 20-10-10, WIRE HARNESS and COMPONENT CLEANING.

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ELECTRICAL WIRING INTERCONNECT SYSTEMS - INSPECTION/CHECK

1. General

A. This procedure contains MSG-3task card data.

TASK 20-50-00-210-801

2. General Visual Wiring Inspection, Electrical Wiring Interconnect System (EWIS)

NOTE: This procedure is a scheduled maintenance task.

A. General

(1) This procedure performs a general visual inspection of the wiring.

(2) This procedure is an enhanced zonal analysis procedure (EZAP) task.

B. Tools/Equipment

Reference	Description
STD-123	Brush - Soft Bristle
STD-10711	Shop Vacuum (400Hz if using aircraft power)

C. Procedure

SUBTASK 20-50-00-010-001

(1) Remove panels as necessary to gain access to the wiring.

SUBTASK 20-50-00-210-001

(2) Do these steps to perform a general visual inspection of the wire bundles:

NOTE: You do not need to pull on the wire bundles, shake the wire bundles, or disconnect the connectors to perform this inspection.

(a) Check the wire bundles and the area around them for combustible material.

NOTE: It is expected that the area to be inspected is clean enough to minimize the possibility that accumulated dirt, lint, fibers or grease might hide unsatisfactory conditions that would otherwise be obvious. Any cleaning that is considered necessary should be performed in accordance with accepted procedures in order to minimize the possibility of the cleaning process itself introducing anomalies.

1) Remove loose contamination by hand.

2) Use a vacuum, STD-10711 to remove accumulations of dust and lint.

3) Use a soft bristle brush, STD-123 to loosen accumulations of dust that remain and vacuum the area again.

(b) Check the wire and the wire harnesses for: contact, chafing, sagging, security, visible damage, lacing tape/ties installation, sheath/conduit deformity or installation, end of sheath rubbing on end attachment, missing or damaged grommets, dust and lint accumulation, surface contamination, deterioration of previous repairs.

(c) Check connectors for: external corrosion, backshell tail, rubber pad/packing on backshell, backshell wire securing device, fool proofing chain, missing or broken safety wire, discoloration or evidence of overheat on terminal lugs or blocks, torque stripe misalignment.

(d) Check switches for rear protection cap damage.

(e) Check ground points for: corrosion, bonding braid/bonding jumper, broken or disconnected braid, multiple strands corroded or broken.

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(f) Check wiring clamps or brackets for: presence, corrosion, condition, bends or twists, attachment, protection/cushion.

(g) Check supports (rails or tubes/conduit) for: breaks, deformity, missing fasteners, missing edge protection on rims of feed through holes, race track cushion damage.

(h) Repair or replace any wire bundles found with defects.

SUBTASK 20-50-00-410-001

(3) Install all panels removed for access .

——— END OF TASK ———

TASK 20-50-00-211-801

3. Detailed Wiring Inspection, Electrical Wiring Interconnect System (EWIS)

NOTE: This procedure is a scheduled maintenance task.

A. General

(1) This procedure performs a detailed inspection of the wiring.

(2) This procedure is an enhanced zonal analysis procedure (EZAP) task.

B. Tools/Equipment

Reference	Description
STD-123	Brush - Soft Bristle
STD-10711	Shop Vacuum (400Hz if using aircraft power)

C. Procedure

SUBTASK 20-50-00-010-002

(1) Remove panels as necessary to gain access to the wiring.

SUBTASK 20-50-00-211-001

(2) Do these steps to perform a detailed inspection of the wire bundles:

NOTE: You do not need to pull on the wire bundles, shake the wire bundles, or disconnect the connectors to perform this inspection.

(a) Check the wire bundles and the area around them for combustible material.

NOTE: It is expected that the area to be inspected is clean enough to minimize the possibility that accumulated dirt, lint, fibers or grease might hide unsatisfactory conditions that would otherwise be obvious. Any cleaning that is considered necessary should be performed in accordance with accepted procedures in order to minimize the possibility of the cleaning process itself introducing anomalies.

1) Remove loose contamination by hand.

2) Use a vacuum, STD-10711 to remove accumulations of dust and lint.

3) Use a soft bristle brush, STD-123 to loosen accumulations of dust that remain and vacuum the area again.

(b) Check the wire and the wire harnesses for: contact, chafing, sagging, security, visible damage, lacing tape/ties installation, sheath/conduit deformity or installation, end of sheath rubbing on end attachment, missing or damaged grommets, dust and lint accumulation, surface contamination, deterioration of previous repairs.

(c) Check connectors for: external corrosion, backshell tail, rubber pad/packing on backshell, backshell wire securing device, fool proofing chain, missing or broken safety wire, discoloration or evidence of overheat on terminal lugs or blocks, torque stripe misalignment.

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(d) Check switches for rear protection cap damage.

(e) Check ground points for: corrosion, bonding braid/bonding jumper, broken or disconnected braid, multiple strands corroded or broken.

(f) Check wiring clamps or brackets for: presence, corrosion, condition, bends or twists, attachment, protection/cushion.

(g) Check supports (rails or tubes/conduit) for: breaks, deformity, missing fasteners, missing edge protection on rims of feed through holes, race track cushion damage.

(h) Repair or replace any wire bundles found with defects.

SUBTASK 20-50-00-410-002

(3) Install all panels removed for access .

——— END OF TASK ———

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WIRING AND CABLES - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides repair instructions for wires and cables, and methods for splicing wires and cables.

CAUTION: DO NOT SPLICE, SOLDER, OR TAPE DAMAGED WIRE UNLESS INVESTIAGTION PROVES THAT SYSTEM INTEGRITY WILL NOT BE AFFECTED. IF EXACT SIZE OF REPLACEMENT WIRE IS NOT AVAILABLE, DO NOT USE SMALLER SIZE WIRE. USE OF SMALLER SIZE WIRE CAN RESULT IN BURNED WIRING OR MALFUNCTIONING EQUIPMENT.

B. Splicing of power cables must be accomplished per Wiring Diagram Manual only.

The only areas where splices to power cables are permitted are:

(1) Stations 218 to 237 in Forward Cargo Compartment.

(2) Stations 1250 to 1271 in Aft Cargo Compartment.

Splices to power cables in conduits or troughs, or under lavatories, are not permitted.

(3) Splices of any type, including crimp or solder type, are not allowed on wires in the fuel tank or on wires inside conduits that are in the fuel tank.

(a) The above step is a Critical Design Configuration Control Limitation (CDCCL) procedure. For important information on CDCCLs, refer to Airworthiness Limitation Precautions (GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 28-00-00/201).

(4) Power feeders above any fuel tank are maintained without splices. Any needed repair splice needs to be implemented at a location at least 3 feet or 2 wire supports (whichever is further) from the fuel tank boundaries.

(a) The above step is a CDCCL procedure. For important information on CDCCLs, refer to Airworthiness Limitation Precautions (GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 28-00-00/201).

C. Repair of wiring within 6 in. of fuel tanks and fuel pipes must use existing wire routing and clipping established per OEM-approved wire installation or maintain wire clearances.

(1) The above step is a CDCCL procedure. For important information on CDCCLs, refer to Airworthiness Limitation Precautions (GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 28-00-00/201).

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Cleaner, Hand Wipe, Brulin MP 1793, DPM 6380-1	Brulin Company, Inc. Richmond, CA
Cleaner, Hand Wipe, EPA 2000, DPM 6380-2	Western Chemical International, Inc. Scottsdale, AZ
Cleaner, Hand Wipe, PF Degreaser, DPM 6380-3	P-T Technologies, Inc. Safety Harbor, FL

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Table 201 (Continued)

Name and Number	Manufacturer
Wire Repair, Liquid-H, 1599-1 DPM 6397	
Plastic film tape, colored adhesive PPP-T-66, Type 1, Class B/2 DPM 853	
Adhesive tape, TFE natural, 1/2 inch width, Type TV-350 DMS 5230-2	Connecticut Hard Rubber Co.
Tape, electrical insulation, 600T series, Type 2 DMS 2186	Moxness Products Inc.
Tape, electrical insulation, RS-SA Series, Type 1 DMS 2186	Moxness Products Inc.
Tape, Teflon, pressure sensitive, adhesive DPM 2306	
Tape, tying, glass fiber DMS 2089	
Tape, lacing and tying 50NOF17W DPM 731-4	Minnesota Mining and Manufacturing Co.
Tape 8671, DPM 5777-1	Minnesota Mining and Manufacturing Co.
Nylon coating, two-part (clear), Chem-on CS7707 DPM 2389	Chem Seal Corp. of America
Thermogun, model 500A, 500°F - 700°F	Rayclad Tubes Inc.
Thermogun, model 500B,	Raychem Corp.
4C Hotweezer	Meisei Corp.
Solder sleeve splice D-144-XX	Rayclad Tubes Inc.
Sealing sleeve (meltable insert tubing) D-502-24, D-505-25	Rayclad Tubes Inc.
Zap gun, model IR-1034	Rayclad Tubes Inc.
Heat reflector TG14A	Rayclad Tubes Inc.
Holding device AD-1319	Rayclad Tubes Inc.
Crimp splice YSVXXX	Burndy Corp.
Sleeves, heat shrinkable, electrical splice D-420-00, D-420-01, D-436-09 DPM 5350	Raychem Corp.
Sleeving, Glass Fiber Braid, Silicone, Elastomer coated Type 1 #Ben-Har 1151 FR-B DMS 2109	Bently Harris Mfg. Co. Lionville, PA
Tubing, teflon, heat shrinkable dual wall, penntube WTF DPM 6058	Pennsylvania Fluorcarbon Co., Inc.
T splice YST2626G3	Burndy Corp.
Tubing, heat shrinkable, polyolefin, highly flexible, 2X expansion, thermofit RT-876 DMS 2380	Raychem Corp.
Multisplice YRV2CV6CL	Burndy Corp.
Tubing, heat shrinkable, rigid irradiated, polyolefin, dual wall, selectively cross linked, colored, thermofit SCL DMS 2381	Raychem Corp.
Tubing, heat shrinkable dual wall, polyolefin, flexible DPM 6362	

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Table 201 (Continued)

Name and Number	Manufacturer
Tubing, heat shrinkable, colored RNF100, Type 2 DMS 2380	Raychem Corp.
Sta-strap SST2S	Panduit Corp. Tinley Park, IL
Sleeve splice YSM28	Burndy Corp.
Splice encapsulator 422B013	Rayclad Tubes Inc.
Crimping tool MRB-4	Burndy Corp.
Crimping tool Y29B	Burndy Corp.
Thermal stripping tool, Stripall Model TW-6	Teledyne Kinetics
M-10 Thermal stripper, power supply	Meisei Corp.
RTV-88 sealant with RTV-9910 catalyst DMS 1799	General Electric Company
Thermogun, model 750 750°F - 1000°F	Rayclad Tubes Inc.
Heat reflector TG12	Rayclad Tubes Inc.
Abrasive finishing paper 320-grit	
Braycote No. 103 DPM 667	
Glyptal Red 1201 DPM 5628	General Electric Co.
MPK Blend Solvent DMS 2458	Chemetall Oakite, La Mirada, CA
Solvent, isopropyl alcohol DPM 530	
Abrasive rod 240-grit	
Cloth, Emery 320 grit DPM 5566	

3. Wire/Cable Repair

A. Repair Wire/Cable (Polyimide) Insulation

(1) If polyimide (Kapton) tapes under the Liquid-H topcoat is not damaged, repair insulation as follows:

NOTE: This method does not improve the integrity of the wire. It improves the appearance of the wire only.

(a) Abrade the scuffed or scraped area.

(b) Apply a brush coat of Liquid-H repair over and at least 1/4 inch beyond each end of scuffed or scraped area. Allow Liquid-H to dry for a minimum of 20 minutes.

(2) If insulation is cut or ripped, but first layer of insulation next to conductor is not damaged, repair insulation as follows:

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- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(a) Clean damaged area with hand wipe cleaner, DPM 6380-1, DPM 6380-2, or DPM 6380-3. Allow surface to dry.

(b) Apply 1 1/2 to 2 1/2 wraps of plastic film tape over damaged area.

(c) Tension spiral wrap TFE adhesive tape, overlapping 1/2 to 3/4 inch (12.7 to 19.1 mm) beyond each end of plastic film tape.

(d) Using a model 500A or 500B thermogun with vent set to open position, apply heat to tape 15 to 20 seconds for 24 to 20 gage wire, 20 to 30 seconds for wire larger than 20 gage.

(3) When repair requires removal of the protective Bentley-Harris 1151 FR-B-1.0 sleeving: (Galley Power Feeders, Right Side Cabin) (Figure 201)

(a) Reinstall Ben-Har 1151 FR-B sleeving with a 33 percent or more overlap.

(b) String tie using fiberglass tying tape or secure with SST2S sta-straps at intervals not to exceed 2.00 inches (50.8 mm) on sleeving.

B. Repair Wire/Cable Braided Covering

NOTE: If more than 10 percent of braided covering thickness is loose or missing and/or loose fibre threads exceed 1/16 inch (1.6 mm) in length, braided covering may be repaired by either of the following methods:

(1) Repair wire/cable as follows:

(a) Lay in loose fibre threads as neatly as possible.

(b) Apply two coats of nylon coating over damaged area, extending at least 1/2 inch (12.7 mm) beyond each end of damaged area. Allow coating to air-dry 15 minutes between coats.

C. Repair Power Feeder Cables

(1) Scuffed or abraded jacket without damage to primary insulation.

(a) Wrap cable using 8671 tape, DPM 5777-1. Tape to extend 2 inches (50.8 mm) on either side of jacket damage.

(b) String tie ends of tape using Air-Tex 17X lacing tape.

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(2) Damaged jacket and primary insulation. Primary insulation abraded or primary insulation can be abraded through to conductor with no broken conductor strands.

(a) Trim cable jacket to provide 1/2-inch (12.7 mm) exposed insulation around damaged insulation.

WARNING: SILICONE SEALANT IS AN AGENT THAT IS POISONOUS, CARGINOGENIC, CORROSIVE, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN SILICONE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE DUST OR GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(b) Apply RTV-9910 silicone sealant to damaged area. Cover entire area extending one inch beyond damaged area with 1/32 inch (0.0313 mm) approximately, coat of sealant.

NOTE: Sealant must be applied within 2 hours of mixing.

(c) Wrap cable using 600-T tape. Start wrap 4 inches (101.6 mm) from damaged area. Proceed over damaged area, then continue 4 inches (101.6 mm) beyond.

NOTE: Wrap with 50 percent overlap; center line on outside of wrap with edge of tape on center line. Pull firmly on tape when wrapping so tape will stretch slightly. However, over damaged area, do not pull on tape so firmly as to squeeze sealant away from damaged area.

(d) String tie ends of tape using Air-Tex 17X lacing tape.

(3) If power feeder cable is to be replaced, refer to following for terminal lug data.

Table 202

Stud Inch	Size (mm)	Term. Code	Part Number	Configu-ration	Aluminum Wire Gage	Strip Dimension
5/16	7.94	856	65025	Straight	00	1.88(±0.031) inches
3/8	9.53	857	65026	Straight	00	(47.8(±0.787) mm)

D. Repair Aluminum Power Feeder Cables

(1) Scuffed or abraded jacket without damage to primary insulation.

(a) Wrap cable using 8561 tape, tape to extend 2 inches (50.8 mm) beyond jacket damage on both sides.

(b) String tie ends of tape using 50N0F17 lacing tape.

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(2) Damage jacket and primary insulation. Primary insulation abraded or primary insulation can be abraded through to conductor with no broken conductor strands.

NOTE: This repair may not be accomplished under a clamp.

(a) Trim cable jacket to provide 1/2 inch (12.7 mm) exposed insulation around damaged area.

WARNING: SILICONE SEALANT IS AN AGENT THAT IS POISONOUS, CARGINOGENIC, CORROSIVE, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN SILICONE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE DUST OR GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(b) Apply RTV-88 sealant with RTV-9910 catalyst to damaged area, cover the entire area extending 1 inch (25.4 mm) beyond damaged area with an approximate 1/32 inch (0.79 mm) thick coat of sealant.

NOTE: Sealant must be applied within two hours of mixing.

(c) Wrap cable using 600-T Series type 2 tape, start wrap 4 inches (98.0 mm) from damaged area, proceed over damaged area, then continue 4 inches (98.0 mm) beyond.

NOTE: Wrap with 50 percent overlap; center line on outside of wrap with edge of tape on centerline. Pull firmly on tape when wrapping so tape will stretch slightly. However, do not pull on tape so firmly as to squeeze sealant away from damaged area.

(d) String tie ends of tape using 50N0F17W lacing area.

E. Repair Copper Power Feeder Cable

(1) Scuffed or abraded jacket without damage to primary insulation.

(a) Wrap cable using RS-SA-Series tape using 50 percent overlap, tape to extend 2 inches (50.8 mm) beyond jacket damage on both sides.

(2) Damage jacket and primary insulation. Primary insulation abraded or primary insulation can be abraded through to conductor with no broken conductor strands.

NOTE: The natural color of Kapton insulation is amber and it appears similar to copper. Suspect areas should be closely checked to distinguish between Kapton and worn conductors.

This repair may not be accomplished under a clamp.

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(a) Trim cable jacket to provide 1/2 inch (12.7 mm) exposed insulation around damaged area.

WARNING: SILICONE SEALANT IS AN AGENT THAT IS POISONOUS, CARGINOGENIC, CORROSIVE, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN SILICONE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SILICONE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE DUST OR GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(b) Apply RTV-88 sealant with RTV-9910 catalyst to the damaged area, cover entire area extending 1 inch (25.4 mm) beyond damaged area with an approximate 1/32 inch (0.79 mm) thick coat of sealant.

NOTE: Sealant must be applied within 2 hours of mixing.

(c) Wrap cable using RS-SA-Series tape, start wrap 4 inches (101.6 mm) from damaged area, proceed over damaged area, then continue four inches (101.6 mm) beyond.

NOTE: Wrap with a 50 percent overlap; center line on outside of wrap with edge of tape on centerline. Pull firmly on tape when wrapping so tape will stretch slightly. However, over damaged area do not pull on tape so firmly as to squeeze sealant away from damaged area.

WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, A SENSITIZER, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, A REDUCER, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, POISONOUS, A REDUCER, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(3) Scuffed or abraded outer insulation without damage to primary green inner insulation, damage is contained to outer white insulation only (for "Superflex" cable).

(a) Clean damaged area and at least 1/2 inch (12.7 mm) beyond each end using kimwipes dampened with hand wipe cleaner, DPM 6380-1, DPM 6380-2, or DPM 6380-3. Allow damaged area to dry.

(b) Apply sufficient tension to wrap 1 1/2 to 2 1/2 layers of white plastic tape over damage area. Tape should lie smoothly on insulation surface with no wrinkles or creases.

(c) Apply sufficient tension and spiral wrap 1/2 inch (12.7 mm) wide of TFE tape over and at least 1/2 inch (12.7 mm) beyond each end of white tape. Overlap TFE tape at least fifty percent on itself. Wrap TFE tape smoothly on white plastic tape with no wrinkles or creases.

(d) Heat TFE tape with a thermogun model 500B.

(e) Heat tape for 25-30 seconds, then allow to cool to room temperature.

(4) Scuffed or abraded outer insulation with damage to the primary green inner insulation and 12 nicked, cut or severed strands for 2 gauge wire. It is permissible to have 20 strands nicked, cut or severed for 1/0 gauge wire. (Figure 202)

(a) Abrade the surface area 1.5 to 2 inches (38.1 to 50.8 mm) on each side of damage area with medium range emery cloth.

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WARNING: ISOPROPYL ALCOHOL IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN ISOPROPYL ALCOHOL IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ISOPROPYL ALCOHOL IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(b) Clean the cable jacket with isopropyl alcohol.

(c) Split the dual wall heat shrinkable tubing lengthwise and center over the damage area.

(d) Wrap Teflon tape (3/4 inch wide) around the dual wall tubing and at least 1/2 inch (12.7 mm) beyond each end. Overlap Teflon tape at least fifty percent on itself. Wrap Teflon tape smoothly with no wrinkles or creases.

(e) Heat the Teflon tape with a thermogun model 500B until adhesive is thoroughly melted.

(f) Secure both ends of the tape with tie tape.

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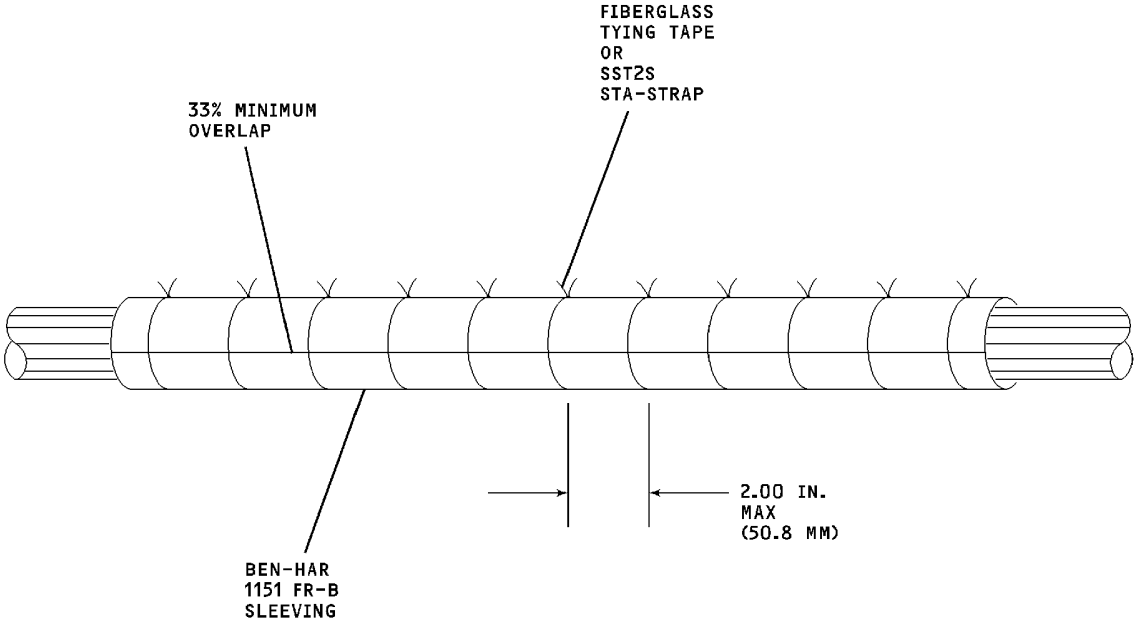

Glass Fiber Braid Sleeving Installation
Figure 201/20-50-01-990-801

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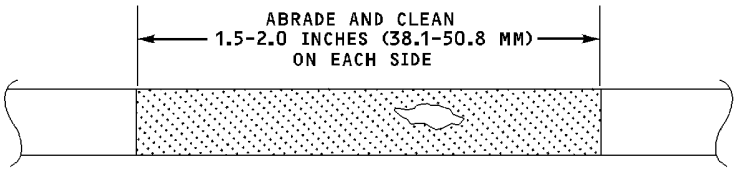
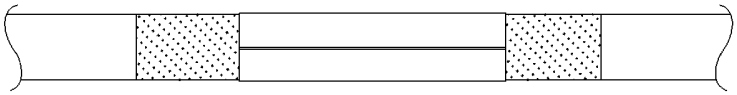
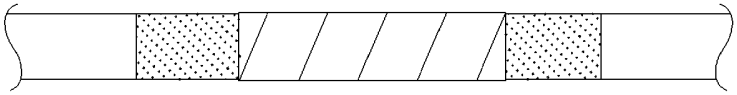


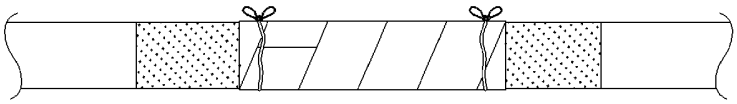
ABRADE AND CLEAN CABLE



CENTER DUAL WALL TUBING



WRAP TELFON TAPE APPLYING PRESSURE



SECURE ENDS OF TAPE

CAG(IDGS)

BBB2-20-139

Repair of Power Feeder Cable - Superflex
Figure 202/20-50-01-990-802

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4. Wire Splicing

A. If damage to a wire involves more than the outer jacket (layer of insulation next to the conductor is damaged), the wire must be spliced.

(1) Splices of any type, including crimp or solder type, are not allowed on wires in the fuel tank or on wires inside conduits that are in the fuel tank.

(a) The above step is a CDCCL procedure. For important information on CDCCLs, refer to Airworthiness Limitation Precautions (GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 28-00-00/201).

(2) Power feeders above any fuel tank are maintained without splices. Any needed repair splice needs to be implemented at a location at least 3 feet or 2 wire supports (whichever is further) from the fuel tank boundaries.

(a) The above step is a CDCCL procedure. For important information on CDCCLs, refer to Airworthiness Limitation Precautions (GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 28-00-00/201).

B. Two methods of wire splicing are used; solder sleeves and crimping. The solder sleeve splice method is used for both single and multiple conductor applications.

NOTE: Solder sleeve splices are preferred and should be used whenever possible except in high temperature areas. Crimp sleeve splices are used in high temperature areas and may be used in inaccessible areas where the zap gun cannot be used.

C. The crimp splice method may be a standard two-wire crimp application, or in cases of large gauge wire, it may be a special crimp application, such as a T splice, a step-down, multi-splice, or a splice sleeve.

D. Solder Sleeve Splice - Two Wire

(1) Strip 1/2(±1/16) inch (12.7(±1.6) mm) of insulation from wire ends. (Figure 203)

(2) Select appropriate solder sleeve splice. (Table 203)

(3) Insert ends of wires into solder sleeve splice.

(4) Overlap bared wire conductors and position solder ring (located inside solder sleeve splice) over center of conductors. (Figure 203)

NOTE: Solder sleeve splice may be installed (shrunk) using either a zap gun, model IR-1034 (Rayclad Tubes Inc.) or a thermogun, model 500A or 500B (Rayclad Tubes Inc.).

(5) Install (shrink) solder sleeve splice with zap gun as follows:

(a) Before operating gun, make certain gun reflector and monocle are clean. Monocle must be fully inserted into slot with reflector surface of monocle facing interior of gun.

(b) Allow gun to warm up by depressing actuator switch two or three times.

(c) Release and remove nose cone from gun.

CAUTION: SOLDER SLEEVE SPLICE MUST LAY STRAIGHT IN NOSE CONE. SAGGING OR BOWING OF SOLDER SLEEVE SPLICE CAN RESULT IN UNSATISFACTORY SPLICE.

(d) Place solder sleeve splice into center of nose cone, and secure in place with clamps.

(e) Mount and lock gun to nose cone.

(f) Select correct timer setting, and set timer knob. (Table 203)

WARNING: AVOID BREATHING FUMES GENERATED BY SOLDER SLEEVE SHRINKING.

(g) Depress actuator switch.

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(h) Wait at least 5 seconds after end of heating cycle before removing completed solder sleeve splice from nose cone.

(6) Install (shrink) solder sleeve splice with thermogun as follows:

(a) Insert TG14A heat reflector.

(b) Set thermogun vent to open position.

(c) Allow gun to warm up approximately 1 minute.

(d) Place splice in AD-1319 holding device.

WARNING: AVOID BREATHING FUMES GENERATED BY SOLDER SLEEVE SHRINKING.

(e) Apply hot air until solder has completely melted and flowed.

(f) Immediately remove gun and deflector from splice assembly.

(g) Allow solder sleeve splice to cool for at least five seconds before unclamping from holding fixture or moving wires.

(h) Switch gun to "COOL" position and allow gun to cool for one minute before turning off.

(7) Check solder sleeve splice for proper installation. (Paragraph 4.F.)

E. Solder Sleeve Splice - Multiple Wire

(1) Strip 1/2(±1/16) inch (12.7(±1.6) mm) of insulation from wire ends. (Figure 203)

(2) Select appropriate solder sleeve splice according to type of splice to be made. (Table 204) (Table 205) (Table 206)

(3) If a three-to-one splice is to be made, select appropriate sealing sleeve and install sleeve over one wire at three-wire end of splice. (Table 206)

(4) Insert ends of wires into solder sleeve splice, with largest wire at single-wire end.

NOTE: Solder sleeve splice is larger at one end. Greatest number of wires go into large end.

(5) Overlap bared wire conductors, and position solder ring (located inside solder sleeve splice) over center of conductors . Also position sealing sleeve (if applicable) under center of sealing ring. (Figure 203)

NOTE: Solder sleeve splice may be installed (shrunk) by using either a zap gun, model IR-1034 (Rayclad Tubes Inc.), or a thermogun, model 500A or 500B (Rayclad Tubes Inc.).

(6) Install (shrink) solder sleeve splice with zap gun as follows:

(a) Before operating gun, make certain gun reflector and monocle are clean. Monocle must be fully inserted into slot, with reflector surface of monocle facing interior of gun.

(b) Allow gun to warm up by depressing actuator switch two or three times.

(c) Release and remove nose cone from gun.

CAUTION: SOLDER SLEEVE SPLICE MUST LAY STRAIGHT IN NOSE CONE. SAGGING OR BOWING OF SOLDER SLEEVE SPLICE CAN RESULT IN UNSATISFACTORY SPLICE.

(d) Place solder sleeve splice into center of nose cone and secure in place with clamps.

(e) Mount and lock gun to nose cone.

(f) Select correct timer setting, and set timer knob. (Table 204) (Table 205) (Table 206)

WARNING: AVOID BREATHING FUMES GENERATED BY SOLDER SLEEVE SHRINKING.

(g) Depress actuator switch.

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(h) Wait at least 5 seconds after end of heating cycle before removing completed solder sleeve splice from nose cone.

(7) Install (shrink) solder sleeve splice with thermogun as follows:

(a) Insert TG14A heat reflector.

(b) Set thermogun vent to open position.

(c) Allow gun to warm up approximately 1 minute.

(d) Place splice in AD-1319 holding device.

WARNING: AVOID BREATHING FUMES GENERATED BY SOLDER SLEEVE SHRINKING.

(e) Apply hot air until solder has completely melted and flowed.

(f) Immediately remove gun and deflector from splice assembly.

(g) Allow solder sleeve splice to cool for at least five seconds before unclamping from holding fixture or moving wires.

(h) Switch gun to "COOL" position and allow gun to cool for one minute before turning off.

(8) Check solder sleeve splice for proper installation. (Paragraph 4.F.)

Table 203 Two Wire Solder Sleeve Splice List

Solder Sleeve Splice Part Number	Wire Gage Combination	Zap Gun Timer Setting
D-144-41	24 to 24	1 3/4
	24 to 22	1 3/4
	24 to 20	2
	22 to 22	2
	22 to 20	2 1/4
D-144-43	24 to 18	2 1/2
	24 to 16	3
	24 to 14	3
	22 to 18	2 1/2
	22 to 16	3
	22 to 14	3 1/4
	20 to 20	2 1/2
	20 to 18	2 3/4
	20 to 16	3
	20 to 14	3 1/2
	18 to 18	3
	18 to 16	3 1/4
	18 to 14	3 3/4
	16 to 16	3 1/2
D-144-47	16 to 14	3 3/4
	14 to 14	4

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Table 204 Three-Wire Solder Sleeve Splice List

Solder Sleeve Splice Part Number	*Wire Gage Combination	Zap Gun Timer Setting
D-144-42	24, 24-24	2
	24, 24-22	2
	24, 24-20	2 1/4
D-144-43	24, 22-22	2 1/2
	22, 22-22	2 1/2
	24, 22-20	2 1/2
	22, 22-20	2 1/2
	24, 20-20	2 1/2
	24, 24-18	2 1/2
D-144-47	22, 20-20	3
	20, 20-20	3

NOTE: *Largest wire should be used at single-wire end.

Table 205 Four-Wire (Two to Two) Solder Sleeve Splice List

Solder Sleeve Splice Part Number	*Wire Gage Combination	Zap Gun Timer Setting
D-144-43	24, 24-24, 24	2 1/2
	24, 24-24, 22	2 1/2
	24, 24-24, 20	2 1/2
	24, 22-24, 22	2 3/4
	24, 22-22, 22	2 3/4
	24, 22-24, 20	2 3/4
D-144-47	24, 20-24, 20	3
	24, 22-22, 20	3
	22, 22-22, 22	3
	22, 22-22, 20	3
	22, 20-22, 20	3 1/4
	24, 20-20, 20	3 1/4
D-144-48	22, 20-20, 20	3 1/4
	20, 20-20, 20	3 1/4

NOTE: *Wire grouping should be balanced as pairings indicate.

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Table 206 Four-Wire (Three to One) Solder Sleeve Splice List

Solder Sleeve Splice Part Number	*Wire Gage Combination	Zap Gun Timer Setting	Sealing Sleeve
D-144-43	24, 24, 24-24	2 1/2	D-502-24
	24, 24, 24-22	2 1/2	D-502-24
	24, 24, 24-20	2 3/4	D-502-24
	24, 24, 22-22	2 3/4	D-502-24
	24, 22, 22-22	2 3/4	D-502-24
	24, 24, 22-20	2 3/4	D-502-24
D-144-47	24, 24, 20-20	3	D-502-25
	24, 22, 22-20	3	D-502-24
	22, 22, 22-22	3	D-502-24
	22, 22, 22-20	3 1/4	D-502-24
	22, 22, 20-20	3 1/4	D-502-25
	24, 20, 20-20	3 1/4	D-502-25
D-144-48	22, 20, 20-20	3 1/4	D-502-25
	20, 20, 20-20	3 1/2	D-502-25

NOTE: *Largest wire should be used at single-wire end. Sealing sleeve should be used on largest of remaining wires.

F. Solder Sleeve Splice - Two-Wire and Multiple Wire Check

(1) Check that completed solder sleeve splice meets the following requirements:

(a) Solder ring is melted and has flowed to form a solder fillet between wires in sleeve splice. Conductor strands show evidence of wetting by solder. (Figure 203)

NOTE: Discoloration (darkening) of sleeve splice is acceptable if it does not prevent visibility of solder fillet through sleeve splice.

(b) Sealing rings (blue thermoplastic material extruding out of three-wire end) and sealing sleeves (if used) are melted and have flowed.

(c) Sleeve splice is completely recovered (shrunk).

NOTE: Minor flare on end of sleeve splice is acceptable if there is evidence of sealing between flare and splicing area.

(d) All bare conductor wires are contained within sleeve splice. Strands do not protrude through sleeve splice.

(e) No tears or holes in sleeve splice.

(f) An underheated splice will show presence of a flare, lack of solder filleting, and/or lack of wetting of solder.

NOTE: Flare on one end of sleeve splice may be due to splice being off-center rather than the result of underheating.

(g) An overheated splice will show excessive discoloration of sleeve splice and/or lack of solder and no solder fillet because of wicking of solder into wire strands.

G. Crimp Splice - Two-Wire

(1) Select appropriate crimp splice according to wire gage combination to be spliced. (Table 207)

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(2) Strip insulation from wire ends according to crimp splice to be used. (Table 208)

(3) Select required insulation. (Table 208)

(4) Slide insulation (sleeve or tubing) onto one wire before installing crimp splice.

CAUTION: MAKE CERTAIN WIRE INSULATION IS NOT IN CONDUCTOR CRIMP AREA.

(5) Insert wire ends into splice until conductors are visible in inspection hole.

(6) Using appropriate crimp tool, crimp splice. (Table 208)

NOTE: Indentation of splice should be on side opposite inspection hole, between hole and end of splice.

(7) Insulate completed splice according to insulation used as follows:

(a) D-436-XX sleeve. Using model 500A or 500B thermogun and TG12 heat reflector, apply heat until sealing rings at both ends have melted and flowed and sleeve has completely shrunk.

(b) D-420-XX sleeve. Using model 500A or 500B thermogun and TG12 heat reflector, apply heat until inner sleeve has melted and flowed and outer sleeve has completely shrunk.

(c) WTF-XXXX-X tubing. Using model 750 thermogun and TG12 heat reflector, apply heat until inner sleeve has melted and flowed and outer sleeve has completely shrunk.

H. T-Splice

(1) Splice three 2/0 (00) gage cables with a YST2626G3 T-splice as follows:

(a) Strip 7/8 to 1 inch (22.2 to 25.4 mm) of insulation from cable ends. (Figure 204)

(b) Insert cables into T-splice.

NOTE: Cable insulation must be flush to 1/16 inch (1.6 mm) from end of splice.

(c) Using appropriate crimp tool, crimp each leg of splice. (Table 208)

(d) Insulate completed splice by installing appropriate size heat shrinkable polyolefin tubing.

Table 207 Two-Wire Crimp Splice List for Wire Specifications 7706560, 7754150, 7801684, and 7891145

Crimp Splice Part Number	Wire Gage Combination
YSV-18	24 to 24
	24 to 22
	24 to 20
	24 to 18
	22 to 22
	22 to 20
	22 to 18
	20 to 20
	20 to 18
	18 to 18

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Table 207 Two-Wire Crimp Splice List for Wire Specifications 7706560, 7754150, 7801684, and 7891145 (Continued)

Crimp Splice Part Number	Wire Gage Combination
YSV-14	18 to 16
	18 to 14
	16 to 16
	16 to 14
	14 to 14
YSV1014-G2	10 or 12 to 14 or 16
YSV10	10 or 12 to 10 or 12
YSV8C-L	8 to 8
YSV6C-L	6 to 6
YSV4C-L	4 to 4

Table 208 Crimp Splice Tooling and Insulation

Crimp Splice Part Number	Wire Minimum Strip Length	Tool	Insulation Sleeve or Tubing (7706560 and 7891145)	Insulation Tubing (7751450 and 7801684)	Insulation Tubing Length
	Inches (mm)				Inches (mm)
YSV-18	1/4 (6.4)	MR8-4	D-436-09	WTF-1204-A	1 1/2 (38.1)
YSV-14	1/4 (6.4)	MR8-4	D-436-09	WTF-1212-A	1 1/2 (38.1)
YSV1014-G2	21/64 (8.3)	MR8-4	D-420-00	WTF-1205-A	1 1/2 (38.1)
YSV10	21/64 (8.3)	MR8-4	D-420-00	WTF-1205-A	1 1/2 (38.1)
YSV8C-L	1/2 (12.7)	Y29B	D-420-01	WTF-1207-A	2 (50.8)
YSV6C-L	1/2 (12.7)	Y29B	D-420-01	WTF-1207-A	2 (50.8)
YSV4C-L	1/2 (12.7)	Y29B	D-420-01	WTF-1207-A	2 (50.8)
YST2626G3	7/8 (22.2)	Y29B			
YRV2CV6CL	*5/8 (15.9)	Y29B	SCL (1/2 inch (12.7 mm) diameter)		3 (76.2)
	**3/4 (19.1)	Y29B	SCL (1/4 inch (6.4 mm) diameter)		1 (25.4)
YSM28	***	Y29B			

NOTE: * 2-gage cable.

** 10-gage wire.

*** 1 1/4 inch (31.8 mm) center strip for 2/0 (00) gage cable; 1-inch (25.4 mm) end strip for 6-gage wire.

(e) Using a heat gun of appropriate temperature range, install (shrink) tubing by heating to 250°F (121°C) minimum.

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(f) Check that splice insulation has no voids, cuts, or tears and that no conductor strands protrude through insulation.

I. Step-Down, Multi-Splice

(1) Splice a 2-gage cable to two 10-gage wires with a YRV2CV6CL multi-splice as follows:

(a) Strip 5/8 inch (15.9 mm) of insulation from 2-gage cable end and 3/4 inch (19.1 mm) from 10-gage wire ends.

(b) Insert cable and wires into splice. (Figure 204)

(c) Using appropriate crimp tool, crimp splice. (Table 208)

NOTE: 10-gage wires must be crimped first.

(d) Insulate 10-gage wires by installing appropriate size selectively cross-linked (SCL) irradiated polyolefin tubing. (Table 208)

(e) Using a heat gun of appropriate temperature range, install (shrink) tubing by heating to 275°F (135°C) minimum.

(f) Insulate complete splice by installing appropriate size SCL irradiated polyolefin tubing over splice.

(g) Using a hot air gun of appropriate temperature range, install (shrink) tubing by heating to 275°F (135°C) minimum.

(h) Check that splice insulation has no voids, cuts, or tears and that outer sleeve has completely shrunk and inner sleeve has melted and flowed.

J. Splice Sleeve

(1) Splice two 6-gage lead wires to a 2/0 (00) gage bus cable with YSM28 splice sleeves as follows:

(a) Strip 1 inch (25.4 mm) of insulation from lead wires and 1 1/4 inch (31.8 mm) from bus cable. (Figure 204)

(b) Center splice sleeve over stripped section of cable and insert lead wires.

(c) Using appropriate crimp tool, crimp sleeve. (Table 208)

NOTE: Indentation of sleeve should be on side opposite lead wires.

(d) Insulate completed splice by installing heat shrinkable splice encapsulator.

(e) Using a hot air gun of appropriate temperature range, install (shrink) encapsulator by heating to 212°F (100°C) minimum.

(f) Check that splice insulation has no voids, cuts, or tears and that no conductor strands protrude through insulation.

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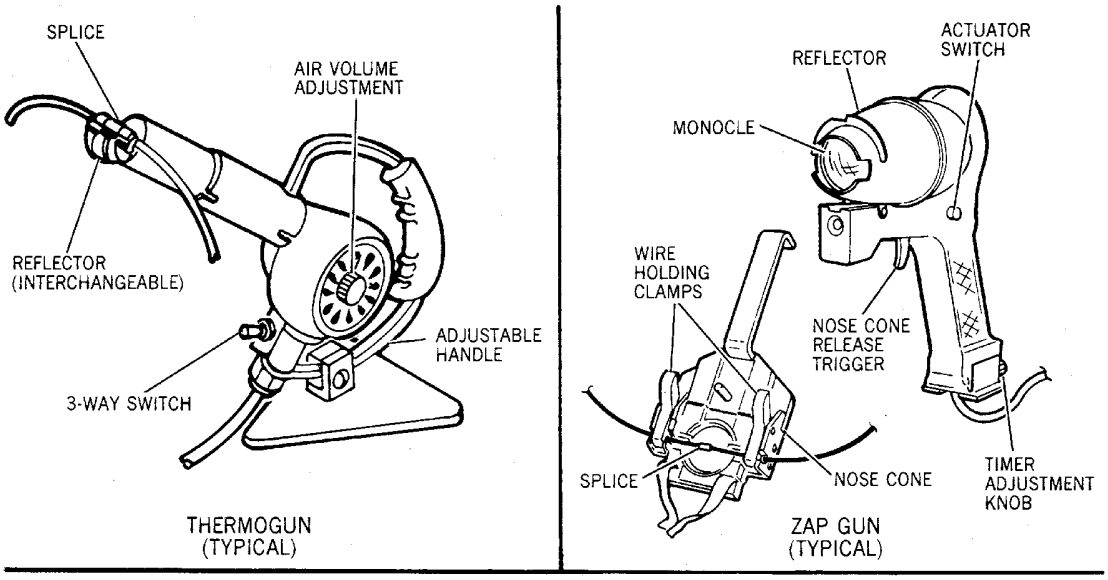
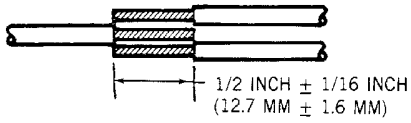
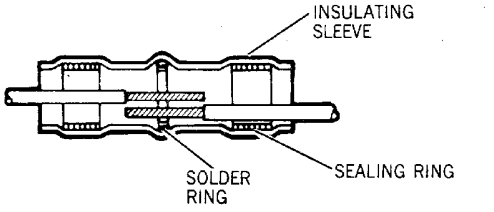
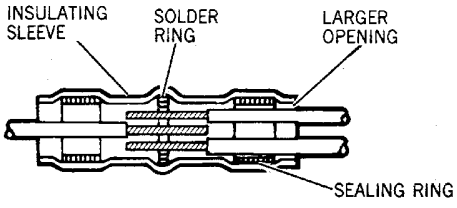




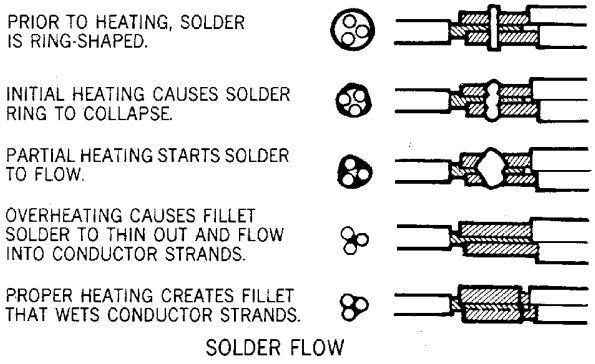
STRIP DIMENSIONS FOR USE WITH SOLDER SLEEVE SPLICES



WIRE POSITIONS IN SPLICE-SINGLE CONDUCTOR



WIRE POSITIONS IN SPLICE-MULTI-CONDUCTOR



NOTES:

1. BARED WIRES MUST OVERLAP.
2. GREATER QUANTITY OF WIRES ARE TO BE PLACED IN LARGER OPENING OF SPLICE.

VISUAL CHECK

1. INSULATION ON CONDUCTOR STRANDS MUST BE FREE OF NICKS OR BREAKS.
2. ALL CONDUCTOR STRANDS MUST BE CONTAINED WITHIN SPLICE.
3. SEALING RINGS, SLEEVES, AND SOLDER RING MUST HAVE MELTED AND FLOWED.
4. DISCOLORATION OF SPLICE INSULATION IS ACCEPTABLE PROVIDING VISIBILITY OF SOLDER FILLET THROUGH INSULATION SLEEVE IS NOT IMPAIRED.

BBB2-20-32A

Solder Sleeve Splices
Figure 203/20-50-01-990-803

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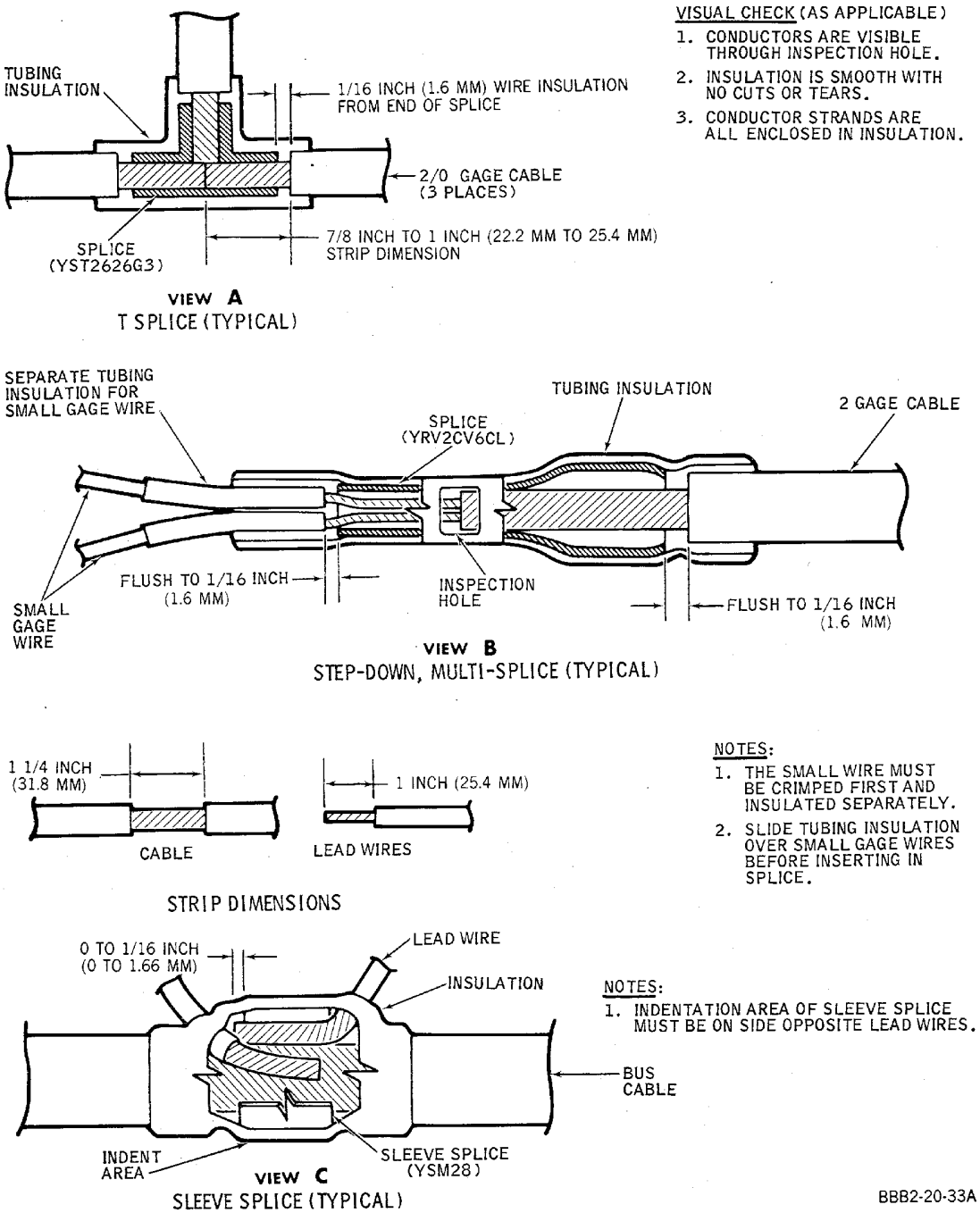

Crimp Splices -- Special Applications
Figure 204/20-50-01-990-804

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5. Splicing Aluminum Cables

A. Damaged jacket and primary insulation and one or more broken conductor strands. If any conductor strands are broken, cable must be spliced or replaced.

NOTE: When splicing aluminum cables, the following guidelines must be adhered to. If the splice does not meet these guidelines, the cable must be replaced.

(1) Should "C" check inspection disclose that any splice shows evidence of discoloration and/or overheating, entire cable containing that splice must be replaced. Otherwise splices may be considered "permanent".

(2) Cables must not be spliced in trough, conduit or enclosed raceway areas.

(3) Cables must not be spliced less than three feet (0.9144 m) from a cable end, nor must cables whose overall length is six feet (1.83 m) or less be spliced.

(4) There must not be more than two splices in any single cable run. Separation between splices must be greater than six feet (1.83 m).

(5) Cables must not be spliced under galleys or lavatories.

(6) Splicing aluminum cable is not permitted in the vicinity of heat ducts or in areas where surrounding temperatures exceed 135°C (275°F). Routing of aluminum cable is permitted in these areas, provided insulation temperature limits are not exceeded, but if repair is necessary and splicing cannot be accomplished outside of this area, then entire cable must be replaced.

(7) If more than one cable is spliced in a given area, splices must be staggered, and proper phase reattachment must be checked. Position splices so as to prevent wires from being pinched or damaged on installation.

(a) When six or less splices are to be installed, position splices on the outside of the bundle so that there is either, a minimum of 1.25 inch (32 mm) overlap between adjacent splices, or 1.50 inch (38 mm) end-to-end clearance. (Figure 206, View A and B)

(b) When there are more than six splices, the splices shall be installed in more than one group to reduce bundle diameter. Individual groups shall be spaced a minimum of 0.75 inch (19 mm) apart, and stacked. Secure splices with tie tape, DPM 731-6. (Figure 206, View C and D)

(c) Splices to be stacked shall be spaced so that the maximum length of the stacked splices does not exceed twice the length of the shortest splice. Splices shall overlap each other by a minimum of half the splice length. Tie splices with tie tape, DPM 731-6. (Figure 206, View D)

(8) Splices must be supported six to eight inches (152.4 to 203.2 mm) from both ends of splice.

(9) Unswaged splice must be in an intact, sealed package until applied. If splice is in an opened package, check that oxidation inhibitor in splice has a soft, greasy texture. If not, do not use.

(10) Splices must be correct part number and installed with correct tooling and procedures.

(11) Splices must be insulated with two layers of clear heat-shrinkable tubing.

(12) Splice must be sealed against ingress of moisture.

B. Preparation of Aluminum Cable

(1) Using thermal stripping tool such as Stripall Model TW-6, strip aluminum wire as follows:

(a) Adjust bi-directional wire guide to accommodate wire or cable diameter. (Figure 205)

(b) Establish required strip length for type of termination.

(c) Energize heating element and lower element onto wire by squeezing tool handle.

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(d) Rotate wire or tool to make circumferential cut in insulation. Cut should extend as deep as possible without cutting completely through insulation.

CAUTION: STRIPPED WIRE MUST BE VISUALLY EXAMINED FOR SEVERED STRANDS. NICKED OR CUT STRANDS ARE CONSIDERED SEVERED.

CAUTION: NO SEVERED OR NICKED STRANDS ARE ALLOWED IN ANY GAUGE OF ALUMINUM WIRE.

(e) Reposition wire in guide and make longitudinal cut extending from circumferential cut to end of wire. Insulation can then be peeled off.

(2) When installing aluminum splices, wire insulation strip dimensions should meet following requirements:

(a) Conductor strands shall extend through entire length of swaged area and end of wire shall stop against nylon plug.

(b) Cable insulation shall extend approximately 7/32-inch (5.56 mm) into terminal insulation grip area.

C. Swaging Aluminum Splices

(1) Select proper splice and applicable tool, as shown in Table 209, check that dimensions between flats of hex ("G" dimension) of tool are as listed.

(2) Insert stripped wire into splice barrel, rotating splice slightly during insertion. Tip of nylon plug in inspection hole will provide a stop point for bare end of wire.

(3) Insert splice end with cable into approved tool and die. Position splice in die so that approximately three quarters of barrel length will be swaged. Swage splice end.

CAUTION: MAKE CERTAIN SWAGED AREA INCLUDES INSULATION GRIP BUT NOT NYLON IN INSPECTION HOLE.

(4) Slide two pieces of RNF100 3/4-inch (19.05 mm) diameter heat-shrinkable tubing on to the unswaged cable.

(5) Repeat Paragraph 5.C.(2), Paragraph 5.C.(3), and Paragraph 5.C.(4) for other splice end and cable segment.

(6) Post insulate splice.

Table 209 Aluminum Cable Splice and Tool Requirements

Wire Gage	Splice Part Number	Model 540 Swaging Tool	Die Number	"G" Dimension
1/0	65206	13642	11766	.541/ .551
2/0	65207	13642	11767	.618/ .628

D. Insulating Aluminum Splices

(1) Remove nylon plugs from splices.

(2) One inch (25.4 mm) from each end of splice, apply a 3/16-inch (4.76 mm) approximately, bead of RTV-88 sealant with RTV-9910 catalyst around entire circumference of cable.

(3) Center one piece of insulation tubing over splice. Shrink in place. Amount of heat shall be slightly in excess of 250°F (121°C) and should be maintained only long enough to shrink tubing to desired fit.

(4) Center second piece of shrink tubing over first piece already shrunk down. Shrink in place.

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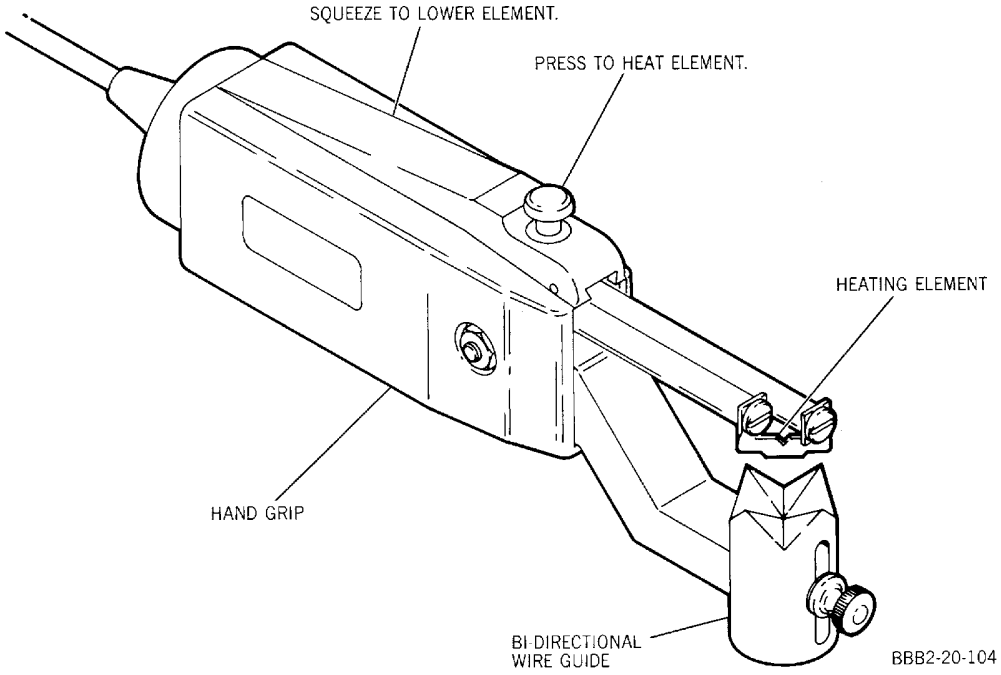

Thermal Stripping Tool Figure
Figure 205/20-50-01-990-805

6. Splicing Copper Cable

A. Damaged jacket and primary insulation and seven or more nicked or broken conductor strands. If seven or more conductor strands are nicked or broken the cable must be spliced or replaced.

B. Preparation of Copper Cable

CAUTION: DO NOT NICK OR CUT STRANDS OF WIRE.

(1) Remove insulation from cable using M-10 thermal stripper with 4C Hotweezer attachment as follows:

(a) Set heating element at a temperature just hot enough to pierce insulation with a minimum of burning, melting or gassing.

(b) Strip 5/8 inch (size 2 splice) or 11/16 inch (size 1/0 splice) length of insulation from cable using the hotweezer. Hold hotweezer like a pencil, close jaws, and rotate around cable to make a circumferential cut.

(c) Remove insulation slug from cable.

C. Swaging Copper Splices

(1) Select the proper splice and applicable swaging tool. Check dimensions between die and nest ("G" dimension) of tool. Refer to Table 209 for applicable splice, swaging tool and "G" dimensions.

(2) Insert stripped wire into splice barrel, rotating splice slightly until conductor butts against shoulder of splice. Make sure none of the cable's insulation material is inserted into the splice barrel.

(3) Swage splice end.

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(4) Slide two pieces, each 8 inches in length, of 3/4 inch diameter RNF100 Type 2 heat shrinkable tubing (clear) on to unswaged cable.

(5) Repeat Paragraph 6.C.(2) and Paragraph 6.C.(3), for other splice end and cable segment.

Table 210 Copper Cable Splice and Tool Requirements

Copper (CU) Cable, P/N's BXS7007, BXS7008, D2340, And CMC 0553					
Wire Gage	**Splice Part Number**	**Swaging Tool**	**Indentor Number**	**Nest Number**	**"G" Dimension (Inches)**
2	YSV2C-L	Y29B	Y29PQ-8	DV2-L	0.168-0.198
1/0	YSV2C-L	Y29B	Y29PQ-8	DV25-L	0.218-0.248

D. Insulating Copper Splices

(1) Apply a 3/16 inch (approximately) bead of RTV-88 sealant with RTV-9910 catalyst to extend one inch from each end of splice, around entire circumference of cable.

(2) Center first piece of insulation tubing over splice. Shrink using heat slightly in excess of 250°F (121°C) and maintain heat just long enough to shrink tubing to desired fit.

(3) Center second piece of shrink tubing over the first applied piece and shrink in place.

7. Check Cable Installation

A. Check Cable

(1) Check power feeder cables, troughs and associated hardware for secure and proper installation, paying particular attention to following:

(a) Check that phenolic brackets supporting wire clamps at both forward and aft above and/or below floor transition areas are properly secured to structure.

(b) Check that wire clamps at both forward and aft above and/or below floor transition areas are properly secured to phenolic bracket and that cushion on clamp is intact.

(c) Check that phenolic brackets supporting wire clamps on aft side of aft pressure bulkhead, at bulkhead feedthroughs, are properly secured to structure, that clamps are in place and cushion on clamps are intact.

(d) Check that cables are routed so they do not impinge on feedthroughs.

(e) Check that power cables in trough are tight with no slack.

(f) Check that areas in and around troughs are clean and free of debris.

(g) Check that there are no sharp edges or burrs in wire troughs, where string tie holes have been drilled.

(h) Check that troughs are installed with no breaks and with proper overlap.

(i) Check that cables are properly clamped at floor beam lightning holes.

8. Removal/Installation Bonding and Grounding

A. Surface Preparation for Normal Bonding

NOTE: Unless low impedance RF bonding is specified, the following procedure shall be used whenever bonding is required.

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WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, POISONOUS, A REDUCER, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(1) Remove oil, grease, dirt, and other contaminants with clean, cotton cloth dampened with hand wipe cleaner, DPM 6380-1, DPM 6380-2, or DPM 6380-3.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1588, SOLVENT/MPK BLEND (DMS QPL 2458)

HAZMAT 1000, REFER TO MSDS

(2) Completely remove paint, dyes, or stains with clean, cotton cloth dampened with MPK Blend Solvent, DMS 2458. Wipe dry with clean, dry cloth. Remove coatings resisting this method according to Paragraph 8.A.(3).

(3) Use abrasive finishing paper, No. 320 grit or finer, to completely remove finishes or nonconductive coatings such as anodic, Alrox, Dow No. 7, Parkerize, Alumilite, etc. Stop abrading as soon as coating is removed. Do not use water during process. Do not use abrasive paper with power tools.

(4) To clean around holes, use power tool with stainless steel brush, or an abrasive rod with 240 grit or finer, or abrasive wheel with 240 grit or finer. Stop cutting action as soon as coating is removed.

B. Surface Preparation Low Impedance RF Bonding

NOTE: When low impedance RF bonding is specified, the following is mandatory:

(1) Completely remove all finishes and chemical treatments other than electro-plating. Restrict bare metal area to within 1/4-inch (6.35 mm) of bond joint.

(2) Use of bonding jumpers in place of bare, metal-to-metal contact is prohibited unless specified, except that suitable jumpers may be used across vibration mounts.

C. Install Bonding and Grounding

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(1) Maximum number of terminals to be attached to any ground stud is four, except for seat assemblies, which may have five. When terminating shielded cables, ground shields only where indicated on applicable wiring diagram.

(2) To lock threads and to protect against corrosion after installing wiring and electrical components, perform the following steps:

(a) Perform visual and continuity checks of all wiring and components installed.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1588, SOLVENT/MPK BLEND (DMS QPL 2458)

HAZMAT 1000, REFER TO MSDS

(b) Carefully clean bottom three threads of all bolts and screws adjusted during installation. Use small clean brush dampened with MPK Blend Solvent, DMS 2458.

(c) Allow solvent to dry thoroughly.

(d) Apply Glyptal red enamel to small area (approximately 1/8- by 1/8-inch) (3.18 by 3.18 mm) of bottom three threads.

(3) Apply corrosion-protection compound (Braycote No. 103) to bare metal areas of all applicable terminal strips and electrical components. Do not apply compound to nylon or vinyl terminal coverings.

NOTE: Exposed conducting frames or parts of electrical or electronic equipment shall have a low resistance bond of less than 0.1 ohm to structure. If the equipment design includes a ground terminal or pin which is internally connected to such exposed parts, a ground wire connection to such terminal will satisfy this requirement.

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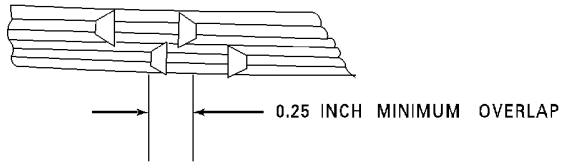
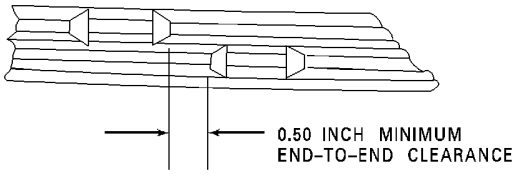


VIEW A



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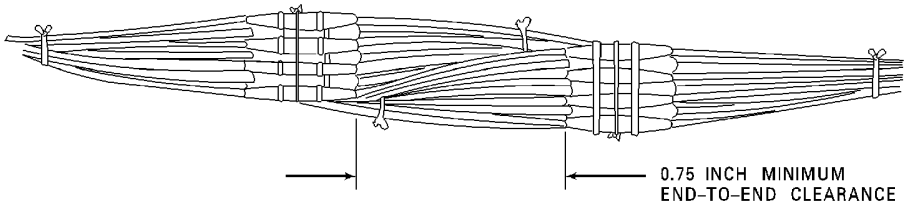
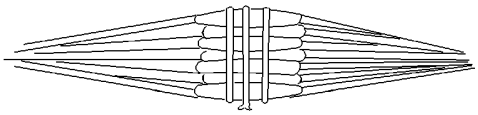


VIEW C



VIEW D

CAG(IGDS)

BBB2-20-150

Splice Positioning
Figure 206/20-50-01-990-806

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WIRE CHAFING - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides instructions for corrective action to be taken where chafing of electrical wiring, located in high vibration areas of the aircraft, has occurred. Chafing is most likely to occur in high vibration areas of the wing leading edge, wing tips, wing and tail pylons, APU compartment, empennage, wheel wells and landing gear.

NOTE: When opening or closing a panel where wire assemblies are present, proper care should be taken to assure the wire assemblies are not pinched/chafed by the panel. Repair/replace, adjust and protect the wire assemblies per Maintenance Practices if pinching/chafing condition is observed.

B. Paragraph 4. contains procedures to repair the landing gear conduit. The repair will be used to cover scratches, minor abrasions and be used in low temperature application from -67°F to 230°F (-55°C to 110°C) only. The conduit should be replaced if braiding is damaged.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

Table 201

Name and Number	Manufacturer
Clamp, Douglas Part No. S7934111	J&M Products, Inc. Burbank, CA
Tape, Air-Tex, 317X or 417X, Type 2, Finish C Size 3	Eon Corp. Los Angeles, CA
Tape, Teflon, Scotch 60	Minnesota Mining and Manufacturing Co. Los Angeles, CA
Tape, Tying, Glass Fiber, Air-Tex 360X	Eon Corp. Los Angeles, CA
Tubing, Heat Shrinkable, Dual Wall, Outer Wall, Crosslinked Polyolefin, Adhesive Inner Wall, Colored (DMS 2373, Class 2) #W3B2 (4X)	Sumitomo Electric Interconnect Products, Inc. Santa Clara, CA
Heat Reflector (MG-2)	Raychem Corp. Menlo Park, CA
Aluminum Foil (DPM 659)	
Heat Gun, Hot Air CV-5300	Raychem Corp. Menlo Park, CA

3. Wire Chafing Check

A. Check Wiring

(1) Check wire bundles for evidence of chafing against aircraft structure and adjacent wire bundles.

(2) Check for wear, wires passing through clamps, wear of wires at cable breakouts, wire crossovers and absence of string ties on parent bundle which can cause wire birdcaging.

(3) If evidence of above exists, perform corrective action as follows:

(a) Replace all worn clamps with clamp, Douglas Part No. S7934111 (Figure 201).

(b) At wire bundle breakouts, add string ties at 1 1/2 inch (±1/2 in.) (38.1 mm) intervals. String tie knots using modified clove hitch (Figure 202).

(c) On vertical wire runs, lace wire bundle as shown in Figure 203 (Sheet 1). Use lacing and tieing methods as shown in Figure 203 (Sheet 1) and Figure 203 (Sheet 2).

(d) For examples of incorrect and correct methods of wire bundle installation, reference Figure 203.

(e) On open wire runs, add string ties at 6.0 (±2.0) inch intervals.

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(f) Repair of wiring within 6 in. of fuel tanks and fuel pipes must use existing wire routing and clipping established per OEM-approved wire installation or maintain wire clearances as prescribed in the applicable sections of INSPECTION INSTRUCTIONS FOR STANDARD WIRING INSTALLATIONS, SWPM 20-00-06 and/or WIRING INSTALLATION - MAINTENANCE PRACTICES, SWPM 20-10-01.

1) The above step is a CDCCL procedure. For important information on CDCCLs, refer to Airworthiness Limitation Precautions (GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 28-00-00/201).

(4) Select clamps for size and install to provide a snug fit on wire bundles. Clamp shall retard sliding or rotation of wire bundle.

(5) If wire bundle (without coaxial cable) can be pulled through clamp with moderate pressure applied, then clamp is too large, or plastic strap is too loose. To correct, perform corrective action as follows:

(a) Select a clamp of the same basic part number, which is one size smaller.

(b) Tighten strap (if applicable).

(c) Use buildup material around wire bundle, Reference Wire Bundle Build Up Table below, and Figure 204.

Table 202 Wire Bundle Build Up Materials Under Clamps and Supports

CLAMP TYPE	CLAMP OR SUPPORT PART NUMBER	TEFLON TAPE (DPM 2306)	SELF ADHERING TAPE (DMS 2186, TYPE 1)
Metal with Rubber	All Others	X (6)	X (6)
	S7934111	Not Allowed	Not Allowed
Metal with Fiberglass	JM44LC22H	X (1)	Not Allowed
	All Others	X	X
Nylon Open Face	NMC1001-0	X	X
	NMC1001-1 if wire bundle dia. less than 0.25"	X	X
	NMC1001-(*) if wire bundle dia. greater than 0.25"	Not Allowed (Ref. steps (4) and (5) above)	Not Allowed (Ref. steps (4) and (5) above)
	NMC1001-0	X (2)	X (2)
	All Others	Not Allowed	Not Allowed
Nylon Closed Face	MS25281-R2 (3) MS25281-R(*)	X X (4)	X X (4)
	All Others	X	X
Nylon TM Mounts	All	Not Allowed	Not Allowed
Snap-In-TM Mounts	All	Not Allowed	Not Allowed
Plastic Mechanical Straps	TM Mount Support Ring Tie Bar	Not Allowed	Not Allowed
	Tie Bar	X (1)	X (1)
Snap-In- Clamp	PRWP, PLWP	X (5)	X (5)

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Table 202 Wire Bundle Build Up Materials Under Clamps and Supports (Continued)

CLAMP TYPE	CLAMP OR SUPPORT PART NUMBER	TEFLON TAPE (DPM 2306)	SELF ADHERING TAPE (DMS 2186, TYPE 1)
NOTE: (1) Minimum of two turns required. (2) Ref. Figure 205for alternate method. (3) For single wire applications, a 23541 grommet may be used in lieu of tape. (4) Buildup is not allowed in the fuel tank. (5) For wire bundles of 0.25 inch or smaller diameter. 6) May be used on as build up over protection material of installed wire bundles.			
NOTE: X= approved application.			
NOTE: For approved specified applications listed in Table (noted with an "X"), the wire bundle shall be built up to achieve proper clamping integrity if required. The tape width shall be greater than or equal to the clamp width. The tape width can exceed the clamp width by a maximum of 0.25 inch.			

4. Landing Gear Conduit Repair With Heat Shrinkable Tubing (DMS 2373, Class 2)

A. Conduit Repair

(1) Disconnect conduit connector and remove conduit clamps as necessary.

(2) Repair part on conduit should be clean and free from sharp protrusions.

(3) Cut heat shrinkable tubing length 5 to 10 percent longer than repair part of conduit to be covered to allow for longitudinal shrinkage. Reference Dimension Table below for tubing size.

NOTE: This tubing is rated for continuous use from -67°F to 230°F (-55°C to 110°C).

Table 203 Tubing, Heat Shrinkable, Dual Wall, Outer Wall Crosslinked Polyolefin, Adhesive Inner Wall, Colored (DMS 2373, Class 2) Dimension Table

DMS 2373, CLASS 2 TUBING SIZES	EXPANDED (AS SUPPLIED) INSIDE DIAMETER INCHES MINIMUM	INSIDE DIAMETER INCHES MAXIMUM	INNER MELTABLE WALL THICKNESS INCH NOMINAL	TOTAL WALL THICKNESS INCH MINIMUM
4/1	0.157	0.039	0.020	0.039±010
8/2	0.315	0.079	0.025	0.047±010
12/3	0.472	0.122	0.027	0.055±014
16/4	0.629	0.157	0.030	0.070±015
24/6	0.944	0.255	0.035	0.088±020
32/8	1.256	0.315	0.039	0.100±020
52/13	2.050	0.512	0.039	0.100±020

(4) Heat shrinkable tubing diameter should be large enough to slide over connector and conduit.

(5) Turn hot air heat gun on and allow to warm up at least 30 seconds.

(6) Using heat gun, shrink tubing with temperatures of 275° to 400°F.

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CAUTION: WHEN USING HOT AIR HEAT GUN, REFLECTOR SHALL BE USED WHENEVER POSSIBLE. WHEN HEAT REFLECTOR CANNOT BE USED, HEAT FLOW SHALL BE DIRECTED WITH EXTREME CARE. ADJACENT PARTS SHALL BE PROTECTED THAT SHOULD NOT BE IN DIRECT CONTACT WITH HEAT STREAM BY COVERING OR SHIELDING WITH ALUMINUM FOIL.

CAUTION: APPLY HEAT ONLY LONG ENOUGH TO SHRINK TUBING UNIFORMLY AND SECURELY.

(7) Hold heat shrink tubing in heat gun reflector until it is fully shrunk.

NOTE: When tubing butts against surface or shoulder, butting end of tubing shall be shrunk first.

(8) Remove heat gun from repair section of conduit.

(9) Turn switch on heat gun to "cool" to avoid damage to gun; allow gun to cool for at least one minute.

(10) Make certain that heat shrink tubing repair is fully shrunk, uniform and secure.

(11) Connect conduit connector and install conduit clamps as necessary.

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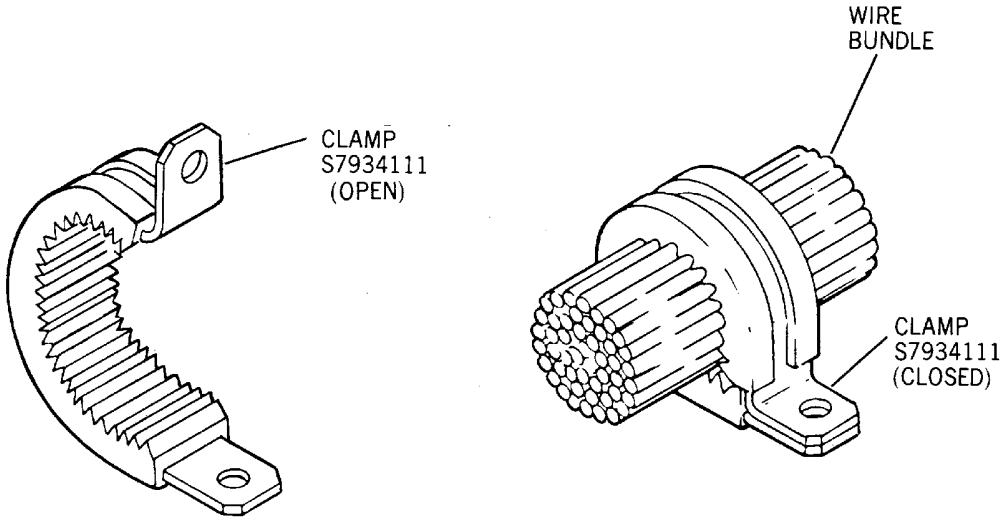
CUSHION			
CODE	USE	"M" SPECIFICATION	COLOR
A	SKYDROL RESISTANT (−70°F TO +400°F) (−56.7°C TO + 204.4°C)	SILICONE RUBBER DMS 1894 OR EQUIVALENT MOLDING	RED
B	FULL RESISTANT (−70°F TO +400°F) (−56.7°C TO +204.4°C)	FLUORO SILICONE RUBBER DMS 1734 OR EQUIVALENT MOLDING	BLK

	CLAMP
CODE	SPECIFICATION
S	STEEL CRES. 321/347 COND. A MIL: S-6271 OR EQUIVALENT
D	ALUMINUM ALLOY QQA 250/5 OR EQUIVALENT H.T. MIL H. 6088 50,000 PSI T.S. MIN.

PART NUMBER EXAMPLE:
S7934111 - 16 S B
DASH NUMBER
STEEL
FUEL RESISTANT



Clamp Details
Figure 201/20-50-02-990-801 (Sheet 1 of 2)

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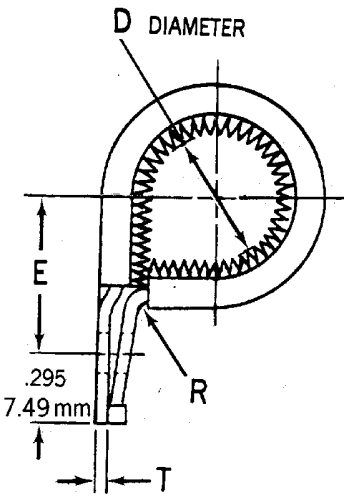
S7934111-( ) CLAMP SIZE & MATERIAL CHART

DASH NO.	D REF INCH	D REF MM	E ±.015 (0.38 mm)	R	T AL	T STL.
-1	.078	2.0	D/2 +.562 (14.3 mm)	.062 (1.57mm)	.032 MIN. (0.81 mm)	.020 MIN. (0.51 mm)
-3	.187	4.7	D/2 +.604 (15.3 mm)			
-4	.250	6.8				
-6	.375	9.5				
-8	.500	12.7				
-10	.625	15.9				
-12	.750	19.1				
-14	.875	22.2				
-16	1.000	25.4				
-18	1.125	28.6				
-20	1.250	31.8				
-22	1.375	34.9				
-24	1.500	38.1				
-26	1.625	41.3	D/2 +.614 (15.6 mm)		.040 MIN. (1.02 mm)	.032 MIN. (0.81 mm)
-28	1.750	44.5				
-30	1.875	47.6				
-32	2.000	50.8				
-34	2.125	54.0				
-36	2.250	57.2				
-38	2.375	60.3				
-40	2.500	63.5				
-42	2.625	66.7	D/2 +.622 (15.8 mm)		.050 MIN. (1.27 mm)	.040 MIN. (1.02 mm)
-44	2.750	69.9				
-46	2.875	73.0				
-48	3.000	76.2		.125 (3.18mm)		
-50	3.125	79.4				
-52	3.250	82.5				
-54	3.375	85.7				
-56	3.500	88.9	D/2 +.632 (16.1 mm)		.063 MIN. (1.60 mm)	
-58	3.625	92.1				
-64	4.000	101.6				
-66	4.125	104.8				



BBB2-20-37A

Clamp Details
Figure 201/20-50-02-990-801 (Sheet 2 of 2)

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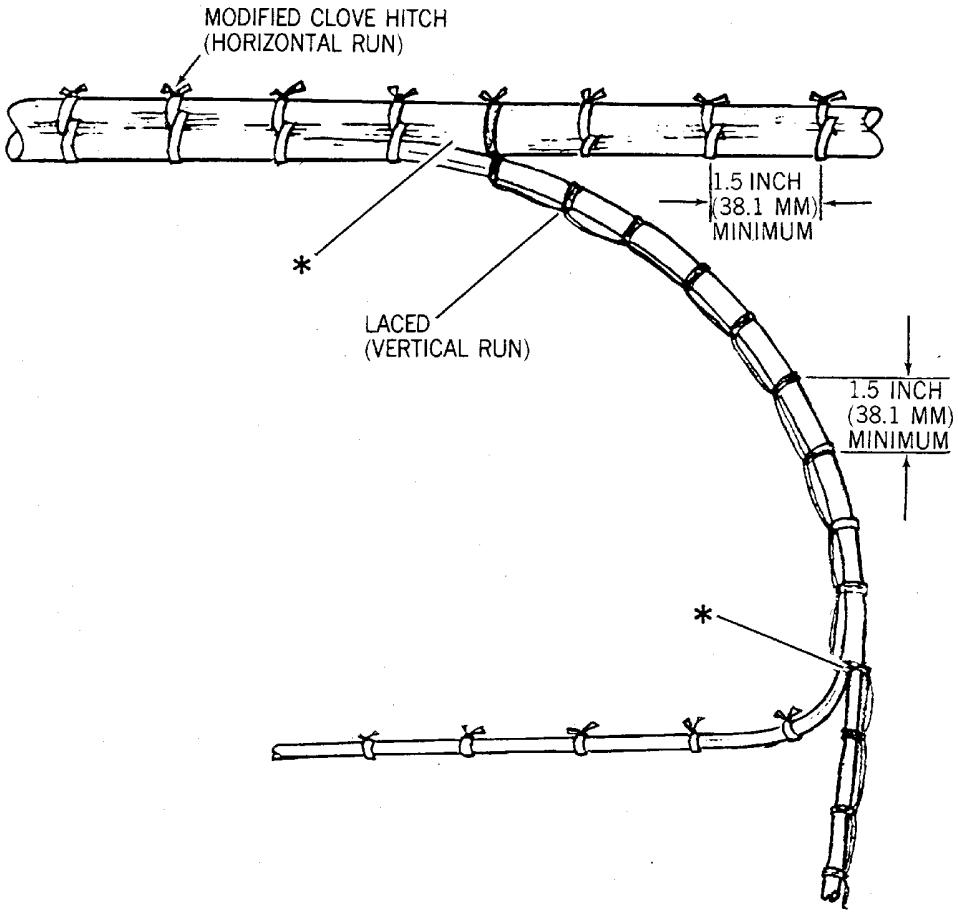

NOTE:

* TEFLON TAPE AT BREAKOUTS NOT SHOWN FOR CLARITY.

BBB2-20-38A

Tieing Sequence For Laced Clove Hitch Knot
Figure 202/20-50-02-990-802 (Sheet 1 of 3)

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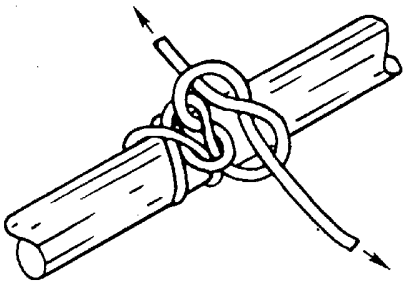
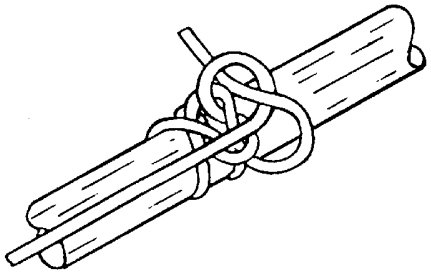


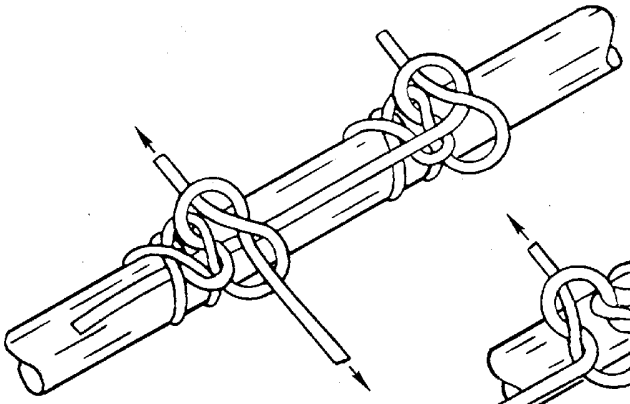
STEP 1

TIEING CLOVE HITCH WITH SQUARE KNOT



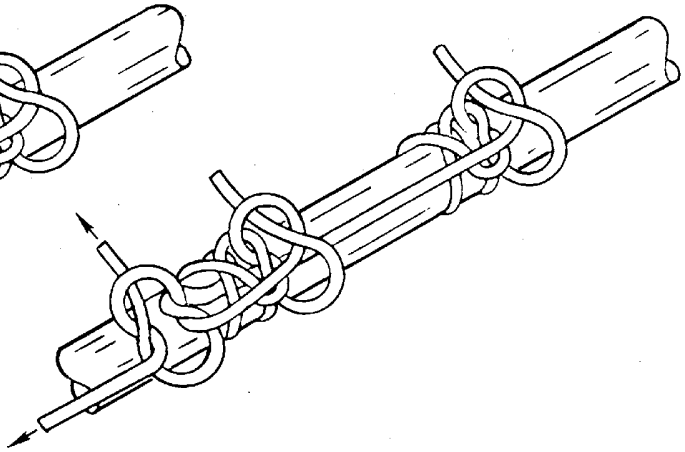
STEP 2

AFTER TIGHTENING KNOT, CUT ONE SIDE OFF AND LEAVE OTHER ONE LONG ENOUGH TO LIE UNDER NEXT KNOT AND BE TIED.



STEP 3

TIE CLOVE HITCH WITH SQUARE KNOT MAKING SURE LAST KNOT STRING IS LYING UNDERNEATH.



STEP 4

AFTER TIGHTENING KNOT, TIE STRING FROM LAST KNOT TO ONE STRING FROM THIS KNOT USING A SQUARE KNOT, RETURN TO STEP 2.

BBB2-20-39

Tieing Sequence For Laced Clove Hitch Knot
Figure 202/20-50-02-990-802 (Sheet 2 of 3)

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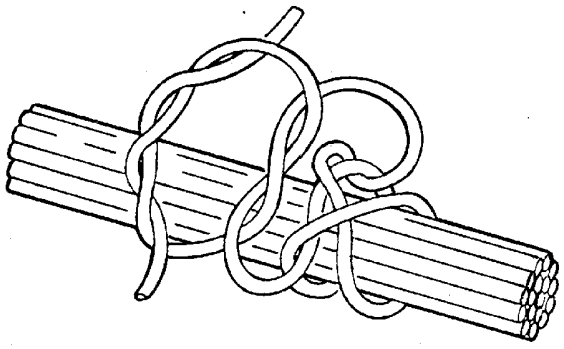

TIEING SEQUENCE FOR LACED CLOVE HITCH KNOT
IN HIGH TEMPERATURE AREAS USING GLASS FIBER
TAPE. FOLLOW STEPS 1 THROUGH 4 PER FIGURE 201 (SHEET 2)
THEN FINISH KNOT AS ILLUSTRATED.

BBB2-20-40

Tieing Sequence For Laced Clove Hitch Knot
Figure 202/20-50-02-990-802 (Sheet 3 of 3)

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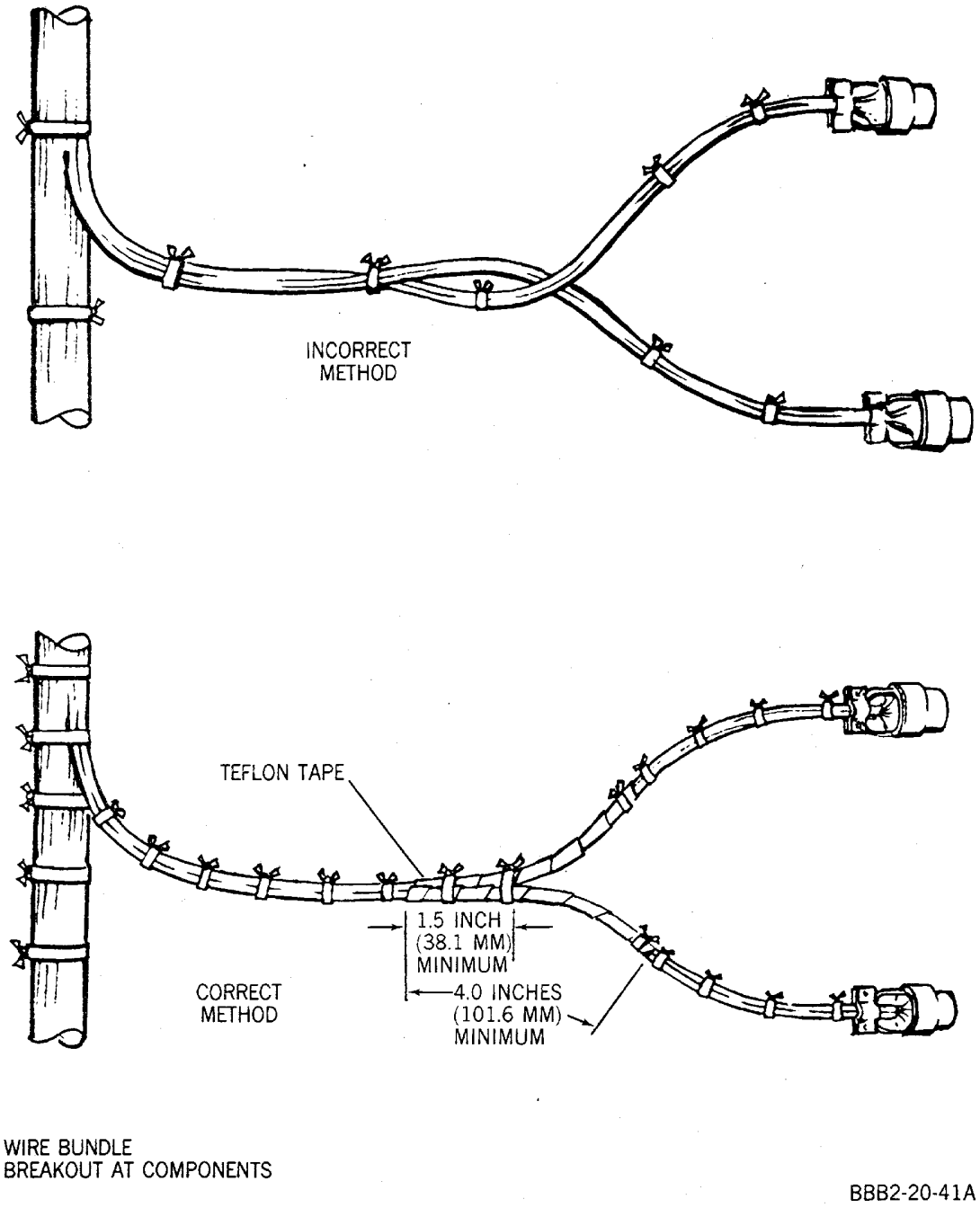

Wire Bundle Installation
Figure 203/20-50-02-990-803 (Sheet 1 of 3)

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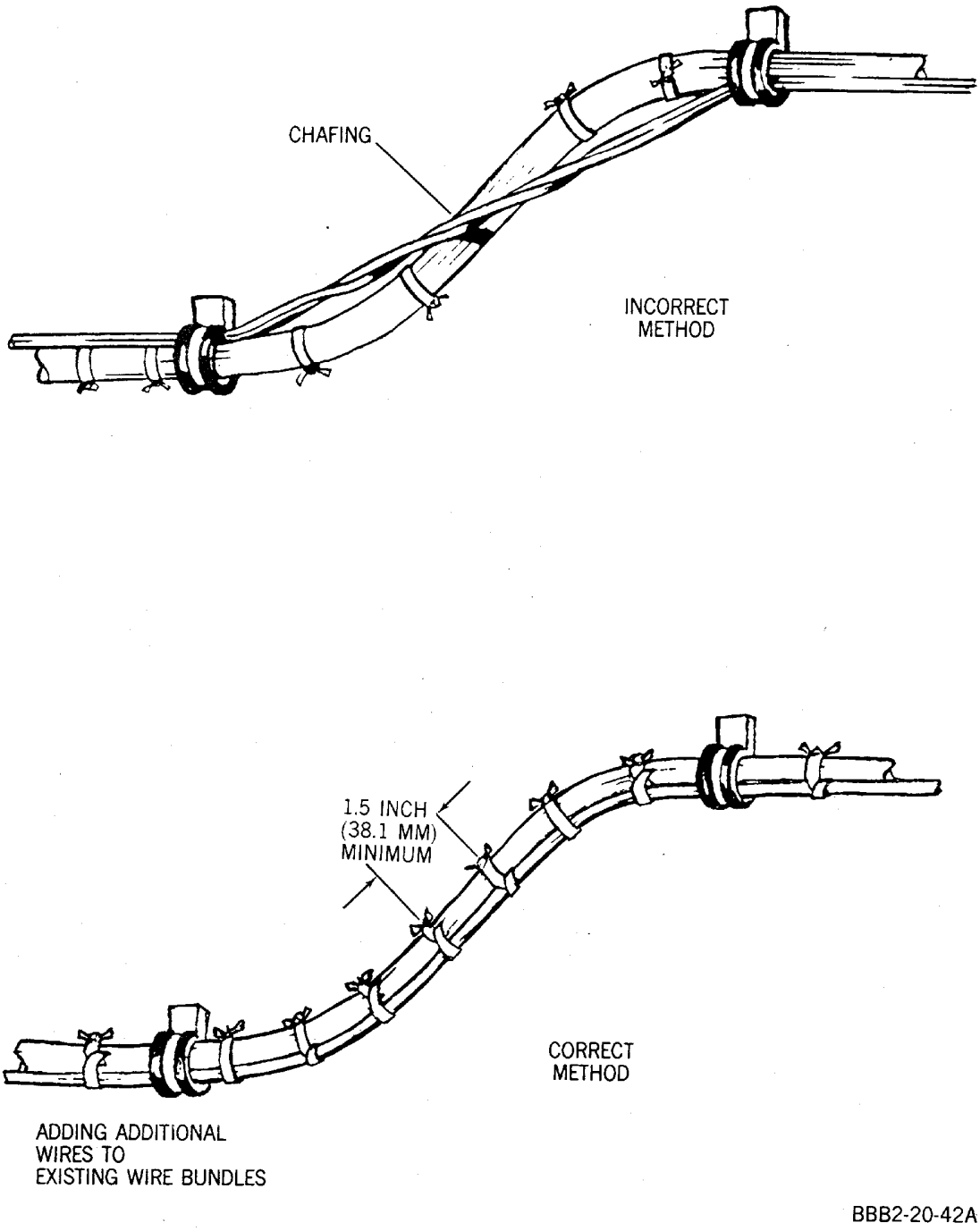

Wire Bundle Installation
Figure 203/20-50-02-990-803 (Sheet 2 of 3)

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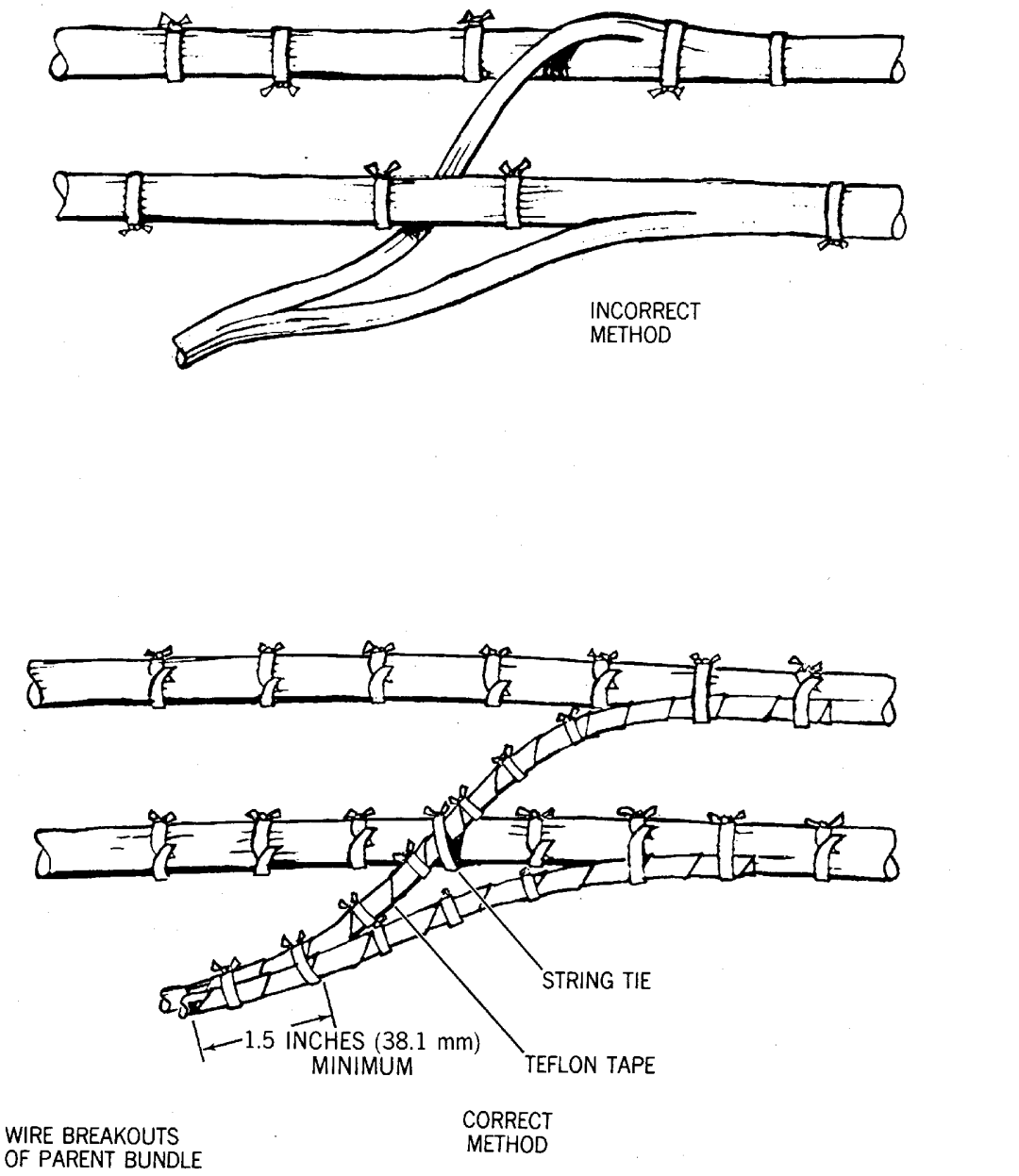

Wire Bundle Installation
Figure 203/20-50-02-990-803 (Sheet 3 of 3)

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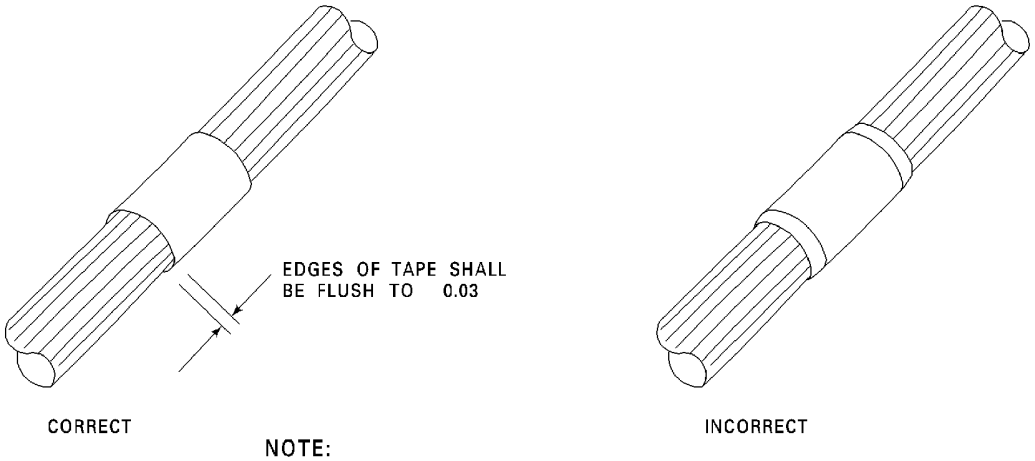
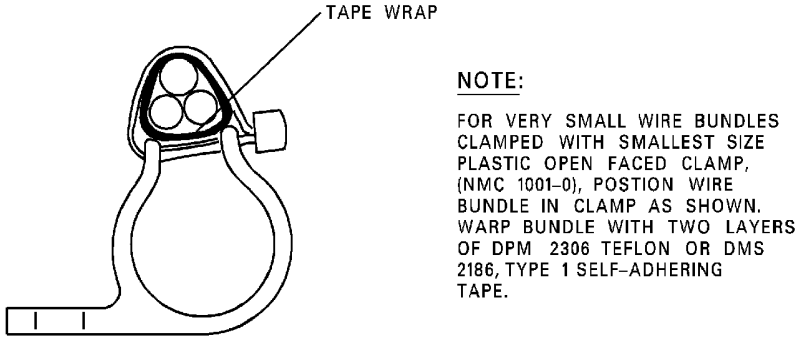


Wrapping Tape for Build Up Under Clamp
Figure 204/20-50-02-990-804



Alternate Clamping Method for NMC1001-0 or Adel 383-0
Figure 205/20-50-02-990-805

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COPPER TERMINALS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides installation instructions for copper terminals.

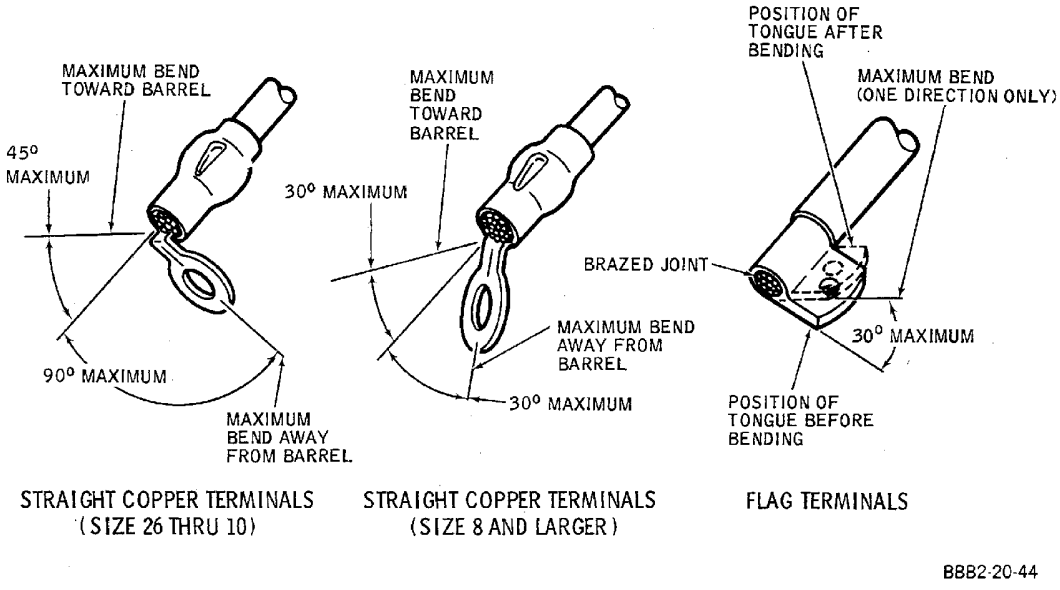
2. Removal/Installation Copper Terminals

A. Install Terminals

(1) Copper terminals can be bent to facilitate installation (Figure 201).

CAUTION: ONCE A TERMINAL IS BENT DO NOT BEND IN OPPOSITE DIRECTION, OR TO LESSER ANGLE. TERMINAL COULD BREAK IN SERVICE.

(2) Determine terminal size and degree of required bend before attaching terminal to ground stud or terminal post.



Copper Terminals -- Removal/Installation
Figure 201/20-50-03-990-801

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ELECTRICAL CONNECTORS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides assembly, repair, and special soldering instructions for electrical connectors.

NOTE: Before connecting the plug to it's mating receptacle, visually verify both connectors are free of FOD, pins and sockets are straight and not recessed, and no obvious defects are visible in the surrounding insert and grommet.

2. Equipment and Materials

WARNING: ITEMS IDENTIFIED WITH AN ASTERISK (*) ARE FLAMMABLE.

SUPPLY ADEQUATE VENTILATION AND EXERCISE APPROPRIATE PRECAUTIONARY MEASURES. CONSULT LOCAL AUTHORITY OR REGULATORY AGENCY, FOR FIRE PREVENTION AND PERSONNEL HEALTH AND SAFETY WHEN USING THESE MATERIALS.

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Brush, bristle, nylon	Commercially available
** Die set S7/SL-2	Burndy Corporation
** Die set S6A/SL-3	Burndy Corporation
Extractor RX16-7	Burndy Corporation
Extractor RX20-24	Burndy Corporation
Iron, soldering American Beauty, 60 watt 200 watt	Commercially Available
Phenophthalein	Commercially Available
Plug, grommet sealing L24-P72	
Repair kit, C612-78195-IGTX	Douglas Aircraft Co.
Solder, 60/40 tin-lead DPM 164-1	Commercially Available
Sodium carbonate DMS 954	Commercially Available
Sodium dichromate DPM 956	Commercially Available

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Table 201 (Continued)

Name and Number	Manufacturer
*Solvent, isopropyl alcohol DPM 530	
Tool, crimping M1OS-1	Burndy Corporation
Tool, grommet removal CTS8095-3 CTS8095-7 CTS8095-12 CTS8095-19 CTS8095-27 CTS8095-37 CTS8095-61	CTS Co., L.A.
Tool, insertion RTM16-2	Burndy Corporation
Tool, insertion RTM20-5	Burndy Corporation
Tool, Large nest 683-14940	
Tool, Large nest 683-51559-1 (alternate WT-231)	
Water, distilled	
Wipers, cotton cleaning, Type 1 Class A, DMS QPL 1820	Commercially Available
Nokorode soldering paste DPM 136	M. W. Dunton Co West Warwick, RI
Flux neutralizing solution DPM 299	
NOTE: For preparation of neutralizing solution, refer to Paragraph 5.A.(3).	
Phosphoric acid, 85% technical grade specification 0-0-670, class DPM 951	
Source of clean dry compressed air	
** Burndy Bandomatic crimping machine may be used in lieu of hand crimping tool and dies.	
Resin Flux Type RA 1544 DPM 6049-1	Kester Solder Co. Division of Litton Systems Inc. Anaheim, CA
Electronic Controlled Variable Minisoldering Station EC4001ESD	Weller Apex, NC
Crimping Tool, HX4	Daniels Mfg. Corp. Orlando, FL
Crimp Dies 6150-192	Times Microwave Systems, Inc. Wallingford, CT
Red transparent Layout Dye, DYKEM "DL"	Dykem Co. St. Louis, MO
Torque Wrench (0 to 100 inch pounds) (0 to 45.36 N·m)	

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Table 201 (Continued)

Name and Number	Manufacturer
X-ACTO Knife	Commercially Available
Cuticle Scissors	Commercially Available
Cable Cutter	Commercially Available
Tool, Hex Crimp M22520/5-01	
Tool, Hex Crimp Die PIC 190118, M22520/5-01 (0.098 hex.)	
Tool, Hex Crimp Die PIC 190118 Hex Crimp Die (0.213 / 0.261 hex.)	
Tape, Teflon DPM 2306-1 or DPM 2306-4	Commercially Available
Ray Gun IR550	
Reflector RG-1	
Tubing, Heat Shrinkable DMS 2381-3	Commercially Available
Band, Metal 9D0180-1 or 9D0180-2	
Lockwire, Inconel, NASM20995N32, DPM 684	Not Specified
Lockwire, Corrosion Resistant Steel, NASM20995C32, DPM 5865	Not Specified

3. **Assembling Connectors**

A. General

WARNING: ISOPROPYL ALCOHOL IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN ISOPROPYL ALCOHOL IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ISOPROPYL ALCOHOL IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Connectors must be handled carefully to avoid contamination. If necessary, clean connectors with a clean wipe, DMS QPL 1820, Type 1, Class A dampened with isopropyl alcohol, DPM 530 before assembly. Dry connectors with clean, compressed air.

(2) For Deutsch connectors installed in vibration areas, make certain that hermetic gasket is installed in receptacle adjacent to mating face. Maximum of two gaskets may be installed.

(3) Connectors, except those designated as moisture resistant, from which wires leave in an upward direction, must be protected against entry of water, dirt, and metal particles. Secure length of vinyl tubing around connector and extend along wires to point where wires have completed turn downward. Tie both ends of vinyl tubing with cord.

(4) All unmated connectors must have cap installed and must be stowed with wires in downward direction to protect wires from damage and contamination. Where this is not practicable, connectors must be sealed and protected with vinyl tubing.

(5) Safety connectors with lockwire, as required. (LOCKWIRE SAFETYING - MAINTENANCE PRACTICES, PAGEBLOCK 20-10-18/201)

(6) Repairs to the fuel pump electrical connector wire/conduit assembly must be done with the assembly removed from the aircraft and in accordance with the DC-9, MD-80, MD-90, 717 Overhaul manual chapter 28-20-7, Revision 6 or later dated May 15,1999.

(a) The above step is a CDCCL procedure. For important information on CDCCLs, refer to Airworthiness Limitation Precautions (GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 28-00-00/201).

B. Assemble Flexible Coaxial Cable Connectors 3492-2, 3492-4, 3492-6, 3492-8, 3492-11, and 3492-12

CAUTION: DO NOT NICK OR CUT SHIELD STRANDS.

(1) Remove 21/32 inch (16.7 mm) of outer jacket by making circumferential cut around cable with sharp knife. Follow circumferential cut with lateral cut to remove that section of outer jacket. (Figure 201)

(2) Trim off 5/16 inch (7.9 mm) of shield with mandrel and razor, small scissors, or fingernail clippers.

CAUTION: DO NOT NICK OR CUT CENTER CONDUCTOR.

(3) Trim off 3/16 inch (4.8 mm) of dielectric with sharp knife or razor blade.

(4) Slip clamp nut, washer, gasket, and outer sleeve into cable.

(5) Carefully slip inner sleeve under shield.

(6) After inner sleeve is situated, move outer sleeve into position. (Figure 201)

(7) Crimp outer sleeve with hex swaging tool. (Paragraph 5.)

(8) Install insulator on dielectric.

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(9) Install and solder contact on conductor. Contact should be flush against dielectric and insulator should be flush against inner sleeve.

(10) Protect connector from contamination and damage.

C. Assemble C Series Connectors with K-grips

(1) Disassemble nut, gasket, and braid clamp from connector body. Remove K-grip and sleeve from individual package.

(2) Slip K-grip sleeve and connector nut onto cable. (Figure 202)

CAUTION: DO NOT NICK OR CUT BRAID.

(3) Remove outer cable jacket to dimension A in Table 202.

(4) Trim braid to dimension B in Table 202 with small scissors or fingernail clippers.

(5) Slide grooved slotted end of K-grip barrel over dielectric and under braid until braid touches step of barrel.

(6) Slide connector nut in place so that nut butts against collar of K-grip barrel.

NOTE: Nut must be correctly positioned before crimping.

(7) Hold K-grip barrel in position and slide K-grip sleeve until forward edge of sleeve is even with step of barrel and braid is visible between sleeve and step.

Table 202 Strip Dimensions and Tool Selection for C Series Connectors with K-grips

	Dimension A	Dimension B	Dimension C		
Connector	IN	IN MM	IN MM	K-grip	Tool
UG572/U	1-3/8 34.9	3/8 9.5	3/64 0.05	KS-89-04	683-14940 Large Nest
UG573A/U	1-1/2 38.1	3/8 9.5	3/64 0.05	KS-89-04	683-14940 Large Nest
UG627A/U	1-1/4 31.8	3/8 9.5	3/16 4.8	KS-89-06	683-51559-1 Large Nest or (Alternate WT-231)
UG628A/U	1-5/8 41.3	3/8 9.5	5/16 8.0	KS-89-04	683-14940 Large Nest
UG710A/U	1-1/2 38.1	3/8 9.5	3/64 0.05	KS-89-04	683-14940 Large Nest
80300	1-7/16 36.5	3/8 9.5	1/8 3.2	KS-89-04	683-14940 Large Nest

NOTE: Refer to Figure 202 for location of dimensions.

(8) Crimp K-grip sleeve as shown using tool selected from Table 202. If an alternate tool is used, crimp sleeve twice to utilize full length of sleeve.

NOTE: Flare must exist on each end of K-grip sleeve regardless of tool being used.

CAUTION: DO NOT NICK OR CUT CENTER CONDUCTOR.

(9) Trim dielectric to dimension C in Table 202.

(10) Trim center conductor to depth of contact solder pot so contact is flush with dielectric.

(11) Tin center conductor lightly.

(12) Install and solder contact on center conductor.

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(13) Install gasket and braid clamp.

(14) Insert complete assembly into connector body so contact enters hole in insulator and braid clamp seats properly. Push assembly into body as far as possible. Start connector nut by hand and tighten moderately with wrench.

(15) Hold connector body and torque to 40(±10) inch-pounds (39 to 5.65 N·m).

NOTE: When removing connector with K-grip for replacement, coaxial cable must be carefully cut as close as possible to K-grip sleeve.

D. Assemble Burndy Connectors

CAUTION: KEEP ALL COMPONENTS CLEAN.

(1) Strip insulation from wire ends. For No. 16 contacts strip ¼ in. (6.4 mm); for No. 20 contacts strip 3/16 in. (4.8 mm).

(2) Insert wire into contact until wire strands are visible in inspection holes. (Figure 203, detail 1)

(3) Crimp contact with crimping tool and proper die.

(4) Remove pressure nut or strain relief clamp and pressure ring from rear of connector and slide them over wire bundle. (Figure 203, detail 2)

NOTE: For ease of assembly when using strain relief clamp, remove one clamp screw.

(5) Place crimped contact into grommet hole at rear of connector. Contacts are more easily loaded from center outward concentrically. (Figure 203, detail 3)

(6) Insert contact with proper insertion tool. (Paragraph 3.A.)

(a) For No. 16 contacts position insertion tool so that tip of tool bears against back of wire barrel, training wire in groove of tool. (Figure 203, detail 4)

CAUTION: BE CAREFUL NOT TO COCK TOOL DURING INSERTION.

DO NOT USE BENT OR DAMAGED CONTACTS.

(b) For No. 20 contacts position insertion tool so that tip of tool passes into shroud barrel between insulation and shroud wall, training wire with thumb in groove of tool. (Figure 203, detail 5)

(7) When fully wired connector is not required, use grommet sealing plugs in unused contact holes. Insert plugs from rear of connector. For alternate method of sealing, insert short length of wire crimped to a spare contact into connector. (Figure 203, detail 3)

(8) After all holes have been filled, bring pressure ring and pressure nut into position and tighten nut.

(9) Replace screw in strain relief clamp and tighten clamp. (Figure 203, detail 6)

(10) Extract contacts as follows:

NOTE: The extraction tool consists of a partially split spring release sleeve, a movable plunger, a body, a return spring, and a slider. The body end cap is color coded for easy identification. The tool is used to extract both pin and socket contacts. (Figure 204, detail 1)

(a) Remove pressure nut or strain relief clamp and pressure ring from rear of connector and slide them over wire bundle.

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CAUTION: DO NOT ATTEMPT TO USE EXTRACTION TOOL IN ANY CONTACT HOLE UNLESS A CONTACT IS LOCKED IN PLACE. DO NOT TWIST OR TURN WHILE EXTRACTING.

(b) Hold tool with thumb, forefinger and middle finger gripping taper of slider and knob resting against palm of hand. (Figure 204, detail 3)

(c) Place spring release sleeve over contact to be extracted. Hold tool as nearly perpendicular as possible to face of connector.

NOTE: A slight angle of 10 degrees will help when first inserting sleeve over socket contacts.

(d) Push on knob with palm of hand so that spring release sleeve enters hole in socket or pin face of connector and engages contact retention spring (Most of the force is required to push through rubber; only a small amount of force is required on tool to open retention spring. A feel can easily be developed for the right amount of force.).

(e) Continue to push with palm of hand on knob to hold contact retention spring in unlocked position and move slider forward with fingers and thumb. This will move plunger forward and push contact out of retention spring.

(f) Push slider forward until it stops. Figure 204, detail 2 shows cross section of release sleeve in extraction position.

(g) If contact fails to extract, remove tool from connector, rotate tool approximately 1/4 turn, and repeat Paragraph 3.D.(2) through Paragraph 3.D.(6).

NOTE: Approximately every 50 extractions, examine extraction tool spring release sleeve. A damaged sleeve must be replaced. Wipe return spring with coating of light weight machine oil before reassembly of tool.

E. Assemble Cannon CA-KE or CA31-KE Connectors

NOTE: The CA-KE and the CA31-KE connectors are identical except that the CA31-KE connector clamping nut has a threaded end bell for a conduit fitting or a cable clamp.

(1) Inserting Contacts.

(a) Disassemble connector. (Figure 205)

(b) Slide clamping ring and compression sleeve onto wire bundle.

(c) Feed wires through sealing grommet and rear insert.

(d) Lock retaining ring into proper position by slipping silicone bushing towards receptacle or pin end of contact.

NOTE: Locking the retaining ring may be accomplished after crimping has been completed.

(e) Strip insulation from wire ends.

(f) Crimp contacts onto wires (Paragraph 4.A. for applicable crimping tool and die sets).

(g) Install contacts in front insert.

(h) After all contacts are properly positioned in front insert, slide rear insert over rear end of contacts until rear insert butts against toward insert.

(i) Align keyway and install assembled inserts into connector shell.

(j) Slide sealing grommet forward until grommet butts against rear insert.

(k) Slide compression sleeve and clamping nut forward until clamping nut engages threads on connector shell. Make certain O-ring in clamping nut is seated properly.

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(l) Tighten clamping nut finger-tight plus quarter turn.

NOTE: A strap wrench or a padded wrench may be used to tighten the clamping nut additional quarter turn.

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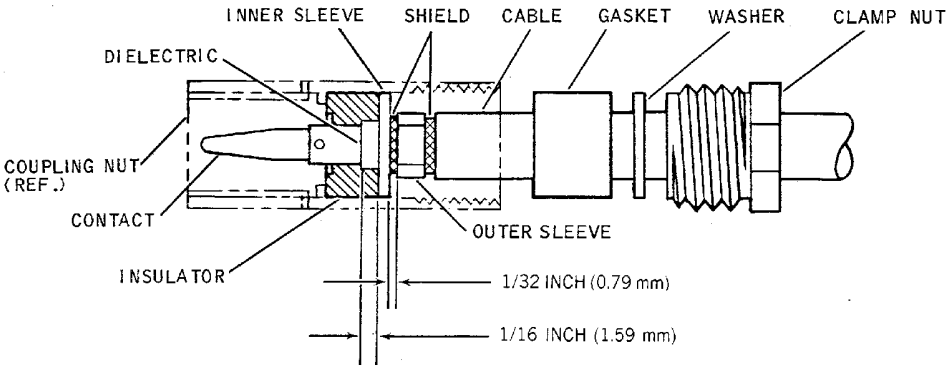
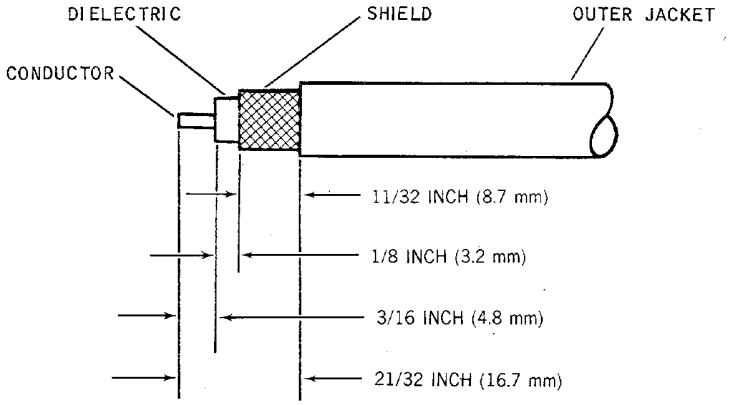


CONNECTOR ASSEMBLY



CABLE STRIPPING METHOD

BBB2-20-45A

Flexible Coaxial Cable Connector
Figure 201/20-50-04-990-801

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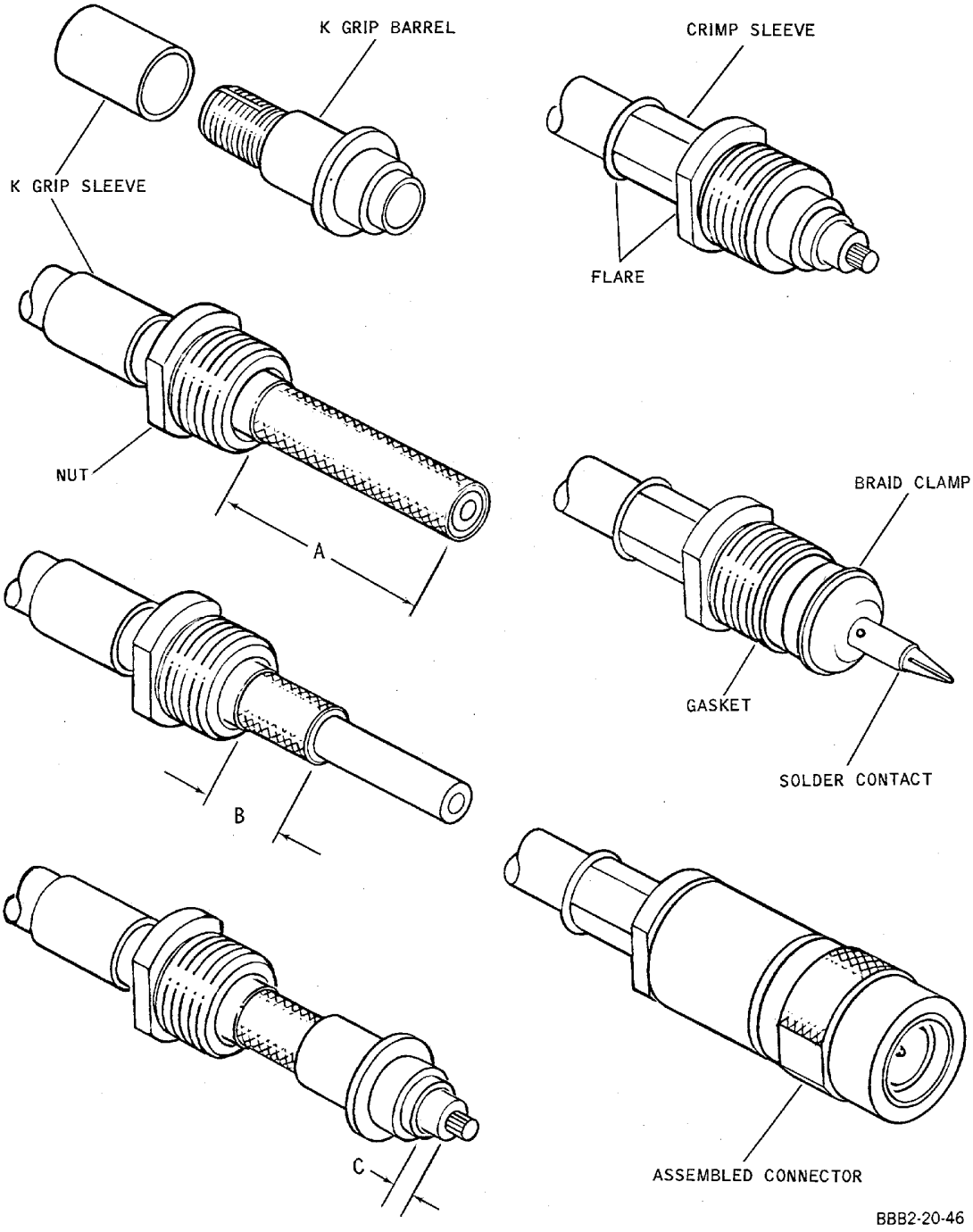

Series C Connector With K-grip -- (Typical)
Figure 202/20-50-04-990-802

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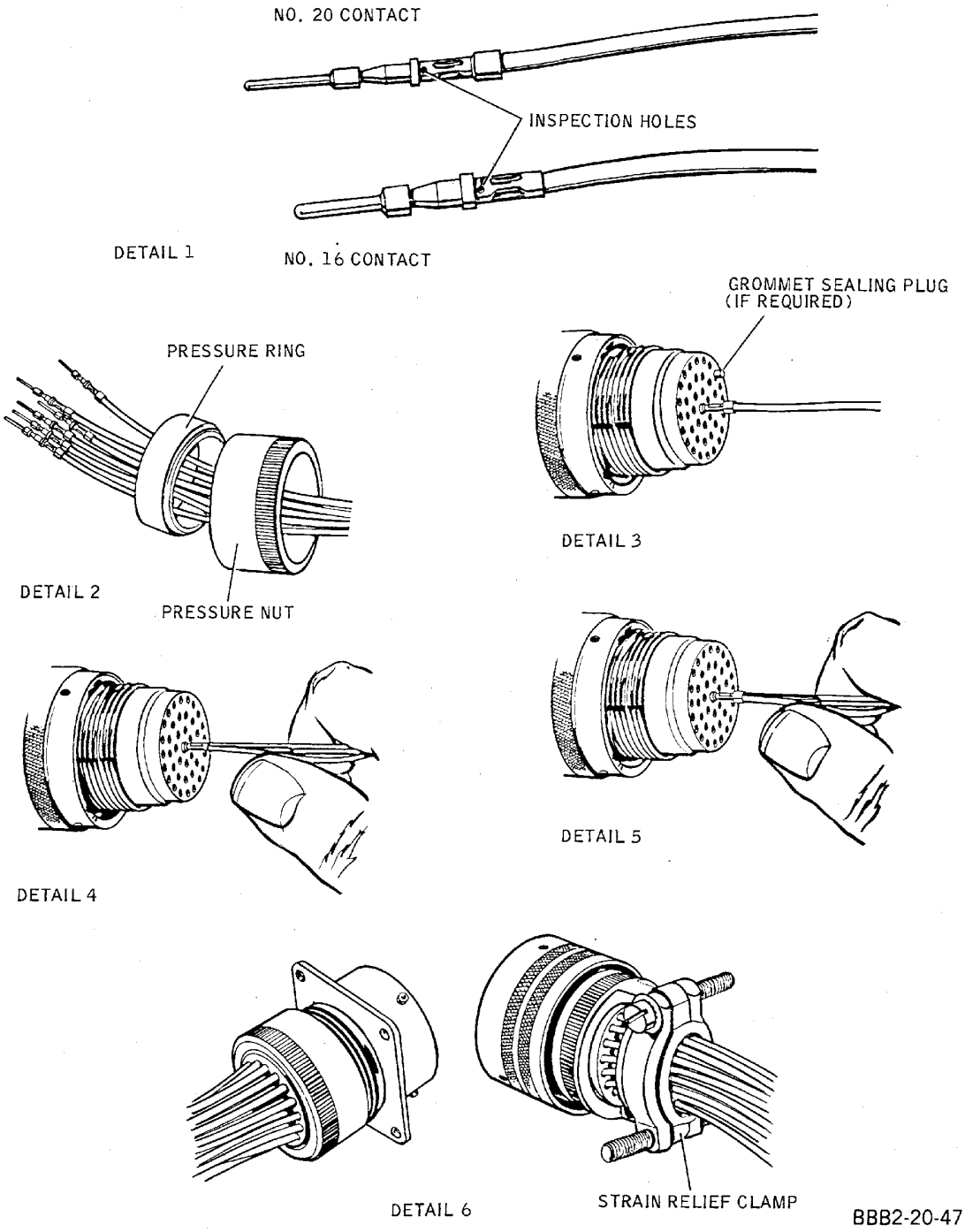

Connector Assembly
Figure 203/20-50-04-990-803

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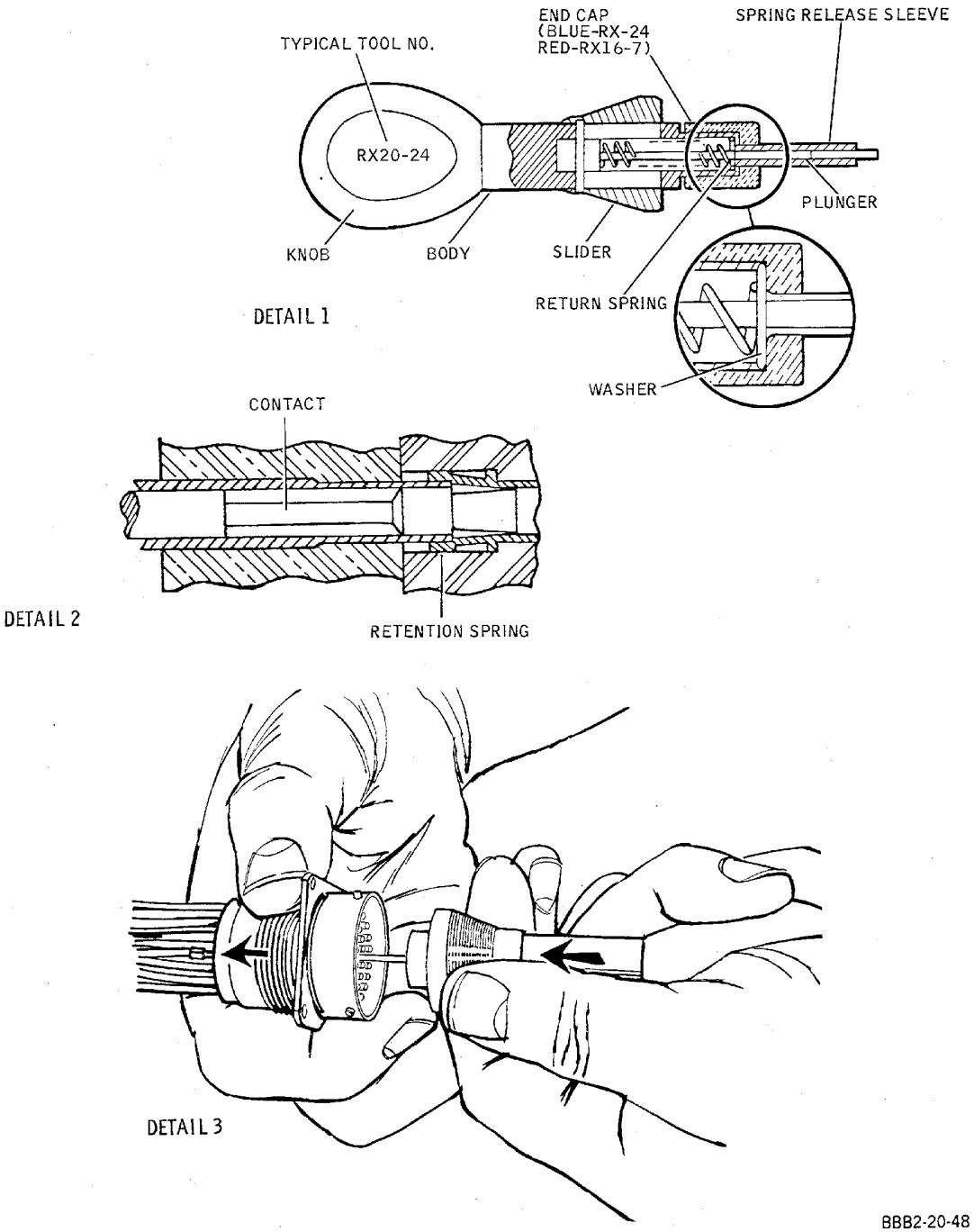

Contact Extraction
Figure 204/20-50-04-990-804

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4. Repair Deutsch DM Connectors

NOTE: The following repair procedure is applicable only to the pressurized areas of the airplane.

WARNING: MAKE CERTAIN THAT APPLICABLE CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURES.

CAUTION: REPAIR OF DEUTSCH CONNECTORS SHOULD BE ACCOMPLISHED ONLY BY CERTIFIED PERSONNEL.

A. Repair Connector

(1) Open circuit breakers, remove fuses, and tag switches as applicable; install breaker safety clamps and warning tags as required.

(2) Disconnect plug from receptacle.

(3) Loosen wire bundle as necessary to permit access to grommet end of connector.

(4) Remove retaining nut and nylon plugs; slide retaining nut and nylon follower back on wire bundle.

(5) Select appropriate grommet removal tool from following list:

Table 203

Number of Contacts	Tool Number
3	CTS 8095-3
7	CTS 8095-7
12	CTS 8095-12
19	CTS 8095-19
27	CTS 8095-27
37	CTS 8095-37
61	CTS 8095-61

(6) Remove connector scaling grommet as follows:

(a) Open grommet removal tool by pulling lock handle away from tool body; tool will separate into two sections.

(b) Place both sections of tool simultaneously around grommet; push tool firmly into connector shell until tool bottoms.

(c) Lock tool in place and allow tool to grip grommet for approximately 2 minutes.

(d) Hold connector body securely and pull tool back over wire bundle, away from connector.

NOTE: If the grommet removal tool slips off grommet, install tool again and allow tool to grip grommet for approximately 4 minutes before attempting to remove grommet.

(7) Remove dislodged or damaged contact from insert; use contact removal tool provided in repair kit (C612-78195-IGTX).

(8) If contact is damaged, remove and replace contact; use only approved soldering method, iron, and iron tip.

(9) Remove all foreign material from outer surface of contact use clean cotton cloth dampened with cleaning fluid furnished in repair kit. Wipe contact dry with clean cotton cloth; avoid handling contact with fingers after cleaning.

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CAUTION: DO NOT ALLOW ADHESIVE TO ENTER SOCKET END OR BE DEPOSITED ON PIN END OF CONTACT.

(10) Apply light film of adhesive, furnished in repair kit, to surfaces of contact as shown in Figure 206.

(11) Allow adhesive to set for approximately 5 seconds before installing contact.

CAUTION: USE FIRM GRIP ON CONTACT. AVOID PLIER DAMAGE TO CONTACT AND WIRES DURING INSTALLATION.

(12) Grip contact with long nose pliers; push contact into insert until contact is aligned in same relative position with other contacts. Do not hesitate during installation of contact, adhesive on contact will set up rapidly.

(13) Allow adhesive to dry from 5 to 10 minutes.

(14) Slide grommet and nylon follower into place in back of connector.

(15) Fill unused holes in sealing grommet with appropriate nylon sealing plug. Select proper plug for grommet hole size from following list:

Table 204

Grommet Hole Size	Nylon Plug Color
20	Red
16	Black
12	Green

NOTE: The nylon plug head should protrude above grommet and should be visible from back of connector when connector is completely assembled.

(16) Install retaining nut finger-tight.

(17) Connect plug to receptacle.

(18) Disconnect plug; verify that no contact damage has occurred.

(19) Connect plug to receptacle.

(20) Secure wire bundle as required.

(21) Close circuit breakers, replace fuses, and remove tags, as applicable.

(22) Check circuit(s) as required.

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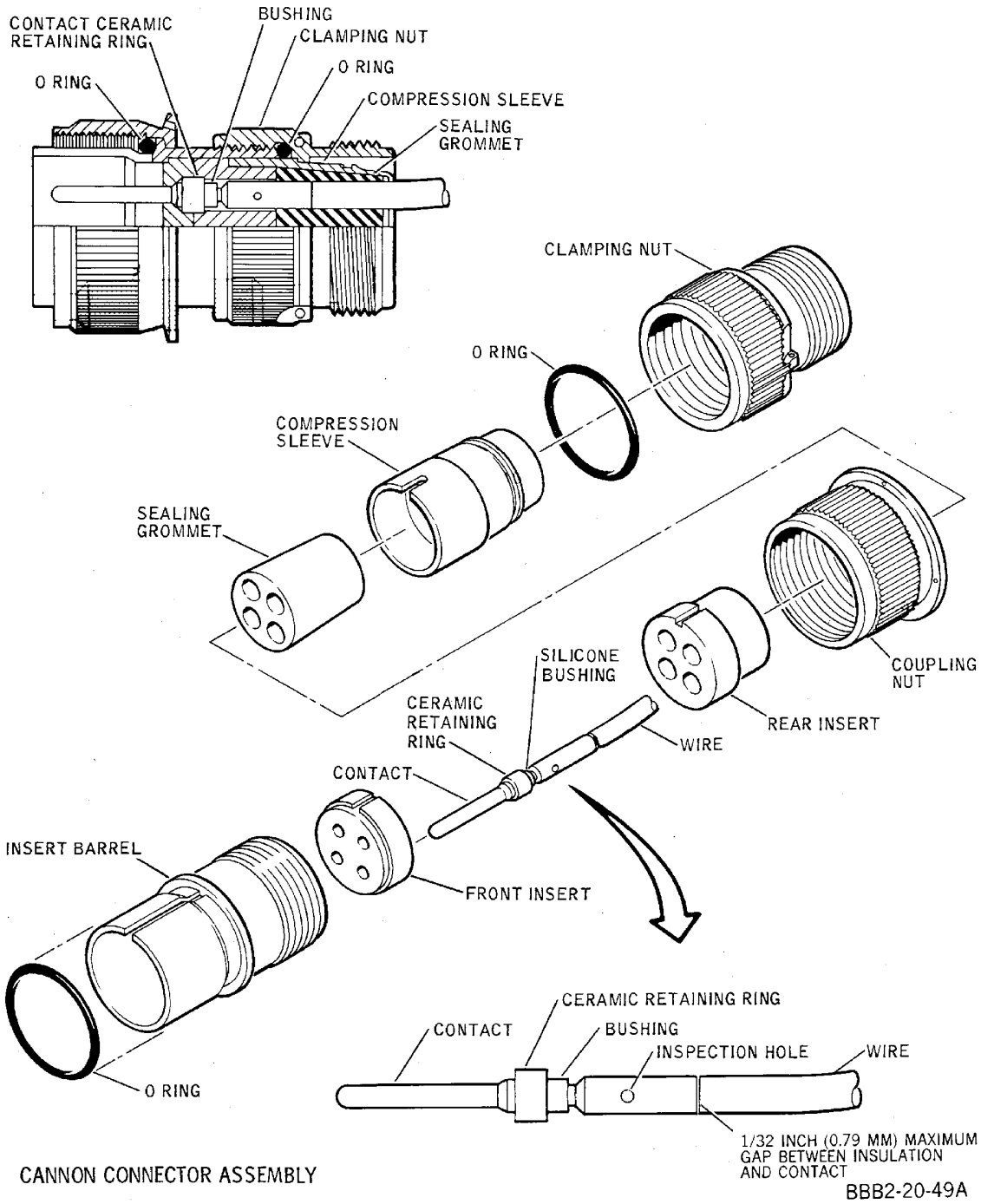

Cannon Connector Assembly
Figure 205/20-50-04-990-805

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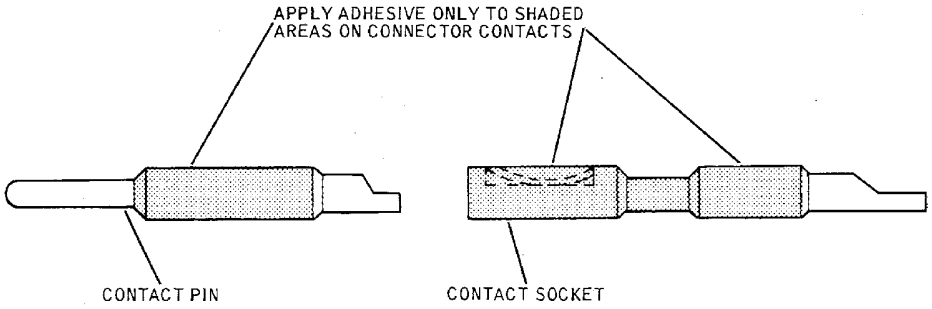

Deutsch DM Connector Contact -- Adhesive Application
Figure 206/20-50-04-990-806

5. Special Soldering Procedures

A. Thermocouple Wire

NOTE: When soldering thermocouple connections, all wires and solder contacts must be tinned, flux neutralized and removed before final soldering.

CAUTION: DO NOT USE NOKORODE SOLDERING PASTE FOR MATERIALS OTHER THAN CONSTANTAN, CHROMEL, OR ALUMEL.

(1) Tin wires and solder contacts with 60/40 tin-lead solder, DPM 164-1, and Nokorode soldering paste, DPM 136, as applicable, only.

WARNING: ISOPROPYL ALCOHOL IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN ISOPROPYL ALCOHOL IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ISOPROPYL ALCOHOL IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(2) After tinning wires or contacts, remove paste by scrubbing with brush or clean cotton cloth saturated with isopropyl alcohol.

(3) Prepare neutralizing solution as follows:

(a) Combine 5 percent sodium carbonate, and 1 percent sodium dichromate in distilled water.

(b) Add enough phenophthalein to above solution to produce red color.

NOTE: Solution should be discarded when color changes to yellow.

(4) Immerse tinned area in neutralizing solution for minimum of 1 minute.

WARNING: CLEANING OPERATIONS USING SOLVENTS SHOULD BE PERFORMED IN A WELL-VENTILATED ATMOSPHERE.

EXERCISE NORMAL SAFETY PRECAUTIONS DURING USE.

(5) Rinse tinned area in clean water, then in clean isopropyl alcohol.

(6) Remove any flux residue from soldering iron before iron is used for final soldering of thermocouple wire or any other electrical soldering.

B. Stainless Steel

(1) When soldering conductors to stainless steel, observe the following procedures:

(a) Roughen stainless steel surface to be soldered with small fine tooth file.

WARNING: ISOPROPYL ALCOHOL IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, AND POISONOUS. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN ISOPROPYL ALCOHOL IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ISOPROPYL ALCOHOL IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(b) Thoroughly wash area and remove loose debris with cloth or stiff brush saturated with isopropyl alcohol.

WARNING: ORTHO PHOSPHORIC ACID IS AN AGENT THAT IS AN IRRITANT AND CORROSIVE. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN ORTHO PHOSPHORIC ACID IS USED.

- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ORTHO PHOSPHORIC ACID IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(c) Cover area on stainless steel to be soldered with Nokorode soldering paste or phosphoric acid may be used as soldering flux.

(d) Tin area to be soldered with 200-watt (minimum) soldering iron and 60/40 tin-lead solder.

(e) Immerse tinned area in neutralizing solution for minimum of 1 minute.

WARNING: ISOPROPYL ALCOHOL IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, AND POISONOUS. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN ISOPROPYL ALCOHOL IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ISOPROPYL ALCOHOL IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(f) Rinse tinned area in clean water, then in clean isopropyl alcohol.

(g) Remove any residual flux from soldering iron before iron is used for final soldering of stainless steel or any other electrical soldering.

CAUTION: DO NOT USE NOKORODE SOLDERING PASTE FOR MATERIALS OTHER THAN CONSTANTAN, CHROMEL, OR ALUMEL.

(h) Tin cable conductor with 60/40 tin-lead solder.

(i) After tinning of conductors, remove flux by scrubbing with brush or clean, cotton cloth saturated with isopropyl alcohol.

(j) Heat tinned stainless steel until solder melts, then connect tinned conductor and remove soldering iron. Do not allow conductor to move while solder is cooling.

6. Repair Times Microwave System AC-4012 "TNC" Connector

NOTE: The following procedure is for removal and replacement of coaxial connector center contact.

WARNING: MAKE CERTAIN THAT APPLICABLE CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURES.

A. Repair Connector

(1) Open circuit breakers, remove fuses, and tag switches as applicable; install breaker safety clamps and warning tags as required.

(2) Remove connector from component.

(3) Loosen coax cable as necessary to permit access to end of connector.

(4) Carefully use two open end wrenches to remove connector body from cable assembly. Turn connector body counterclockwise to remove.

NOTE: Turn connector body only, cable assembly must remain stable.

NOTE: If cable does not have a contact on cable end, lightly tap connector to remove contact from inside connector body.

NOTE: Check to insure that black O-ring is in place inside connector body.

(5) Remove white dielectric spacer from contact on cable. Spacer must be retained for reassembly of connector.

(6) Use Weller EC4001ESD electronic controlled minisoldering station or equivalent, to remove center contact from coax cable.

NOTE: Set soldering iron at 750° (398°C).

(7) Place soldering iron to contact, and allow solder to become fluid before attempting contact removal.

NOTE: Do not damage the installed brown spacer during desoldering procedure.

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(8) Carefully remove contact from coax cable using pair of small pliers. Contact can be discarded.

NOTE: Do not remove brown spacer from cable assembly.

(9) Use Weller EC4001ESD electronic controlled minisoldering station or equivalent, to remove solder by wicking solder into stranded conductor or woven wire braid.

NOTE: Set soldering iron at 750° (398°C).

(10) Put stranded conductor or woven braid into Kester 1544 resin flux, or equivalent.

(11) Place fluxed wire or braid on conductor with solder to be removed.

(12) Place heated soldering iron tip on top of fluxed wire or braid.

(13) Heat wire or braid until it becomes soaked with solder.

NOTE: Coax cable conductor must be clean and free from contamination.

(14) If desired quantity of solder is not completely removed, cut off cold solder and repeat procedure.

(15) Place Times Microwave Systems 4231-299 replacement contact on center conductor, contact must seat firmly against brown spacer. (Figure 207)

NOTE: Coax cable conductor and replacement contact must be clean and free from contamination.

NOTE: Verify conductor is visible in inspection hole before crimping contact.

(16) Use Daniels MFG. HX4 crimp tool with Times Microwave Systems 6150-192 crimp dies, to crimp replacement contact. (Figure 207)

(17) Crimp contact to conductor using specified tool and assembly sequences. (Figure 207)

(18) Open crimp tool and rotate 90 degrees. Again crimp contact.

(19) Open and remove crimp tool with dies from contact.

NOTE: Conductor must be visible in inspection hole.

NOTE: Check that contact is round over crimp area and on securely. Apply a slight tug with small pliers.

(20) Reinstall white dielectric spacer onto contact, spacer must seat against brown spacer.

NOTE: Contact and spacers must be clean and free from contamination.

NOTE: One end of spacer has a recessed shoulder around hole, this end of spacer must go onto contact first.

CAUTION: BLACK O-RING MUST BE INSTALLED INSIDE CONNECTOR BODY BEFORE REASSEMBLY OF CONNECTOR.

(21) Screw connector body onto repaired cable assembly. Turn connector body while holding cable assembly.

NOTE: Connector body and cable assembly must be clean and free from contamination.

NOTE: Turn connector body only, cable assembly must remain stable.

(22) Tighten and torque to 50-75 in-lbs (5.6-8.5 N·m).

(23) Use Dykem "DL" red transparent layout dye or equivalent, to torque stripe repaired connector assembly.

(24) Install connector onto component.

(25) Remove connector; check that no contact damage has occurred.

(26) Install connector onto component.

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(27) Secure coax cable as required.

(28) Close applicable circuit breakers, replace fuses, and remove tags as applicable.

(29) Check component as required.

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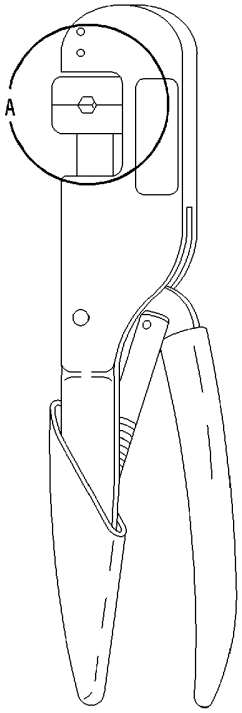
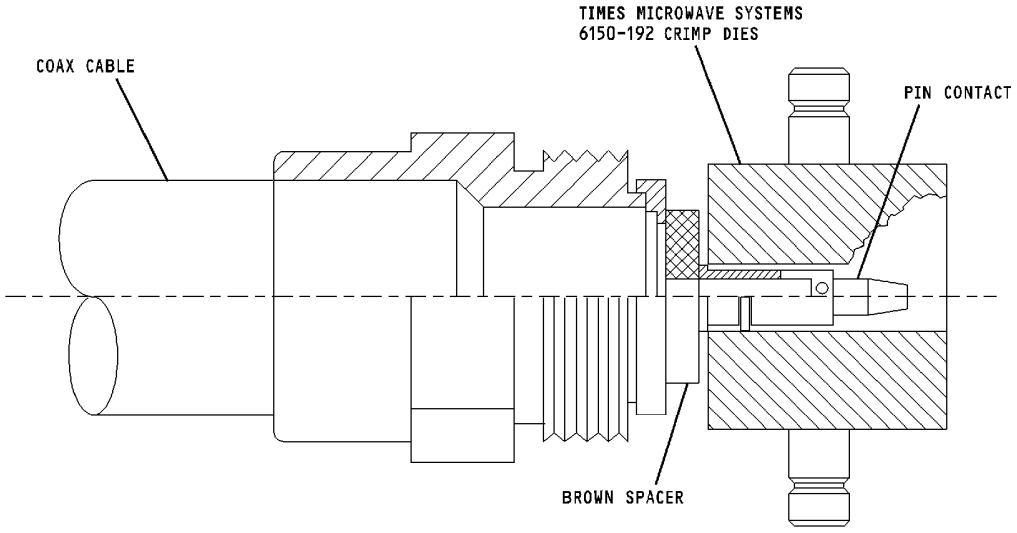


1. INSERT CONTACT ONTO CABLE ASSEMBLY.
2. PLACE CONTACT AND CABLE ASSEMBLY INTO CRIMPING DIES AND CLOSE HANDLES JUST ENOUGH TO HOLD ASSEMBLY IN PLACE.
3. CLOSE HANDLES UNTIL RATCHET RELEASES.
4. OPEN CRIMPING DIES AND TURN CABLE ASSEMBLY 90°, CLOSE HANDLES AGAIN UNTIL RATCHET RELEASES.

NOTE:
PIN CONTACT MUST SEAT FIRMLY AGAINST BROWN SPACER.

DANIELS HX4 CRIMPING TOOL



DETAIL A

CAG(IGDS)

BBB2-20-142

Use of Daniels HX4 Crimp Tool on Timer Microwave Coaxial Connector
Figure 207/20-50-04-990-807

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7. Adjusting Non-Straight Electrical Connector Backshells

A. General

(1) When changing threaded Line Replaceable Units (LRU) such as temperature bulbs, and pressure switches, often, the replacement LRU's main keyway will not be located in the same clocking position as the part being replaced. It then becomes necessary to adjust the position of the connector backshell to allow for proper wire installation for connectors having non-straight (30, 45, 90 degree etc...) backshells. (Figure 208)

B. To Reposition Connector Backshell for Proper Wire/Connector Installation. (Figure 209)

(1) If applicable, remove safety wire that retains backshell coupling.

(2) Loosen backshell with soft-jawed pliers.

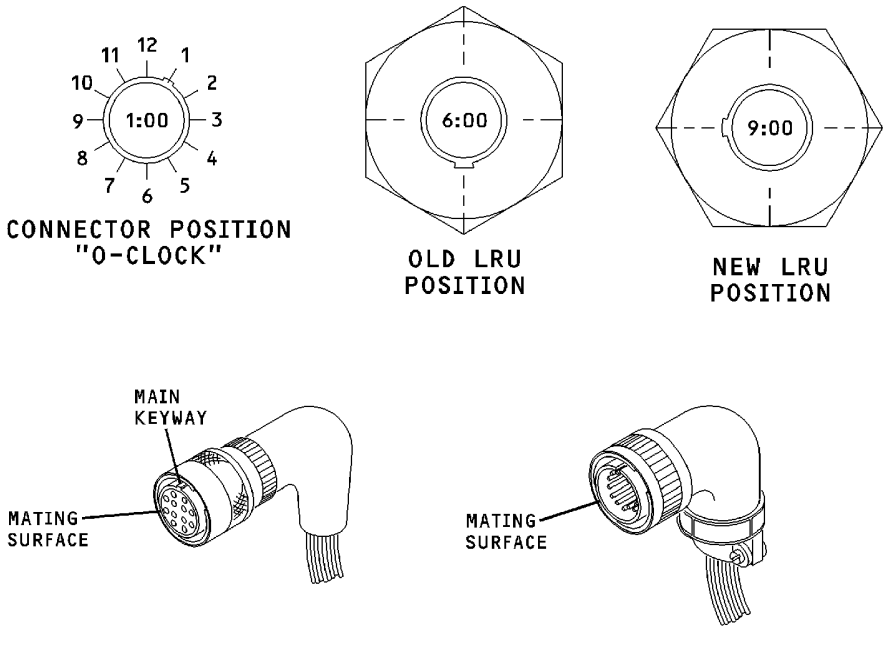
NOTE: The connector can be attached to the LRU to assist in loosening the connector backshell coupling.

(3) Position electrical connector on the newly installed LRU and tighten hand-tight.

(4) Position connector backshell so that the associated electrical wiring is not taut and maintains best possible drip-loop.

(5) Tighten backshell coupling with soft-jawed pliers and safety wire, if applicable.

(6) Tighten electrical connector coupling with soft-jawed pliers.



LRU Mating Electrical Connectors
Figure 208/20-50-04-990-808

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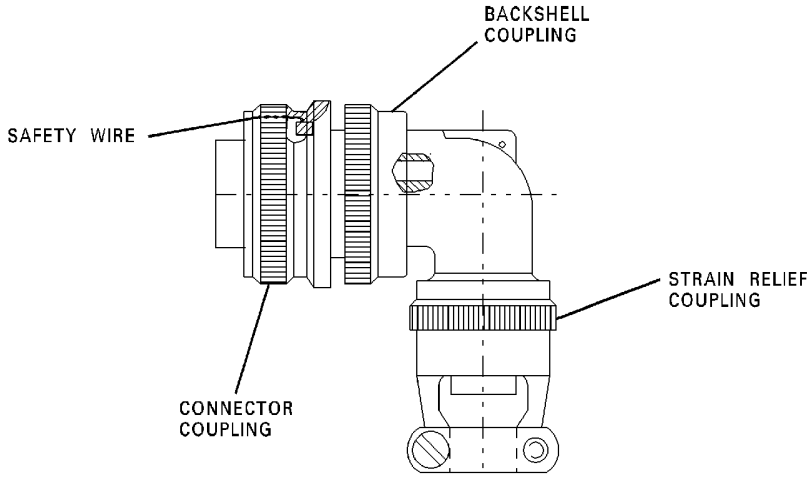

Electrical Connector Nomenclature
Figure 209/20-50-04-990-809

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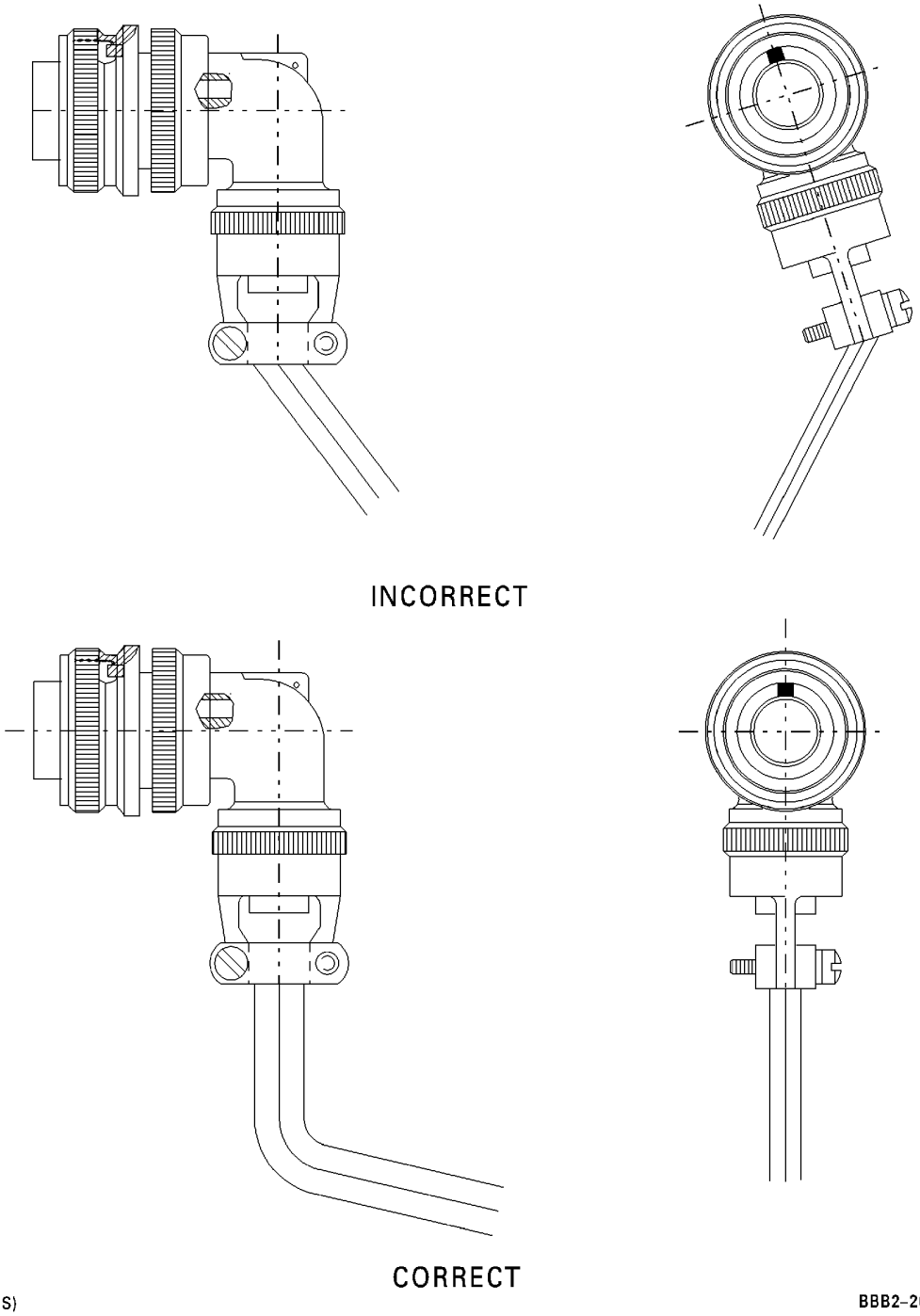

Electrical Connector Wire Position
Figure 210/20-50-04-990-810

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ELECTRICAL TERMINAL BLOCKS AND BUS BARS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides repair instructions for electrical terminal blocks and bus bars.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Die sets N10ET-4 N10ET-17 N14ET-9 N14ET-25	Burndy Corporation
Die sets S-1	Burndy Corporation
Locator SL-53	Burndy Corporation
Tool,crimping M10S-1	Burndy Corporation
Tool,crimping M8ND	Burndy Corporation
Tool,insertion J-1276-1 or J-1276-3	Burndy Corporation
NOTE: S-1 and SL-53 are located inside Burndy hand crimping tool M10S-1. A Burndy power crimping tool YD-2 may be used in lieu of hand crimping tool and die. Terminal block contacts are available, mounted in strips, for use in power crimping tool. Numbers differ only because "M" prefix contact part number.	

3. Repairing Burndy Terminal Blocks and Contacts

A. Repair Blocks and Contacts

WARNING: MAKE CERTAIN CIRCUIT BREAKERS ARE OPEN AND TAGGED BEFORE ATTEMPTING MAINTENANCE PROCEDURES.

(1) The Burndy terminal blocks are similar to terminal strips and are used to electrically connect two or more wires. Three types of terminal blocks are used: The YHLZ-2 terminal block has four sockets, the two sockets on each end are bused together. YHLZ-4 terminal block has four sockets bused together. YHLZ-8 terminal block has eight sockets bused together. (Figure 201, detail 1)

NOTE: The Burndy insertion tool is a dual purpose tool. One end is used to extract the contacts from the terminal blocks and the other end is used to insert the YHMM-22-1 contacts into the terminal blocks. The extraction tool is used for both YHMM-16-1 and YHMM-22-1 contacts. (Figure 201, detail 2)

(2) Extract contacts as follows:

(a) Remove end clamps, fillers, and terminal blocks from open end of track.

CAUTION: DO NOT ATTEMPT TO REMOVE CONTACT WITHOUT USE OF EXTRACTION TOOL.

(b) Insert extraction tip of Burndy extraction tool into guide hole with flat side of tip facing toward socket. Tip of tool will trip nose-like spring and unlock contact. Pull wire gently and withdraw contact. (Figure 201, detail 3)

(c) Remove contact from wire and repair, or replace wire.

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(3) Insert contact as follows:

NOTE: YHMM-16-1 silver plated contact has larger inner diameter and thinner shroud wall than gold plated YHMM-22-1 contact. Both contacts have outer dimensions identical. (Figure 202, detail 1).

CAUTION: EXERCISE CARE TO MAINTAIN STRIPPING DIMENSIONS WHEN USING HAND STRIPPING TOOLS.

(a) Strip wire 11/64 to 3/16 inch (4.36 to 4.8 mm). (Figure 202, detail 2)

(b) Insert selected contact (terminal) in nest of Burndy crimping tool. Make certain die holds contact firmly in place, but does not deform contact.

NOTE: Contact is selected according to wire gage. YHMM-22-1 is used with 22 and 24 gage wire. YHMM-16-1 is used with 16, 18, and 20 gage wire.

(c) Insert wire into contact and crimp. Make certain wire insulation butts against contact barrel. (Figure 202, detail 3)

NOTE: Wire must butt against or be within 1/32 inch (0.79 mm) of locator and be visible in "Inspection Hole". (Figure 202, detail 4)

CAUTION: DO NOT PUSH BURNDY INSERTION TOOL AGAINST RIM OF SHROUD.

(d) Hold crimped YHMM-22-1 gold plated contact and insert into Burndy terminal block. Final seating must be done with Burndy insertion tool. Push contact into fully engaged position. Tines of insertion tool should butt against back end of contact. Approximately 5 pounds (2.25 kg) of force will be needed to fully insert socket. (Figure 203, detail 1)

(e) Insert YHMM-16-1 contact into Burndy terminal block by hand.

(4) Install terminal blocks as follows:

(a) Two methods are used to insert terminal blocks, fillers, and end clamps into track. Slip into open end of track, or, set on base of track and pivot into position. (Figure 203, detail 2)

(b) Snug end clamp against terminal block and fillers.

(c) Tighten screw to fully compress lock-washer and prevent pivot end clamp under finger pressure.

(d) Install terminal blocks, fillers, and end clamps so part numbers are facing open side of tract assembly. (Figure 203, detail 3)

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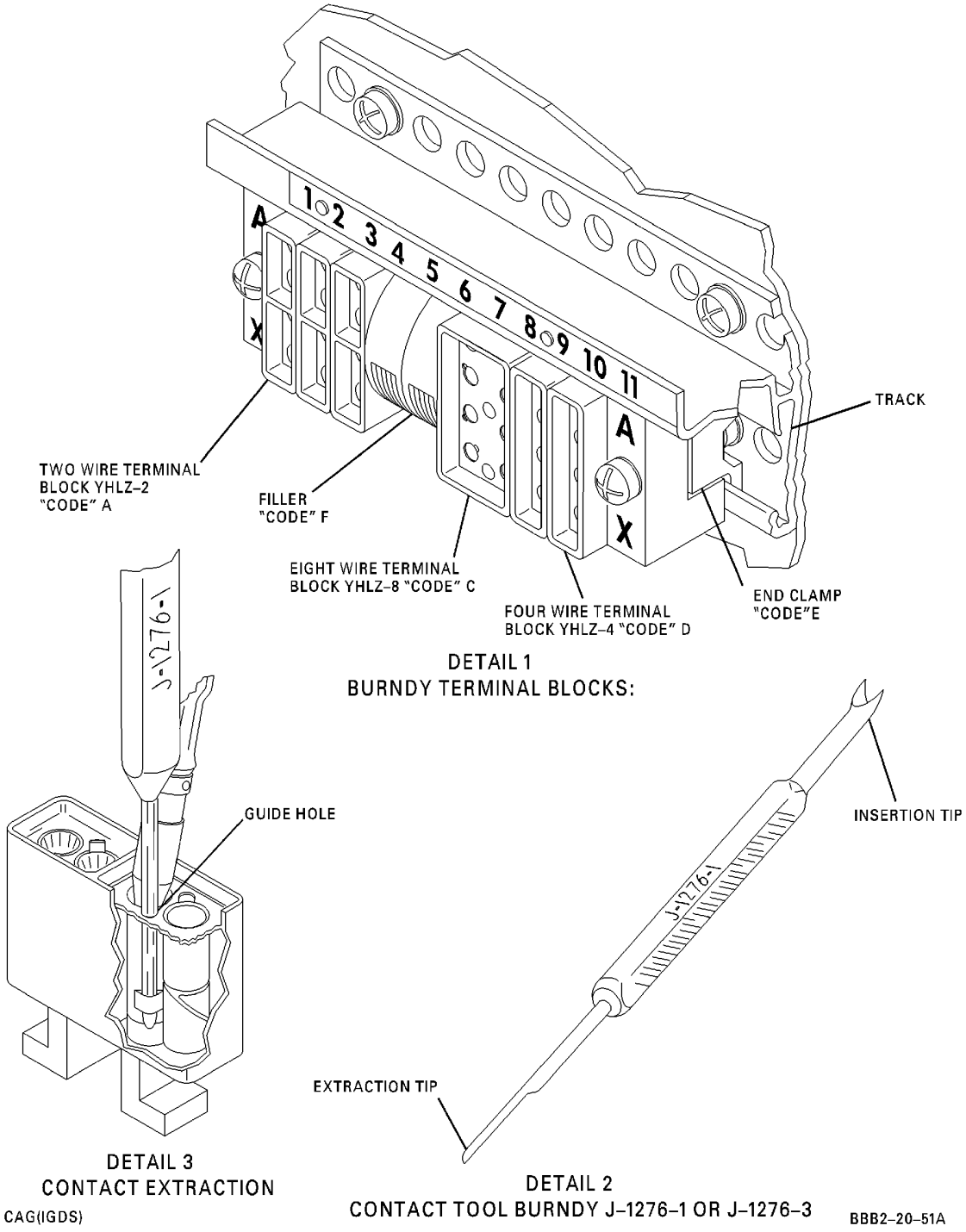

Burndy Terminal Block Assembly and Repair
Figure 201/20-50-05-990-801

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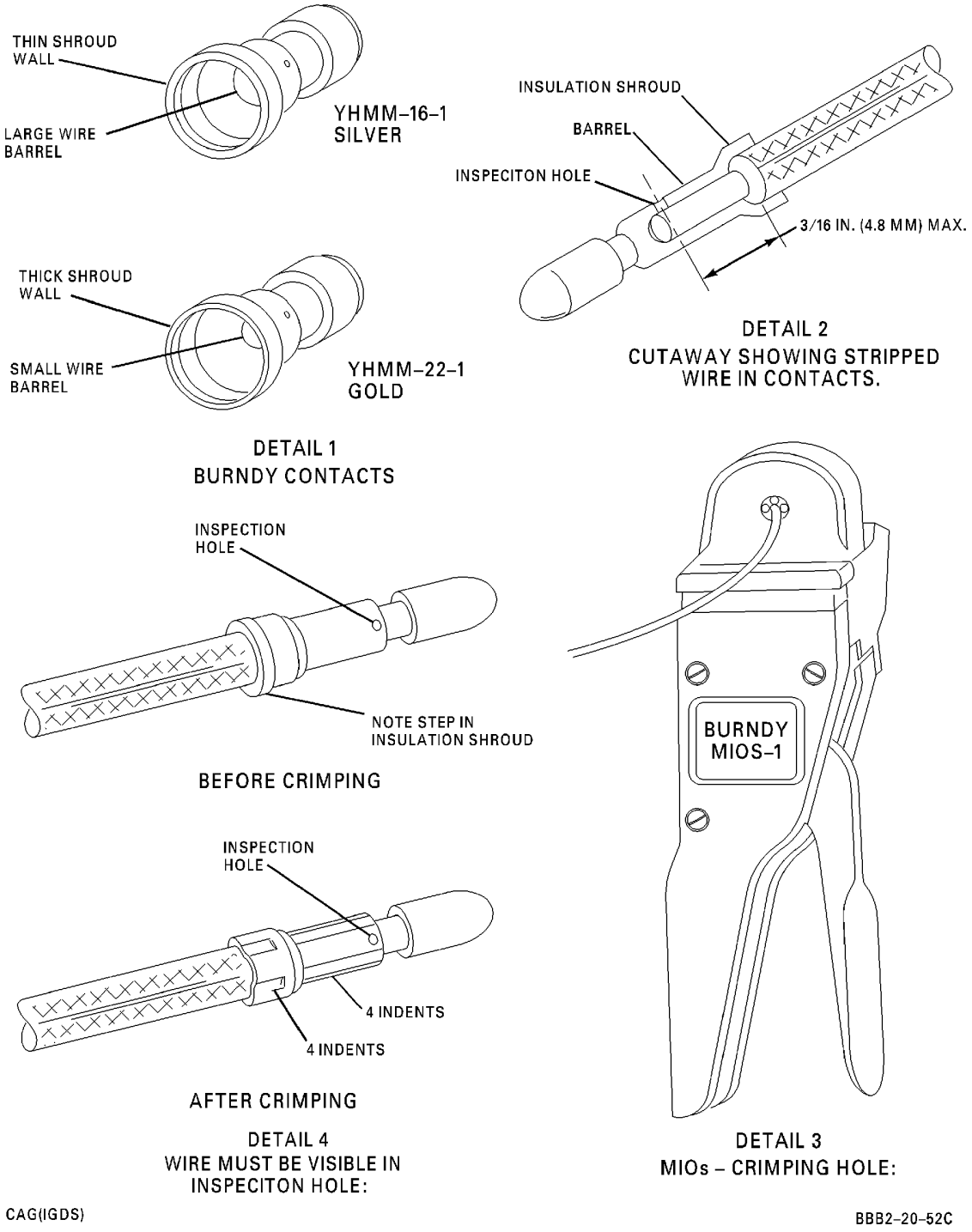

Contact Installation
Figure 202/20-50-05-990-802

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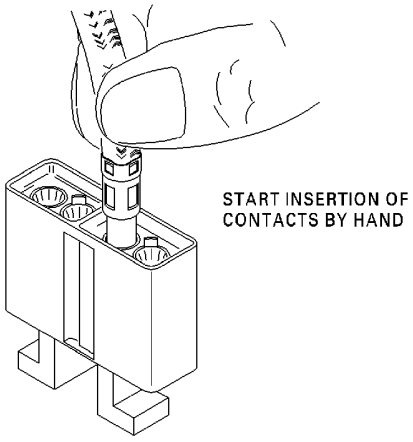
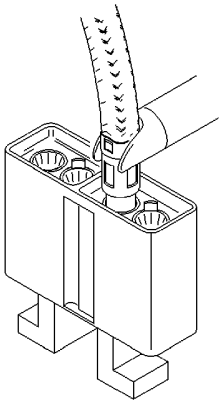
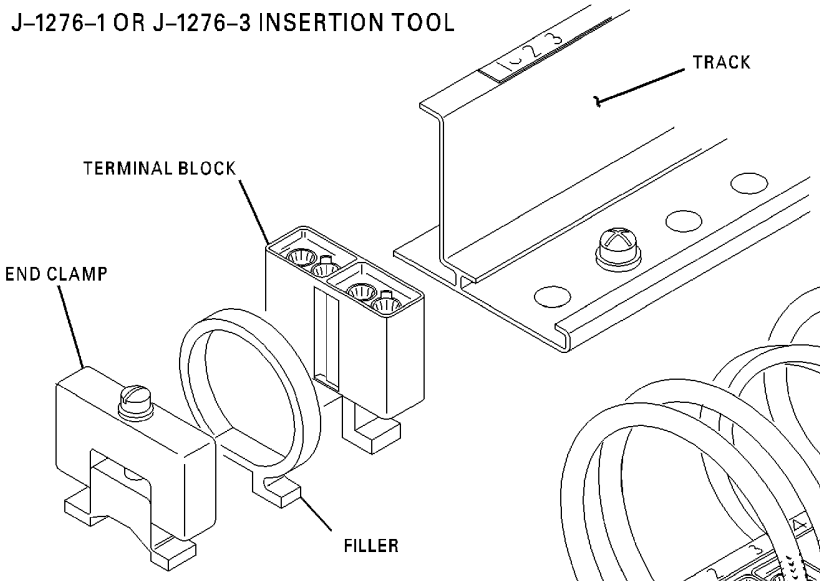
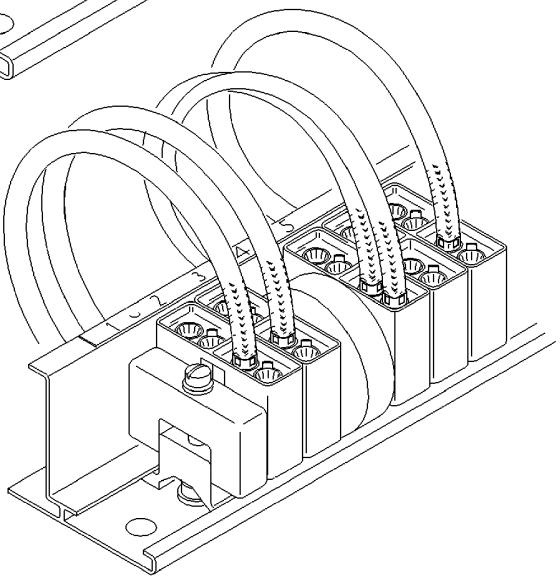


DETAIL 1
J–1276–1 OR J–1276–3 INSERTION TOOL





DETAIL 2
EXPLODED VIEW OF TERMINAL BLOCK



DETAIL 3
INSTALLED TERMINAL BLOCKS

CAG(IGDS)

BBB2–20–53A

Terminal Block Installation
Figure 203/20-50-05-990-803

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4. Repairing Burndy Bus Bar and Contacts

A. Repair Bar and Contacts

(1) Remove feeder lead as follows:

(a) Insert extraction tip of insertion tool in guide hole with flat side toward hypin. (Figure 204)

CAUTION: DO NOT ATTEMPT TO REMOVE PIN FROM SOCKET WITHOUT USE OF EXTRACTION TOOL.

(b) Compress retaining lock spring and remove pin from socket.

(2) Select proper terminal hardware, crimping tool, and dies as required by wire gage. (Table 202)

Table 202 Wir gage terminal Hardware

Wire Gage	Terminal Hardware	Tool	Die
18	YHE18-H	M8ND	N14HET-9
18	YHE18	M8ND	N14HET-25
14	YHE14-H	M8ND	N14HET-9
14	YHE14	M8ND	N14HET-25
10	YHE10	M8ND	N10ET-4
10	YHE10	M8ND	N10ET-17

CAUTION: A MAXIMUM OF TWO SEVERED STRANDS IS PERMISSIBLE FOR 10-GAGE WIRE. NO SEVERED STRANDS ARE PERMITTED FOR 24- THROUGH 12-GAGE WIRE.

(3) Strip insulation from each end of new wire to provide proper insertion depth in terminal hardware. (Figure 205)

(4) Insert conductor in terminal barrel; assure proper penetration depth of both conductor and insulation.

(5) Insert terminal hardware with inserted conductor in crimping tool die nest; crimp terminal.

NOTE: Hypin crimp slot must be orientated at 90 degrees with respect to applied crimp force. (Figure 205)

(6) Make certain that hypin socket is free from metal chips or other foreign matter.

(7) Using insert end of insertion tool, insert and lock hypin.

(8) Connect feeder lead terminal at circuit breaker.

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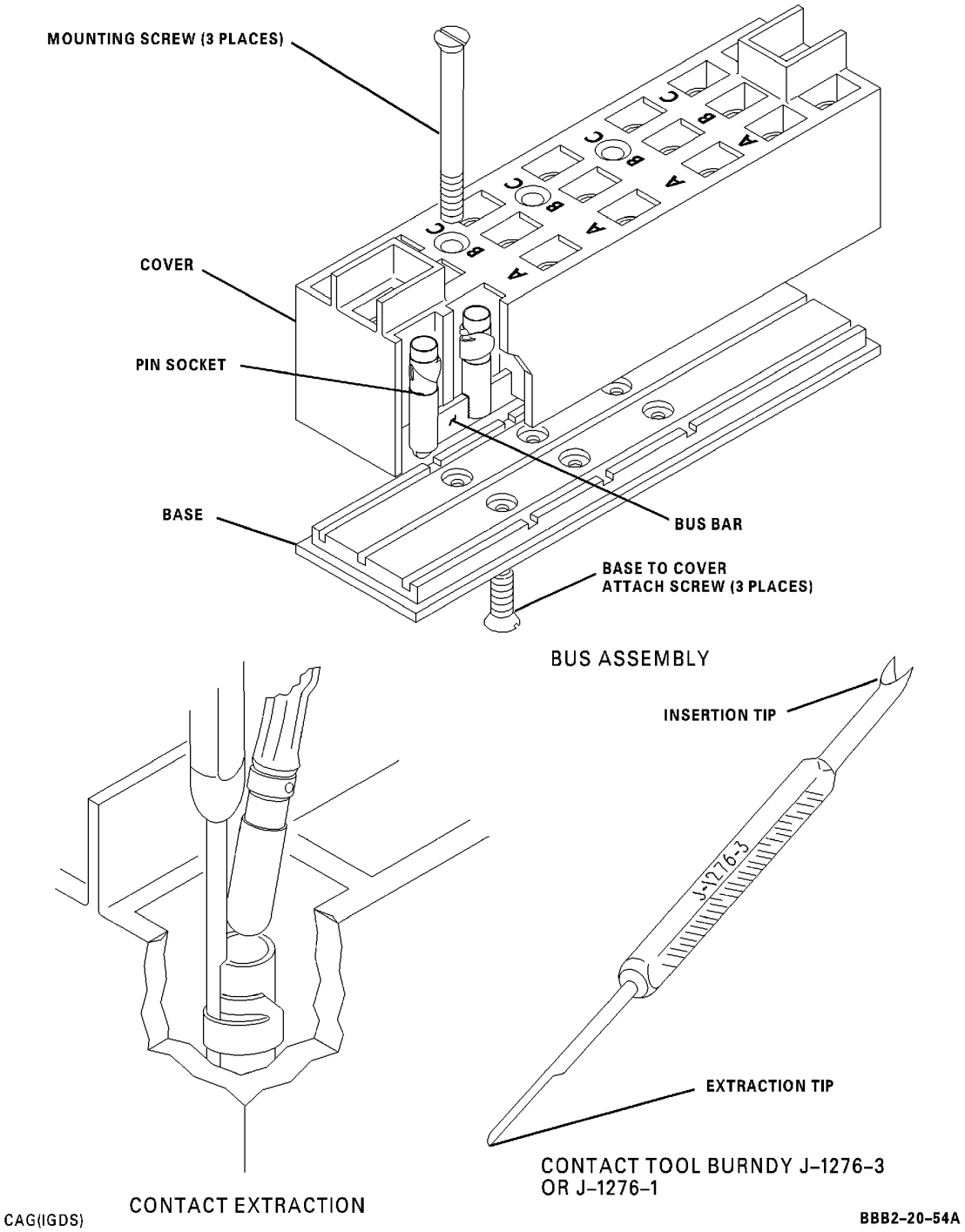

Circuit Breaker Feeder Terminal -- Removal/installation
Figure 204/20-50-05-990-804

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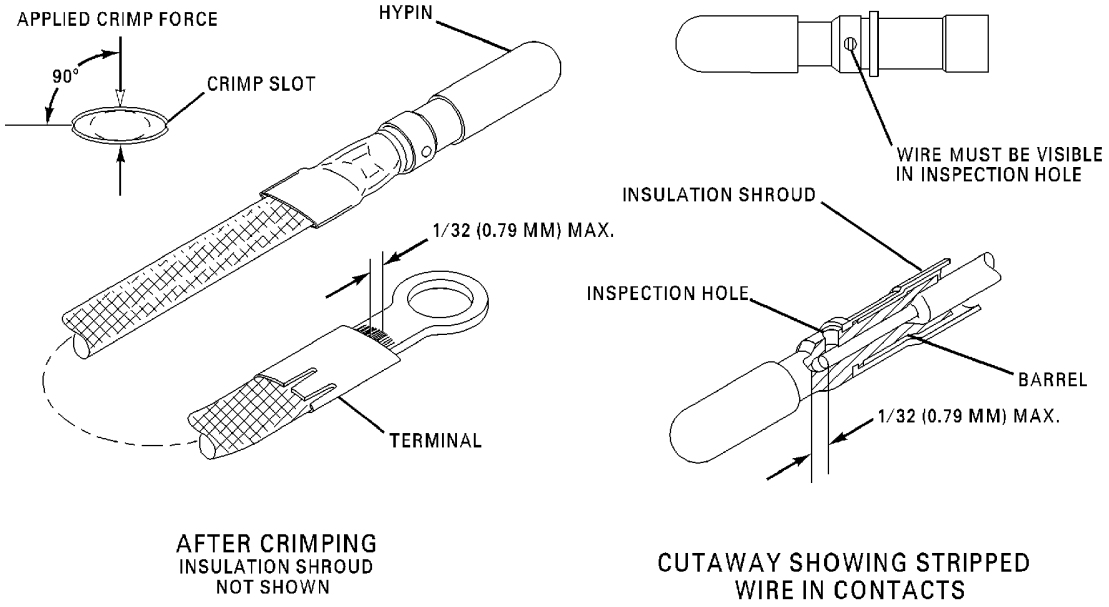

Feeder Terminal Installation
Figure 205/20-50-05-990-805

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ELECTRICAL/ELECTRONICS SAFETY AND EQUIPMENT - MAINTENANCE PRACTICES

1. General

A. Working on any high voltage electrical/electronics system presents hazards, such as electrical shock on contact with energized wiring, short circuits caused by metal tools dropped across electrical conductors, and explosions caused by electrical sparks in the presence of flammable vapors.

B. This section covers safety practices that will help in preventing injury to personnel and damage to equipment during maintenance operations on electrically operated equipment, or while performing maintenance on any part of the electrical/electronics systems.

2. Safety and Operating Precautions

A. General Procedures

WARNING: INFORM PERSONNEL WORKING ON AIRCRAFT BEFORE ENERGIZING ELECTRICAL SYSTEM.

(1) Deenergize electrical system before performing maintenance. (PAGEBLOCK 24-00-00/401)

(2) To make certain that a circuit breaker will remain open until maintenance work is completed, follow this procedure:

(a) Install inoperative ring, S4933959-501 (Paco Plastics Engineering, 8540 Dice Road, Santa Fe Springs, Calif. 90620) under open circuit breaker button to prevent accidental closing of circuit breaker.

(b) Tag circuit breaker as follows:

WARNING: DO NOT CLOSE THIS CIRCUIT BREAKER. THIS CIRCUIT BREAKER MUST REMAIN OPEN UNTIL COMPLETION OF MAINTENANCE WORK.

(3) To safeguard against switch being placed in battery on position while maintenance is performed on certain components not equipped with circuit breakers, tag switch as follows:

WARNING: DO NOT MOVE THIS SWITCH FROM OFF POSITION UNTIL MAINTENANCE WORK HAS BEEN COMPLETED.

(4) Make certain that connectors are properly indexed before mating.

(5) Make certain that cause of component failure has been remedied and related components or systems function properly.

WARNING: MAKE CERTAIN THAT ALL SWITCHES AND CONTROLS ARE IN A POSITION TO PREVENT INADVERTENT OPERATION OF ANY COMPONENT.

(6) Upon completion of maintenance work, follow this procedure:

(a) Remove tag and close applicable circuit breaker.

(b) Energize system.

(c) Perform operational test.

(d) Return switches and controls to normal shutdown position.

(7) When external power is used to energize electrical system, make certain that voltage and frequency of external power supply are set within proper limits.

3. Circuit Breaker Reset Procedure

A. For Fuel Pump and Auxiliary Hydraulic Pump Circuit Breakers:

(1) Verify it is safe to reset the circuit breaker(s) by following the applicable Boeing troubleshooting procedures. Fault(s) that resulted in circuit breaker trip must be isolated and corrected prior to reset if the fault(s) occurred inside the fuel tank or adjacent to any fuel tank wall.

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(a) The above step is an Airworthiness Limitation Instruction (ALI) procedure. For important information on Airworthiness Limitation Instructions (ALIs), refer to Airworthiness Limitation Precautions. (GENERAL - MAINTENANCE PRACTICES, PAGEBLOCK 28-00-00/201)

B. General Procedure

(1) When a circuit breaker trips, do not attempt to reset until discrepancy that caused tripping has been corrected (see applicable trouble shooting procedure for affected equipment).

(2) If tripped circuit breaker is one of three circuit breakers protecting 3-phase circuit, open other two circuit breakers.

(3) Close circuit breaker(s) after trouble has been determined and corrected.

4. Check Electrical Connectors

A. Check Connectors

CAUTION: SKYDROL, ENGINE OIL, GREASE, OR GENERATOR DRIVE TRANSMISSION OIL SPILLED ON ANY OPEN CONNECTOR MAY CAUSE INSERTS TO SWELL, PREVENTING FULL ENGAGEMENT OF CONNECTOR.

(1) Before installing electrical connectors, remove caps and make certain each insert is free from moisture or contaminants.

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ELECTROSTATIC DISCHARGE SENSITIVE COMPONENTS (ESDS) PROTECTION MAINTENANCE PRACTICES

1. General

A. This section contains the guidelines for protecting electrostatic discharge sensitive (ESDS) components from damage or degradation due to electromagnetic fields and electrostatic discharge. This is a recommendation only, not intended as a mandatory maintenance action.

B. The electrostatic charges (static electricity or electrostatic fields) are those generated and stored on plastic surfaces, garments, ungrounded bodies of people, and other commonly unnoticed sources of static electricity. The passage of these charges through electrostatic discharge sensitive devices (ESDS) and the fields generated by these charges can result in component failure, major electrical characteristic change, or performance degradation.

C. Electrostatic sensitive parts and equipment must be identified to provide awareness that they are subject to damage by electrostatic discharge (ESD). Appropriate identification symbols, labels, etc., must be used on units, components, and packages during shipping, handling, checking, maintenance, and storage to provide precautionary measures (Figure 201).

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

Table 201

Name and Number	Manufacturer
Wrist strap and grounding cord	3M Static Control Systems Division, Austin, TX Charleswater Products, West Newton, MA Simco Company, Hatfield, PA
LRU conductive connector dust caps	3M Static Control Systems Division, Austin, TX Protective Closures Co., Inc., Buffalo, N.Y. ITT Cannon, Santa Ana, CA

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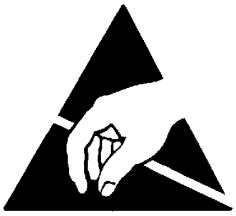

Caution

Contents
Static Sensitive

Handling
Precautions Required

Contents _____

_____

_____

PACKAGING LABEL

ESDS EQUIPMENT LABEL

ESDS PACKAGING/ASSEMBLY LABEL

LABEL PLACED ON OR ADJACENT
TO ESDS COMPONENTS ON PRINTED
WIRING BOARD ASSEMBLIES

CAG(IGDS)

BBB2–20–141

Typical ESD Caution/Advisory Labels
Figure 201/20-50-07-990-801

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3. **Removal/Installation of Electrostatic Discharge Sensitive Components**

A. Remove Line Replaceable Unit (LRU)

(1) Open and tag applicable circuit breakers of LRU to be removed.

(2) Make certain area near LRU rack is clean.

WARNING: PERSONNEL SHOULD NEVER BE ATTACHED DIRECTLY TO A HARD GROUND. THERE SHOULD ALWAYS BE AT LEAST 800 KILOHMS TO 5 MEGOHMS SERIES RESISTANCE BETWEEN PERSON AND GROUND.

(3) Personnel should wear wrist strap set (ESD approved wrist strap and ground cord) in direct contact with bare skin.

(4) Connect ground cord to aircraft metallic structure using alligator clamp adaptor provided with wrist strap kit.

NOTE: Make certain ground attachment is connected to aircraft structure. Do not connect ground attachment to metallic section which is insulated from basic aircraft structure.

(5) Unlatch LRU and slowly slide out of rack.

(6) Place LRU on clean area near rack.

CAUTION: DO NOT TOUCH EXPOSED CONNECTOR PINS. COMPONENTS CAN BE DAMAGED BY ELECTROSTATIC DISCHARGE THROUGH CONNECTOR PINS.

(7) Install conductive dust caps on LRU electrical connectors.

(8) LRU can now be transported to ESD work station or storage.

B. Install Line Replaceable Unit (LRU)

(1) Make certain applicable circuit breakers of LRU to be installed are open and tagged.

WARNING: PERSONNEL SHOULD NEVER BE ATTACHED DIRECTLY TO A HARD GROUND. THERE SHOULD ALWAYS BE AT LEAST 800 KILOHMS TO 5 MEGOHMS SERIES RESISTANCE BETWEEN PERSON AND GROUND.

(2) Personnel should wear wrist strap set (ESD approved wrist strap and ground cord) in direct contact with bare skin.

(3) Connect ground cord to aircraft metallic structure using alligator clamp adaptor provided with wrist strap set.

NOTE: Make certain ground attachment is connected to aircraft structure. Do not connect ground attachment to metallic section which is insulated from basic aircraft structure.

(4) Remove conductive connector dust caps from LRU.

CAUTION: DO NOT TOUCH EXPOSED ELECTRICAL CONNECTOR PINS. COMPONENT CAN BE DAMAGED BY ELECTROSTATIC DISCHARGE THROUGH CONNECTOR PINS.

(5) Immediately slide LRU slowly into rack, making certain that electrical connectors are fully engaged.

(6) Lock and secure LRU into position.

(7) Remove tag and close applicable circuit breakers of affected LRU.

(8) Test LRU as necessary.

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COMMUNICATION / NAVIGATION ANTENNAS SEALING - MAINTENANCE PRACTICES

1. General

A. This procedure has the instructions for sealing the communication / navigation antennas that follow:

- Marker Beacon (MB) (Paragraph 4.B.)
- Very High Frequency (VHF) (Paragraph 4.C.)
- Radio Altimeter (RA) (Paragraph 4.D.)
- VHF Omnidirectional Range/ILS Localizer (VOR/LOC) (Paragraph 4.B.)
- Distance Measuring Equipment (DME) (Paragraph 4.B.)
- Air Traffic Control (ATC) Transponder (Paragraph 4.B.)

WJE 410, 412, 414, 875-879

- Traffic Alert and Collision Avoidance System (TCAS) (Paragraph 4.E.)

WJE 401-412, 414, 415, 417-419, 421, 423, 863-866, 869, 871-881, 883, 884, 886, 887, 892, 893

- Automatic Direction Finder (ADF) Sense/Loop (ARINC 712) (Paragraph 4.A.)

WJE 416, 420, 422, 424-427, 429, 861, 862, 868, 891

- ADF Loop (Paragraph 4.A.)

WJE ALL

- ADF Cover Plate (Paragraph 4.B.)
- RA Cover Plate (Paragraph 4.B.)
- VHF Cover Plate (Paragraph 4.B.)

WJE 405-411, 880, 881, 883, 884

- Global Positioning System (GPS) (Paragraph 4.B.)

WJE ALL

B. For antenna removal/ installation steps, refer to the respective antenna procedure.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Equipment and Materials

Name and Number	Manufacturer
Solvent, Sealant Remover, Hand Wipe Cleaner DPM 6410 Skykleen 1000 Aviation Solvent.	Solutia, Inc., St. Louis, MO.
Solvent, Sealant Remover, Hand Wipe Cleaner DPM 6410-1 Shopmaster RC	Buckeye International, Inc., Maryland Heights, MO.

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Equipment and Materials (Continued)

Name and Number	Manufacturer
Handwipe Cleaner DPM 6380-1 Brulin MP 1793	Brulin & Company, Inc. Richmond, CA
Handwipe Cleaner DPM 6380-3 PF Degreaser	P-T Technologies, Inc. Safety Harbor, FL
Handwipe Cleaner/Solvent DPM 6380-4 561026P	Dynamold Solvents, Inc. Fortworth, TX
Mold Release DPM 5355 #FreKote 700 NC	Automotive Materials Div., The Dexter Corp., Seabrook, NH, NC (Dist.: K. R. Anderson Co., Inc., Santa Ana, CA).
Release, Mold, Fluorocarbon DPM 3494 MS-122 AD (Average Dry Time) MS-122 FD (Fast Dry Time) MS-122 SD (Slow Dry Time)	Miller-Stephenson Chemical Company, Sylmar, CA.
Lubricant, Antisieze, Petrolatum DPM 675 Braycote 236	Air BP, Parsippany, NJ.
Compound, Non-Curing, Corrosion Inhibiting DPM 6498 Cor-Ban 27L	Zip-Chem Products, Morgan Hill, CA
Sealant, Electrically Conductive, Fuel Resistant, Corrosion Inhibitive DPM 6142 P/S 872, B-2	PRC-DeSoto International, Inc., Glendale, CA.
Sealant, 6-hour Application Life DPM 2296-6 PR 1422, B-6	PRC-DeSoto International, Inc., Glendale, CA.
Sealant, Faying Surface, Chromated DMS 2013 Class C Type 1 P/S 870C	PRC-DeSoto International, Inc., Glendale, CA.
Sealant, Corrosion Inhibiting DPM 5896-2 Class B-1/2, B-2 PR 1775	PRC-DeSoto International, Inc., Glendale, CA.
Sealing Compound, Integral Fuel Tanks & Fuel Cell Cavities DMS 2082 Class B-1/2, B-2 PR1422, B-1/2, B-2	PRC-DeSoto International, Inc., Glendale, CA.
Fillet Sealing Compound, Lower Specific Gravity DMS 2427 CLASS B-2; PR1776M	PRC-DeSoto International, Inc., Glendale, CA.

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Equipment and Materials (Continued)

Name and Number	Manufacturer
Wipers, Cleaning DMS 1820, Type 1, Class A	Commercial available.
Long Fiber, Surgical Grade Cotton DPM 3274	Commercial available.
Acid Resistant Brush DPM 5690	Commercial available.
Brush, Glue DPM 3566	Commercial available.
Plastic Scraper DPM 6587	Commercial available.

3. **Surface Preparation for Application of Sealant**

A. Removal of cured sealant

(1) Remove the cured sealant from the applicable antenna and/or mount surfaces as follows:

CAUTION: ONLY USE APPROVED SCRAPERS ON THE AIRPLANE SKIN. SCRAPERS THAT ARE NOT APPROVED CAN MAKE SCRATCHES ON THE SKIN, AND CAUSE FATIGUE CRACKS.

CAUTION: DO NOT USE ABRASIVES, WIRE BRUSHES, UNAPPROVED SCRAPERS, CHIPCHASERS, PICKS, SCREWDRIVERS, BLADES, OR OTHER SUCH DEVICES TO REMOVE CURED SEALANT. THIS WILL HELP PREVENT DAMAGE TO THE COMPONENT SURFACES AND FINISHES.

(a) Use an approved plastic scraper to remove the cured sealant.

NOTE: Sealant removal tools shall not contain silicone, PTFE (polytetrafluoroethylene) or any other material known to interfere with the adhesion of paint or sealant.

WARNING: SEALANT REMOVER SOLVENT IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN SEALANT REMOVER SOLVENT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET SEALANT REMOVER SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

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(WARNING PRECEDES)

(b) If necessary, use sealant remover solvent in the removal process provided the solvent is not allowed to puddle on cured sealant that is not being removed.

NOTE: Use only clean, dry, low lint cloths, that are released of contamination.

1) Clean only as large of an area as can be properly protected from contamination until the sealant can be applied.

2) Wipe the area dry before the hand wipe cleaner evaporates and picks up contamination.

3) Solvent cleaned fillet rework areas shall be permitted to dry for approximately 30 minutes prior to applying new sealant.

(c) After you complete the removal of the cured sealant, check the affected surfaces for damage to the coating, paint system, surface treatment or structure.

(d) The coating, paint system or surface treatment shall be touched up as required.

B. Mold Release/Parting Agent Application Requirements

Use one of the following methods:

NOTE: This procedure is not required when non-curing, corrosion inhibiting compound is used.

(1) Mold Release/Parting Agent Application (aerosol)

NOTE: Do not use aerosol near the aircraft.

(a) Surfaces to be coated shall be thoroughly cleaned and dried per Paragraph 3.A..

(b) All safety precautions printed on the supplier's aerosol containers shall be observed.

WARNING: FLUOROCARBON MOLD RELEASE IS AN AGENT THAT IS POISONOUS, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN FLUOROCARBON MOLD RELEASE IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET FLUOROCARBON MOLD RELEASE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(c) Apply the aerosol as follows:

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1) The spray nozzle shall be directed at the surface to be coated while maintaining a distance of 6 in. (152 mm) to 9 in. (229 mm) between the nozzle and the surface being coated.

NOTE: Use aerosol application on the surfaces that are easily accessible.

NOTE: Do not apply fluorcarbon mold release to the antenna base at the location of the antenna installation as this will contaminate the aircraft skin.

2) Using a sweeping motion while holding the nozzle in a fully-depressed position, apply one uniform coat of mold release to the surface; observe for coverage as evidenced by an opaque milky appearance.

NOTE: The first coat must dry for a minimum of 15 minutes prior to application of a second coat or the application of sealant or assembly.

(2) Mold Release/Parting Agent Application (brush type)

(a) Surfaces to be coated shall be thoroughly cleaned and dried per Paragraph 3.A..

WARNING: PARTING AGENT IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, AND POISONOUS. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN PARTING AGENT IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET PARTING AGENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(b) Apply the brush type as follows:

1) Two uniform wet coats of parting agent shall be applied using a clean bristle brush.

NOTE: The first coat must dry for a minimum of 15 minutes prior to application of a second coat or the application of sealant or assembly.

2) Care shall be used to ensure complete coverage and to avoid puddling.

NOTE: Parting agent is a clear fluid coating and will not exhibit any visual sign of incorrect coverage.

NOTE: Brushes shall be discarded after each use.

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WARNING: WHITE PETROLATUM IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN WHITE PETROLATUM IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT BREATHE THE MIST.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

(3) Petrolatum lubrication application.

(a) A light film of lubricant shall be applied using a clean lit free cloth.

4. Sealing Of Antennas

WJE **WJE 412, 414**

WJE NOTE: Per MD80-SL-20-104, it is technically acceptable to defer the application of aero smoothing/fillet sealing during this antenna installation. Generate a Midwest Airlines Deferred Maintenance Item (DMI) to apply permanent sealant prior to completion of 56 days. Sealant application is considered terminating action for the DMI. All other Aircraft Maintenance Manual sealing and bonding requirements are required to be accomplished.

WJE If an antenna has had aero smoothing/fillet sealing deferred, the antenna should be removed; the fuselage and antenna mating surfaces should be checked for signs of moisture or corrosion; the multi-color conversion coating removed and reapplied to meet RF bond requirements, if moisture or corrosion is noted; any further appropriate corrective action taken as necessary prior to the application of sealant.

WJE **WJE ALL**

A. Automatic Direction Finder (ADF) Loop, ADF Sense/Loop (ARINC 712) Antenna

(1) Seal antenna as follows:

(a) Seal attachment screw heads.

WARNING: FAYING SURFACE SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN FAYING SURFACE SEALANT IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET FAYING SURFACE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: CORROSION INHIBITING NON-CURING COMPOUND IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING NON-CURING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING NON-CURING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

1) Apply sealant compound, P/S 872 or Cor-Ban 27L, under the attachment screw heads.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS FOR THE MATERIALS USED.

WARNING: CORROSION INHIBITING SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AN IRRITANT, AND CARCINOGENIC. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: INTEGRAL FUEL TANKS SEALING COMPOUND (POLYSULFIDE SEALANT B1/2 AND B2) IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN INTEGRAL FUEL TANKS SEALING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET INTEGRAL FUEL TANKS SEALING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(b) Apply fillet seal (PR-1422 B-1/2 B-2, PR-1775, or PR-1776M) around the periphery of the antenna. The sealing material shall be faired to approximately a 45° angle.

B. Marker Beacon (MB), Distance Measuring Equipment (DME), Air Traffic Control (ATC) Mode-S System , Mode SL Band, Global Positional System (GPS), VOR/LOC Antenna, and ADF, RA, VHF, GPS Cover Plate

WJE **WJE 412, 414**

WJE NOTE: Per MD80-SL-20-104, it is technically acceptable to defer the application of aero
WJE smoothing/fillet sealing during this antenna installation. Generate a Midwest Airlines
WJE Deferred Maintenance Item (DMI) to apply permanent sealant prior to completion of 56
WJE days. Sealant application is considered terminating action for the DMI. All other Aircraft
WJE Maintenance Manual sealing and bonding requirements are required to be accomplished.

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WJE If an antenna has had aero smoothing/fillet sealing deferred, the antenna should be removed; the fuselage and antenna mating surfaces should be checked for signs of moisture or corrosion; the multi-color conversion coating removed and reapplied to meet RF bond requirements, if moisture or corrosion is noted; any further appropriate corrective action taken as necessary prior to the application of sealant.

WJE **WJE ALL**

(1) Seal antenna or cover plate as follow:

(a) One of the following sealing methods listed below shall be applied under the antenna base or cover plate:

1) A separable faying surface seal shall be formed by applying two coats of fluorocarbon mold release or a very light film of petrolatum antisieze lubricant to the antenna base or cover plate. (Paragraph 3.B.)

NOTE: Mold release or petrolatum is only needed with curing seal (P/S 872), for noncuring seal (Cor-Ban 27L) no mold relaese or petrolatum is needed.

WARNING: ELECTRICALLY CONDUCTIVE SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ELECTRICALLY CONDUCTIVE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ELECTRICALLY CONDUCTIVE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: CORROSION INHIBITING NON-CURING COMPOUND IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING NON-CURING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING NON-CURING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

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TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

a) A separable faying surface seal of electrically conductive, fuel resistant, corrosion inhibitive sealant (P/S 872, B-2) shall be applied between the antenna/cover plate and the fuselage skin.

WARNING: ELECTRICALLY CONDUCTIVE SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ELECTRICALLY CONDUCTIVE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ELECTRICALLY CONDUCTIVE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: CORROSION INHIBITING NON-CURING COMPOUND IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING NON-CURING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING NON-CURING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

2) A faying surface seal of non-curing, corrosion inhibiting compound (Cor-Ban 27L) shall be applied between the antenna/cover plate and the fuselage skin.

(b) Seal attachment screw heads.

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WARNING: USE THE HAZARDOUS MATERIAL WARNINGS FOR THE MATERIALS USED.

WARNING: FAYING SURFACE SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN FAYING SURFACE SEALANT IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET FAYING SURFACE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: CORROSION INHIBITING NON-CURING COMPOUND IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING NON-CURING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING NON-CURING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

1) Apply sealant compound, P/S 872 B-2 or Cor-Ban 27L, to under the attachment screw heads.

(c) Fillet seal sealant around the periphery of the antenna

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WARNING: USE THE HAZARDOUS MATERIAL WARNINGS FOR THE MATERIALS USED.

WARNING: CORROSION INHIBITING SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AN IRRITANT, AND CARCINOGENIC. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: INTEGRAL FUEL TANKS SEALING COMPOUND (POLYSULFIDE SEALANT B1/2 AND B2) IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN INTEGRAL FUEL TANKS SEALING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET INTEGRAL FUEL TANKS SEALING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

1) Apply fillet seal (PR-1422 B-1/2 B-2, PR-1775, or PR-1776M) around the periphery of the antenna. The sealing material shall be faired to approximately a 45° angle.

C. Very High Frequency (VHF) Antenna

WJE **WJE 412, 414**

WJE NOTE: Per MD80-SL-20-104, it is technically acceptable to defer the application of aero smoothing/fillet sealing during this antenna installation. Generate a Midwest Airlines Deferred Maintenance Item (DMI) to apply permanent sealant prior to completion of 56 days. Sealant application is considered terminating action for the DMI. All other Aircraft Maintenance Manual sealing and bonding requirements are required to be accomplished.

WJE If an antenna has had aero smoothing/fillet sealing deferred, the antenna should be removed; the fuselage and antenna mating surfaces should be checked for signs of moisture or corrosion; the multi-color conversion coating removed and reapplied to meet RF bond requirements, if moisture or corrosion is noted; any further appropriate corrective action taken as necessary prior to the application of sealant.

WJE **WJE ALL**

(1) Seal antenna as follow:

(a) One of the following sealing methods listed below shall be applied under the antenna base:

1) A separable faying surface seal shall be formed by applying two coats of fluorocarbon mold release or a very light film of petrolatum antisieze lubricant to the antenna base. (Paragraph 3.B.)

NOTE: Mold release or petrolatum is only needed with curing seal (P/S 872), for noncuring seal (Cor-Ban 27L) no mold relaese or petrolatum is needed.

WARNING: ELECTRICALLY CONDUCTIVE SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ELECTRICALLY CONDUCTIVE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ELECTRICALLY CONDUCTIVE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: CORROSION INHIBITING NON-CURING COMPOUND IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING NON-CURING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING NON-CURING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

a) A separable faying surface seal of electrically conductive, fuel resistant, corrosion inhibitive sealant (P/S 872, B-2) shall be applied between the antenna and the fuselage skin.

WARNING: ELECTRICALLY CONDUCTIVE SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ELECTRICALLY CONDUCTIVE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ELECTRICALLY CONDUCTIVE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: CORROSION INHIBITING NON-CURING COMPOUND IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING NON-CURING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING NON-CURING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

2) A faying surface seal of non-curing, corrosion inhibiting compound (Cor-Ban 27L) shall be applied between the antenna and the fuselage skin.

(b) Fillet seal sealant around the periphery of the antenna

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS FOR THE MATERIALS USED.

WARNING: CORROSION INHIBITING SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AN IRRITANT, AND CARCINOGENIC. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: INTEGRAL FUEL TANKS SEALING COMPOUND (POLYSULFIDE SEALANT B1/2 AND B2) IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN INTEGRAL FUEL TANKS SEALING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET INTEGRAL FUEL TANKS SEALING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

1) Apply fillet seal (PR-1422 B-1/2 B-2, PR-1775, or PR-1776M) around the periphery of the antenna. The sealing material shall be faired to approximately a 45° angle.

D. Radio Altimeter (RA) Antenna

WJE **WJE 412, 414**

WJE NOTE: Per MD80-SL-20-104, it is technically acceptable to defer the application of aero
WJE smoothing/fillet sealing during this antenna installation. Generate a Midwest Airlines
WJE Deferred Maintenance Item (DMI) to apply permanent sealant prior to completion of 56
WJE days. Sealant application is considered terminating action for the DMI. All other Aircraft
WJE Maintenance Manual sealing and bonding requirements are required to be accomplished.

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WJE If an antenna has had aero smoothing/fillet sealing deferred, the antenna should be removed; the fuselage and antenna mating surfaces should be checked for signs of moisture or corrosion; the multi-color conversion coating removed and reapplied to meet RF bond requirements, if moisture or corrosion is noted; any further appropriate corrective action taken as necessary prior to the application of sealant.

WJE **WJE ALL**

(1) Seal antenna as follow:

(a) One of the following sealing methods listed below shall be applied under the antenna base or cover plate:

1) A separable faying surface seal shall be formed by applying two coats of fluorocarbon mold release or a very light film of petrolatum antisieze lubricant to the antenna base or cover plate. (Paragraph 3.B.)

NOTE: Mold release or petrolatum is only needed with curing seal (P/S 872), for noncuring seal (Cor-Ban 27L) no mold relaese or petrolatum is needed.

WARNING: ELECTRICALLY CONDUCTIVE SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ELECTRICALLY CONDUCTIVE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ELECTRICALLY CONDUCTIVE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: CORROSION INHIBITING NON-CURING COMPOUND IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING NON-CURING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING NON-CURING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

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- EMERGENCY MEDICAL AID.

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(WARNING PRECEDES)

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

a) A separable faying surface seal of electrically conductive, fuel resistant, corrosion inhibitive sealant (P/S 872, B-2) shall be applied between the antenna/cover plate and the fuselage skin.

WARNING: ELECTRICALLY CONDUCTIVE SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ELECTRICALLY CONDUCTIVE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ELECTRICALLY CONDUCTIVE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: CORROSION INHIBITING NON-CURING COMPOUND IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING NON-CURING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING NON-CURING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

2) A faying surface seal of non-curing, corrosion inhibiting compound (Cor-Ban 27L) shall be applied between the antenna/cover plate and the fuselage skin.

(b) Butt seal sealant between the antenna and aircraft structure.

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WARNING: USE THE HAZARDOUS MATERIAL WARNINGS FOR THE MATERIALS USED.

WARNING: CORROSION INHIBITING SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AN IRRITANT, AND CARCINOGENIC. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: INTEGRAL FUEL TANKS SEALING COMPOUND (POLYSULFIDE SEALANT B1/2 AND B2) IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN INTEGRAL FUEL TANKS SEALING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET INTEGRAL FUEL TANKS SEALING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

1) Apply butt seal (PR-1422 B-1/2 B-2, PR-1775, or PR-1776M) between the edge of the antenna and aircraft structure.

E. Traffic Alert and Collision Avoidance System (TCAS) Upper and Lower

WJE **WJE 412, 414**

WJE NOTE: Per MD80-SL-20-104, it is technically acceptable to defer the application of aero smoothing/fillet sealing during this antenna installation. Generate a Midwest Airlines Deferred Maintenance Item (DMI) to apply permanent sealant prior to completion of 56 days. Sealant application is considered terminating action for the DMI. All other Aircraft Maintenance Manual sealing and bonding requirements are required to be accomplished.

WJE If an antenna has had aero smoothing/fillet sealing deferred, the antenna should be removed; the fuselage and antenna mating surfaces should be checked for signs of moisture or corrosion; the multi-color conversion coating removed and reapplied to meet RF bond requirements, if moisture or corrosion is noted; any further appropriate corrective action taken as necessary prior to the application of sealant.

WJE **WJE ALL**

(1) Seal TCAS antenna or cover plate as follow:

(a) One of the following sealing methods listed below shall be applied under the antenna base or cover plate:

1) A separable faying surface seal shall be formed by applying two coats of fluorocarbon mold release or a very light film of petrolatum antisieze lubricant to the antenna base that will contract the adapter plate. (Paragraph 3.B.)

WARNING: ELECTRICALLY CONDUCTIVE SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ELECTRICALLY CONDUCTIVE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ELECTRICALLY CONDUCTIVE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: CORROSION INHIBITING NON-CURING COMPOUND IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING NON-CURING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING NON-CURING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

a) Apply separable faying surface seal (PR 1422, B-6) shall be applied between the antenna/cover plate and the fuselage skin.

WARNING: ELECTRICALLY CONDUCTIVE SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN ELECTRICALLY CONDUCTIVE SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET ELECTRICALLY CONDUCTIVE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: CORROSION INHIBITING NON-CURING COMPOUND IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING NON-CURING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING NON-CURING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THESE HAZARDOUS AGENTS.

2) Apply faying surface seal of non-curing, corrosion inhibiting compound (Cor-Ban 27L) between the antenna/cover plate and the fuselage skin.

NOTE: For noncuring seal (Cor-Ban 27L), no mold release or petrolatum is needed.

(b) Seal attachment screw heads.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS FOR THE MATERIALS USED.

WARNING: FAYING SURFACE SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN FAYING SURFACE SEALANT IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET FAYING SURFACE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

1) Apply chromated faying surface sealant (P/S 870C) to under the attachment screw heads.

(c) If only installing cover plate, seal set screw heads.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS FOR THE MATERIALS USED.

WARNING: FAYING SURFACE SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN FAYING SURFACE SEALANT IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET FAYING SURFACE SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

1) Apply chromated faying surface sealant (P/S 870C) to treads of the set screws.

(d) Fillet seal sealant around the periphery of the antenna

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WARNING: USE THE HAZARDOUS MATERIAL WARNINGS FOR THE MATERIALS USED.

WARNING: CORROSION INHIBITING SEALANT IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AN IRRITANT, AND CARCINOGENIC. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CORROSION INHIBITING SEALANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CORROSION INHIBITING SEALANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET FILLET SEALING COMPOUND (LOWER SPECIFIC GRAVITY) IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: INTEGRAL FUEL TANKS SEALING COMPOUND (POLYSULFIDE SEALANT B1/2 AND B2) IS AN AGENT THAT IS POISONOUS AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN INTEGRAL FUEL TANKS SEALING COMPOUND IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET INTEGRAL FUEL TANKS SEALING COMPOUND IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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(WARNING PRECEDES)

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

1) Apply fillet seal (PR-1422 B-1/2 B-2, PR-1775, or PR-1776M) around the periphery of the antenna. The sealing material shall be faired to approximately a 45° angle.

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ENHANCED ZONAL ANALYSIS PROCEDURE (EZAP) TASK CARDS - MAINTENANCE PRACTICES

1. General

A. This procedure contains MSG-3 task card data.

TASK 20-51-01-160-801

2. Cleaning to Remove Combustible Material Around Wiring

NOTE: This procedure is a scheduled maintenance task.

A. General

(1) This procedure cleans the wire bundles and the area around them where dust, lint, and other foreign objects accumulate.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-10710	Explosion Proof Vacuum **MD80-81, -82, -83, -88** Part #: 23954 Supplier: 05490 Part #: EXP1-55 TC TE Supplier: 0YX65 Part #: SS-55 TE TC Supplier: 0YX65
STD-123	Brush - Soft Bristle

C. Prepare for Cleaning and Remove the Combustible Material Around Wiring

SUBTASK 20-51-01-010-001

(1) Open access panels.

D. Cleaning to Remove Combustible Material Around Wiring

SUBTASK 20-51-01-160-001

(1) Do these steps to clean the wire bundles and the area around them:

NOTE: Do not disturb systems installations.

(a) Remove loose contamination by hand.

(b) Use a vacuum, COM-10710 to remove accumulations of dust, lint, and foreign objects.

(c) Use a soft bristle brush, STD-123 to loosen accumulations of dust that remain and vacuum the area again.

E. Job Close-up

SUBTASK 20-51-01-942-001

(1) Remove all the tools and equipment from the work area. Make sure the area is clean.

SUBTASK 20-51-01-410-001

(2) Close access panels.

END OF TASK

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TASK 20-51-01-210-801

3. General Visual Inspection of the Vapor Barrier

A. General Visual Inspection of the Vapor Barrier

SUBTASK 20-51-01-210-001

(1) Do a general visual inspection of the vapor barrier in area between lower surface of cabin floor to upper surface of center wing.

——— END OF TASK ———

TASK 20-51-01-211-801

4. Detailed Inspection of All Wires in the Area of the Bleed Air Duct Joints (Aft Side of Aft Pressure Bulkhead, Left and Right Side)

A. Detailed Inspection of All Wires in the Area of the Bleed Air Duct Joints

SUBTASK 20-51-01-211-001

(1) Do a detailed inspection of all the wiring installations in area of the bleed air duct joints.

(a) Check the wire and wire bundles for degradation due to excessive heat.

(b) Check the wire bundles and the area around them for combustible material.

——— END OF TASK ———

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HYDRAULIC FLUID - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides methods for sampling and testing, and criteria for maintenance, acceptance, or rejection of DMS 2014 hydraulic fluid.

B. The operational environment of the hydraulic fluid will affect the service life of the fluid. Samples of the fluid should be removed from the aircraft at intervals in accordance with the operator's experience and analyzed for the fluid properties. If the fluid properties exceed any one of the fluid in service limits, fluid should be removed and replaced with new fluid in order to bring the fluid properties within service limits. (Paragraph 4.)

C. The problems of hydraulic fluid being mistakenly diluted with other fluids and carrying wear producing contaminants from one failing mechanical component to another are well understood. Equally important is an understanding that the fluid itself deteriorates or wears, producing its own decomposition products which initially stay dissolved in the fluid and pass through the filters. Deterioration of the phosphate ester type fire resistant hydraulic fluids is increased not just in proportion to hours of use but also at an increasing rate as the temperature of the hydraulic components rises. It is further accelerated when air is constantly available in the reservoir.

D. Based on the increasing importance of hydraulic system performance relative to aircraft reliability and dispatch-ability, it is recommended that operators establish a fluid monitoring program which would sample and test fluid condition on a periodic basis commensurate with the operator's route structure and maintenance program. A six month interval is regarded as adequate for most conditions. In addition, samples of fluid in each affected hydraulic system should be taken and tested whenever any of the following occurs:

(1) An unscheduled hydraulic system component removal is made. This will aid in determining the cause of the removal plus safeguard the entire remaining system from wear-contaminated or heat-damaged fluid.

(2) Any evidence is found of hydraulic fluid operation at temperatures over 250°F (121.1°C).

(3) A scheduled major downtime of the aircraft.

E. Trichloroethane and Freon TF solvents used in overhaul of hydraulic system components are not volatile enough to evaporate from within pump cases, valve ports and lines, etc., by just standing at room temperature. If used, the parts must be manually drained, blown with dry air and gently baked dry to remove all solvent. All overhauled parts must be known to be free of solvent before reassembly.

F. The need to ascertain hydraulic fluid quality does not always occur at locations where a laboratory analysis of the fluid may be readily accomplished. There are test kits, however, that may be either carried on board the aircraft or may be prepositioned at selected line stations. These kits are called XX6504730 Patch Test Kits and are available commercially from Millipore Corp., 80 Ashby Rd., Bedford, MA, 01730-2237. One kit checks neutrality number (total acid number). Another kit checks neutrality number, viscosity, and gravity (density). Use of these kits can assist in a local determination of the suitability for continued use of a fluid suspected of deterioration or dilution.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

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Table 201

Name and Number	Manufacturer
Bottles, sample, glass (1-pint, 500cc with fluid resistant cap liners)	
Patch Test Kits XX6504730	Millipore Corp. 80 Ashby Rd. Bedford, MA., 01730-2237

3. Contamination Detection

A. The presence of contamination in the hydraulic system can be detected as follows:

(1) Check filter differential pressure indicators for over-pressure and filter cartridges for visible contamination.

(2) Take samples of hydraulic fluid from system reservoir, components, or lines and check for visible contamination.

(3) Take samples of overheated or diluted hydraulic fluid from associated pump pressure lines and send samples to laboratory for analysis.

NOTE: If hydraulic fluid samples show that the system is not contaminated, filter elements located in the engine hydraulic manifold, system manifold, and auxiliary pump manifold should be checked and replaced as required. If hydraulic fluid samples show that the system is contaminated, proceed with flushing procedures.

B. Draining of Fluid Samples

NOTE: To assure correct results from testing fluid samples, care must be used with sample bottles to make certain that they are carefully precleaned, including final rinse with nonchlorinated solvent, which has been filtered through Millipore membrane (1 micron rating or less), followed by complete drying of bottle.

(1) Obtain fluid samples as follows:

(a) Depressurize system/reservoir. (PAGEBLOCK 29-00-00/201)

(b) Place waste pan under sampling port; for example, reservoir drain valve.

(c) Open valve such that steady but not forceful stream is running.

(d) Allow approximately 1 pint (500cc) to drain. This should purge immediate area of any settled particles.

(e) Insert sample bottle under stream and fill, leaving small air space at top. Withdraw bottle and cap immediately.

NOTE: Bottle cap should contain conical polyethylene closure or piece of mylar or polyethylene film under cap. Deterioration of bottle caps will cause false indication of fluid contamination.

(f) Close drain valve.

(g) Label bottle with full information including date, air-craft identification, system in aircraft, and where in system sample was taken.

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4. Hydraulic Fluid Tests and Limitations

A. Use applicable test kits, filters and vacuum source. Do a test of hydraulic fluid limitation as follows:

Table 202

Property	Limits	Corrective Action
Fluid Type	Must originally have been an approved DMS 2014 product.	Drain, check for immisci ble layers, deposits, gums, or precipitates in used fluid, lines, reser voirs, and filters. Retain sample, then flush and clean (Ref.HYDRAULIC SYSTEM FLUSHING - GENERAL, PAGEBLOCK 29-01-00/201). Consult fluid supplier for means of identification of the non-DMS 2014 fluid.
Viscosity	At 100°F (37.8°C), 6.0 c.s. minimum and 12.5 c.s. maximum, using ASTM Method D445.	If viscosity is low, drain and refill or top off until system bulk viscosity is within limits. If viscosity is high, drain and refill system, furnish identified sample and consult fluid supplier and aircraft manufacturer for cause.
Specific Gravity 77/77°F (25/25°C)	At 77°F (25°C) fluid must be within the range from 0.900 to 1.066 depending on the DMS 2014 type being used. Use ASTM Method D 4052 or D 1217. Consult fluid supplier for exact specific gravity range of type in use.	If outside of range, furnish fluid samples for analysis. Drain and refill until specific gravity is within range for the type in use.
Dissolved Water Content	At 77°F (25°C) fluid must be within 0.0 to 0.7 percent by weight (0 to 7000 PPM). Use ASTM Method D1744. in use. There may not be separated, free water anywhere in the system. Fluid must be clear, not hazy. Consult fluid supplier for exact H_2O content of type in use and means of adding H_2O or drying fluid as needed.	Otherwise, drain, refill, operate, and retest until H_2O content is within range for type
Total Acid Number (TAN)	1.5 maximum mg. KOH per gram using ASTM Method D974 (Ref. Note 1).	Drain and top off or refill system until TAN is below the limit.
Solid Particle Contamination	10 mg./100 ml. maxi- mum by ASTM Method F313 using Type NR, 1 micron pore size, Duralon Millipore membrane and Freon TF (Ref. Note 3).	Examine hydraulic system for potential mechanical component failure from wear or local overheat ing. Examine and replace filters. Check fluid servicing equipment. Drain and service the reservoir with new fil tered fluid. If necees sary, flush and refill until fluid is within limits (Ref. Note 2) or until the damaging parti cles, which cause the component overheating, have been removed.

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Table 202 (Continued)

Property	Limits	Corrective Action
Filtering Time	Time for filtering 100 ml. of used fluid at room temperature through a dry, Type NR, 1 micron pore size, Duralon Millipore membrane under approximately 19 inches of mercury (64.2 kPa) vacuum shall not be more than three times the duration obtained with new fluid under the same conditions (Ref. Note 4).	Drain and refill.
Appearance	Clear single liquid free of haze, sediment or solids.	Check other properties for cause.
NOTE: The 0.5 mg. KOH per gram maximum will prevail until hydraulic servo-valve endurance tests demonstrate that higher acid numbers do not adversely influence servo valve leakage and life.		
NOTE: All flushing of installed pipes, hoses and components should be done only with approved and filtered DMS 2014 fluid that meets all requirements. or solvents shall not be used because they cannot be entirely removed.		
NOTE: The specified value is intended as a conservative safeguard to serve until more data is obtained. operator's experience for typical values obtained in use is solicited.		
NOTE: No solvents are to be used in this test since they often precipitate additional materials from both new and used fluids.		

B. Make sure that solid particle contamination for applicable hydraulic system(s) is not more than limits in table that follows:

Contamination Limitation Chart (NAS 1638, CLASS 9)

Particle Size Limits (microns)	Particles in a 3 fl-oz (100 ml) Fluid Sample *[1]	Corrective Action
5-15	128,000	If the solid particles is above the limitation, examine the hydraulic system(s) for failure or indication of overheating.
15-25	22,800	
25-50	4,050	Use an external hydraulic test stand drain and service the applicable hydraulic system reservoir(s) to remove the particulate contamination that hydraulic system .
50-100	720	
Over 100	128	

*[1] This is the maximum allowable amount of particles by size in a sample.

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BACKUP RINGS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides installation instructions for teflon backup rings. Do not use hardened steel, pointed, or sharp-edged tools for removal or installation of backup rings. Tools fabricated from soft metals such as brass or aluminum are recommended. Tools made of phenolic rod, plastics, or wood can be formed into useful aids to facilitate ring removal and installation.

B. Tool surfaces must be well rounded, polished, and free of burrs. Check tools often, especially tool surfaces which are apt to come in contact with component ring grooves and critical polished areas.

C. When removing backup rings from pistons and cylinders, every effort should be made to avoid contact of tools with critical surfaces of parts.

2. Removal/Installation Backup Rings

A. Install Backup Rings - General Precautions

NOTE: In most installations, teflon backup rings are used to support O-rings, preventing O-ring deformation and resultant bypass leakage. Backup rings are used extensively in high-pressure systems, but are also used in low-pressure systems to prolong O-ring service life.

(1) Check backup rings for deformities, cuts, scratches, or frayed condition. All surfaces must be smooth, without exception.

(2) Check rings in relaxed condition for proper ID and OD.

CAUTION: DO NOT STRETCH OR BEND BACKUP RINGS EXCESSIVELY.

DO NOT EXPOSE TEFLON RINGS TO HOT SURFACES OR OPEN FLAME. TEFLON FUMES ARE EXTREMELY TOXIC.

(3) If required, heat backup rings only as necessary to facilitate installation or rewind spiral rings; use indirect heat or hot water.

(4) Use only compatible lubricant or fluid to lubricate backup rings.

(5) When possible, use hands to install backup rings. Avoid using knives or sharp-pointed tools as aids during installation.

(6) Install single turn backup rings with scarfed ends staggered.

(7) Ensure that spiral backup rings are installed with scarfed end taper to outside of ring to avoid pinching O-ring.

B. Install Internal Continuous Backup Rings

(1) Fold backup ring and insert into cylinder bore. Position backup ring to coincide with ring groove.

(2) Using a small wooden dowel and packing spatula with flattened end bent up at right angle, work ring into ring groove starting at a point opposite fold and continuing in either direction until folded portion of ring is unfolded into groove.

(3) Install second backup ring if required; repeat Paragraph 2.B.(1) and Paragraph 2.B.(2).

(4) Install O-ring in proper position in ring groove of cylinder bore.

(5) Manually form backup ring to its original circular shape with a probe (preferably a wooden dowel with a blunted conical end).

NOTE: If needed a mandrel or expander tool may be inserted into cylinder to reform backup rings.

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(6) After making certain backup rings are completely engaged insert piston or mating rod being careful to avoid pinching rings.

C. Install External Continuous Backup Rings

(1) Expand backup ring, over metal shim stock wrapped over piston, or over conical end of mandrel.

(2) Slip backup ring off, shim stock, or end of mandrel, onto piston ring groove.

(3) Install second backup ring if required; repeat Paragraph 2.C.(1) and Paragraph 2.C.(2)(2).

(4) Install O-ring in proper position in piston ring groove.

(5) Form backup rings to their original circular shape by clamping with a hose clamp.

NOTE: Piston may be frozen with hose clamp holding backup rings in place. Remove clamp, leaving rings frozen in a compressed state. Install piston in bore immediately.

(6) Remove hose clamp and insert piston in bore being careful to avoid pinching rings.

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HYDRAULIC SYSTEM O-RINGS - MAINTENANCE PRACTICES

1. General

A. This maintenance practice provides identification and installation instructions for O-rings used in fire resistant (DMS 2014) fluid systems.

B. Do not use hardened steel, pointed, or sharp-edged tools. Tools made of soft metals such as brass or aluminum are recommended. Tools made of phenolic rod, plastic, or wood can be formed into useful aids to remove O-rings (Figure 201).

C. Check tools often. Tool surfaces must be well rounded, polished, and free of burrs. Give special attention to tool surfaces apt to touch ring grooves or critical areas.

D. When removing O-rings, every effort should be made to avoid contact of tools with critical surfaces of parts (Figure 202).

E. Envelopes containing O-rings to be used in DMS 2014 fluid systems are identified CT.

F. Identification information on O-ring envelopes explains the use and limits of O-rings as follows:

Part Number Cure date Manufacturer's name or trademark CT-(For use in DMS 2014 fluid systems) Applicable specification

(1) Cure date of O-ring is marked in yearly quarters as follows:

1st quarter.....January, February, March 2nd quarter.....April, May, June 3rd quarter.....July, August, September 4th quarter.....October, November, December Example: Cure date "1 Q 78" shows that O-ring was manufactured during first quarter of 1978.

G. O-rings used in the installation of hydraulic power system components are shown in Chapter 29, Figure 29-00-00-990-828. O-rings required for the landing gear, power control systems, etc., will be found in the applicable chapters.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Solvent, P-D-680, Type 1 DPM 518	Commercially available

3. Removal/Installation Hydraulic System O-Rings

A. Care and Cleaning

CAUTION: CLEANLINESS IS OF PRIME IMPORTANCE IN HANDLING O-RINGS. CONTAMINATION BY FOREIGN MATTER, MATE-RIALS, OR CHEMICALS, IS DAMAGING TO SYSTEMS AND PARTS AND CAN CAUSE SLUGGISH ACTION OR COMPLETE SYSTEM FAILURE.

(1) Make sure that work area is clean.

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WARNING: P-D-680 TYPE 1 SOLVENT IS AN AGENT THAT IS FLAMMABLE AND POISONOUS. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN P-D-680 TYPE 1 SOLVENT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET P-D-680 TYPE 1 SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(2) Wash dust, dirt, and grime from parts with cleaning solvent (P-D-680), before installing O-rings.

(3) Thoroughly clean hands and tools.

(4) Provide clean, lint-free cloths or papers to lay O-rings on during buildup.

(5) Avoid contamination of fluids and lubricants during cleaning and handling.

B. Install O-rings

NOTE: To ensure proper O-ring sealing, observe installation precautions. This will aid in making a correct installation and prevent needless damage to O-rings and related parts.

(1) Check O-ring identification.

(2) Check each O-ring for defects. O-rings must be perfectly formed and free of blemishes, abrasions, mold flash or mis-match, cuts, or punctures. Use a 4-power magnifying glass to check.

(3) Check O-ring receiving grooves closely for burrs or other defects. Groove finishes are important. Small scratches cause heavy leakage in high-pressure systems.

(4) Avoid stretching O-rings unnecessarily.

(5) Ensure that correct torque values are used when tightening fittings.

(6) Perform leakage and operational check of component.

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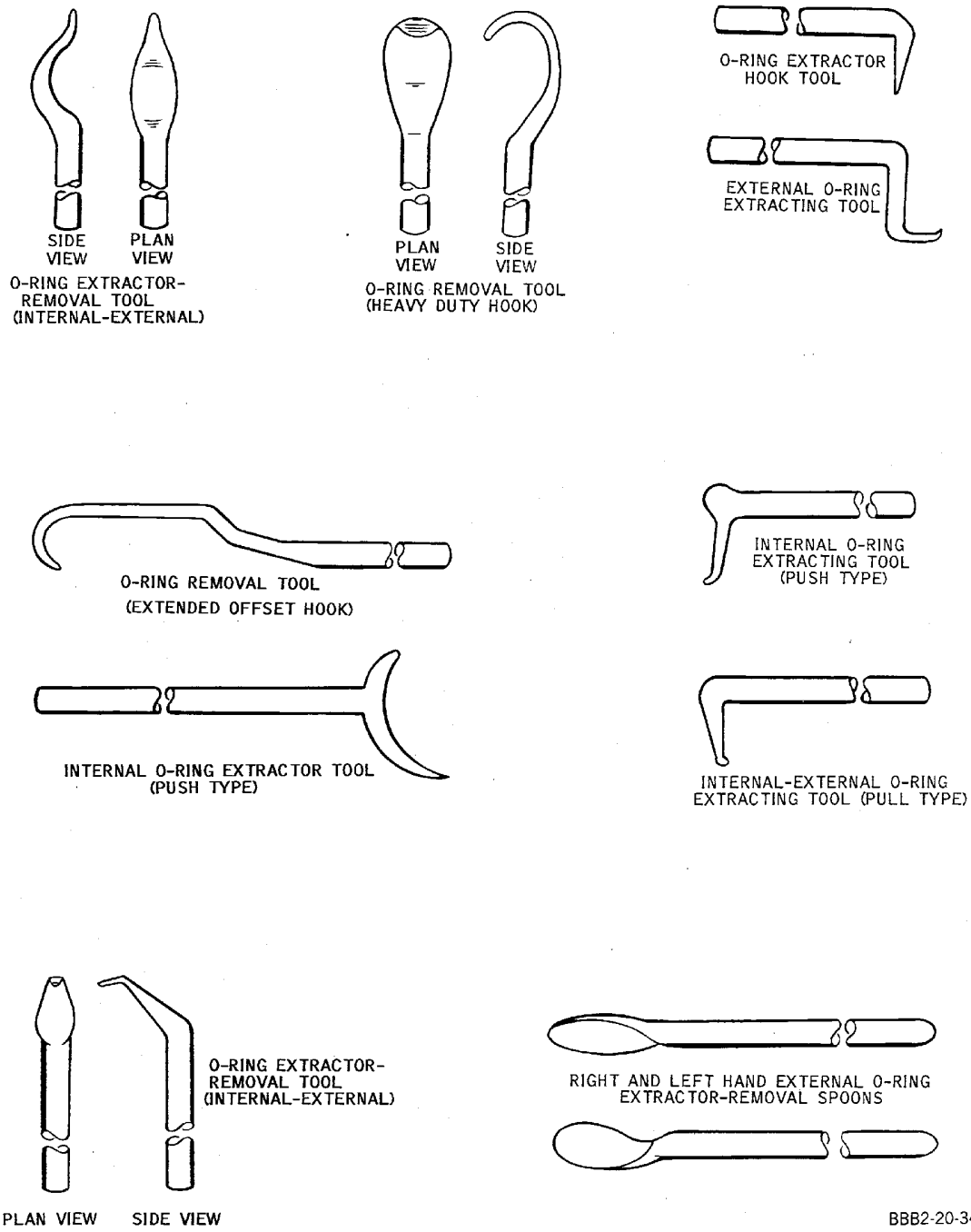

O-ring Removal Tools
Figure 201/20-60-03-990-801

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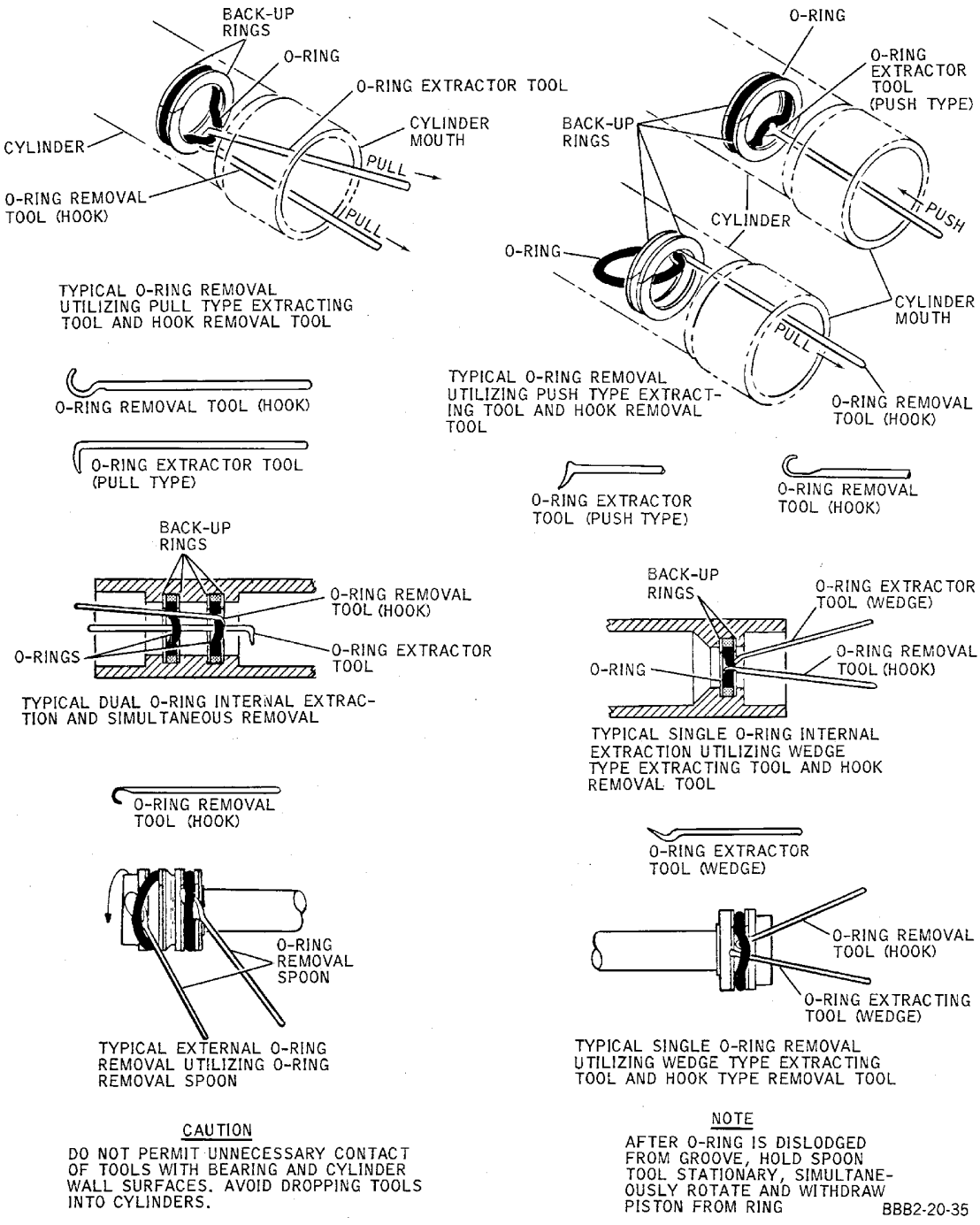

O-ring Removal
Figure 202/20-60-03-990-802

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4. O-ring Storage

A. Store O-rings as follows:

NOTE: O-rings should be kept in original heat-sealed envelopes until ready for use. Envelopes provide protection, identification, and cure date.

(1) In storing, handling, and using O-rings, avoid following:

(a) Improper stacking of parts

(b) Creasing caused by force against corners and edges or squeezing between boxes and storage containers

(c) Compression and flattening caused by storage under heavy parts

(d) Punctures caused by staples used to attach identification tags

(e) Deformation and contamination due to hanging from nails or pegs

(f) Contamination by piercing sealed envelopes to store O-rings on rods, nails, or wire hanging devices

(g) Contamination by fluid leaking from parts stored above or near O-rings

(h) Contamination caused by adhesive tapes put directly on O-rings

(i) Contamination from dirt

(j) Contamination from petroleum products.

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ANTISEIZE LUBRICANTS - MAINTENANCE PRACTICES

1. General

A. This section covers materials used on threads and mating parts of the aircraft. These materials are known as antiseize lubricants, and their use facilitates removal of parts and prevents seizure.

B. The application of antiseize lubricants is divided into two classes; use of special antiseize materials, and use of the system fluid as an antiseize agent.

C. When using special antiseize materials, apply a minimum of the material with extreme care to prevent contaminating the system fluid; plugging orifices, screens, and filters; or dripping on adjacent parts.

D. When using system fluid as an antiseize agent, apply the fluid only to mating surfaces. Do not immerse fittings in the fluid.

E. Leakproof joints are obtained only by proper fitting and installation of mating parts whether they are smooth surfaces, threads, or flares. Do not use lubricants or tinning to seal faulty joints.

F. Procedures in this section are necessarily general; therefore, material specifications are avoided as much as possible. Specific application will determine the exact type material to be used.

2. Equipment and Materials

WARNING: CLEANING OPERATIONS USING SOLVENTS SHOULD BE PERFORMED IN A WELL VENTILATED ATMOSPHERE. EXERCISE NORMAL SAFETY PRECAUTIONS DURING USE.

WARNING: ITEMS IDENTIFIED WITH AN ASTERISK(*) ARE FLAMMABLE. SUPPLY ADEQUATE VENTILATION AND EXERCISE APPROPRIATE PRECAUTIONARY MEASURES. CONSULT LOCAL AUTHORITY OR REGULATORY AGENCY, FOR FIRE PREVENTION AND PERSONNEL HEALTH AND SAFETY WHEN USING THESE MATERIALS.

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Antiseize, high temperature, MIL-A-907 DPM 377	Commercially Available
Corrosion preventive, finger print remover MIL-C-15074 DPM 673	Commercially Available
Corrosion preventive, soft film MIL-C-11796, class 3 DPM 672	Commercially Available
Flux, neutralizing solution	Commercially Available
Fluid, hydraulic, MIL-H-5606 DPM 366	Commercially Available
Loctite, grade EV(2-10)	American Sealants Co. Hartford, Conn.
*Lubricant, cetyl alcohol solution, (100 to 200 grams cetyl alcohol in one liter of 410H solvent) DMS 3440	Electrofilm Inc. No. Hollywood, CA
Lubri-bond 220 DMS 1762	Electrofilm Inc. No. Hollywood, CA

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Table 201 (Continued)

Name and Number	Manufacturer
Lubricant, anti- seize, oxygen Krytox 240AC DPM 5891	E.I. Dupont de Nemours Wilmington, DE
Lubricant, moly, silicone DOD-L-25681 DPM 5782	Commercially Available
Parker-O-Lube DPM 5367	Parker Seal Co. Culver City, CA
Petrolatum VV-P-236 DPM 675	Commercially Available
Skydrol 500B-4 DMS 2014	Monsanto Chemical Co. Los Angeles, CA
Compound Anti-fretting MIL-M-7866 DPM 334	E/M Lubricants, Inc. No. Hollywood, CA.
Skydrol assembly lube, MCS 352 DPM 5073	Monsanto Chemical Co. Los Angeles, CA
Solder, 50/50 tin/ Commercially Available lead alloy QQ-S-571, Sn 50	
*Solvent, cleaning, Commerically Available P-D-680, Type 1 DPM 518	
Tape, polytetra- fluoroethylene, MIL-T-27730 DPM 2766	Commercially Available

3. Application Antiseize Lubricants

A. General Instructions

(1) Apply antiseize lubricant to fluid line fittings per Figure 201 and Paragraph 5..

(2) Apply minimum amount of antiseize lubricant to back of flare when installing flared lines with AN 817 couplings.

(3) Apply antiseize lubricant to tube joint couplings. (Figure 201)

(4) Apply antiseize lubricant to faying surfaces of flareless (MS) assemblies. (Figure 201)

(5) Apply antiseize lubricant when specified on tapered pipe threads, to male threads only. Do not permit lubricant to enter line.

4. Special Antiseize Applications

WARNING: DO NOT TIN OXYGEN FITTINGS. CONTAMINATION OF SYSTEM MAY OCCUR OR AN IMPERFECT JOINT WILL BE FORMED, WHICH WILL CAUSE LEAKAGE.

A. Tinning Male Pipe Threads

WARNING: CLEANING OPERATIONS USING SOLVENTS SHOULD BE PERFORMED IN A WELL VENTILATED ATMOSPHERE. EXERCISE NORMAL SAFETY PRECAUTIONS DURING USE.

WARNING: P-D-680 TYPE 1 SOLVENT IS AN AGENT THAT IS FLAMMABLE AND POISONOUS. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN P-D-680 TYPE 1 SOLVENT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET P-D-680 TYPE 1 SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

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WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Degrease part or clean with brush and cleaning solvent (P-D-680).

(2) Preheat part by dipping in solder at 600° to 650°F (315.6° to 343°C).

(3) Dip area to be tinned in soldering flux.

(4) Tin part by dipping in solder (lead-tin 50/50).

(5) Shake parts lightly to remove excess solder.

(6) Dip tinned area in flux to flow out coat.

(7) Rinse in clear water.

(8) Immerse in flux neutralizer, scrub internal and external if necessary.

(9) Rinse in fresh water, dry with filtered compressed air.

(10) Immerse tinned fittings in fingerprint remover and allow to drain.

NOTE: Steel parts may not tin properly due to black identification dye. Dye should be removed from threads with a steel wire brush. Tin again.

(11) After tinning, check that no buildup of solder or residual is apparent, at roots of threads or inside of fittings. Thin uniform solder coat is required.

B. Antiseize Lubricants in Torque Applications

(1) On threaded parts for which unlubricated torque values have been specified, do not apply lubricant unless galling is encountered; then apply only after a wet torque value has been determined.

(2) Apply soft-film corrosion-preventive to cadmium-plated steel bolts and shafts when installed in magnesium castings. Use soft-film corrosion-preventive as thread lubricant.

NOTE: Wet torque value should be used for lubricated fittings.

C. O-rings and Chevrons

(1) Apply light coat of fluid or compound used in system, or lubricant specified for part.

WARNING: WHITE PETROLATUM IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN WHITE PETROLATUM IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT BREATHE THE MIST.

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(WARNING PRECEDES)

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(2) Lubricate fuel system O-rings with petrolatum.

(3) Lubricate hydraulic system O-rings by dip and drain method before installation.

D. Small O-rings and Adjacent Backup Rings; Application of Non-fluid Lubricants

(1) Saturate small piece of lint-free cloth with lubricant.

(2) Place cloth on a flat surface and lay O-ring on cloth.

(3) Press hard on O-ring to bring ID and OD in contact with cloth.

(4) Turn O-ring over and repeat pressing operation.

E. O-rings Over 2-inch (50.8 mm) Diameter

(1) Wipe O-rings with cloth saturated with specified lubricant.

F. Dry-film Lubricants

WARNING: P-D-680 TYPE 1 SOLVENT IS AN AGENT THAT IS FLAMMABLE AND POISONOUS. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN P-D-680 TYPE 1 SOLVENT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET P-D-680 TYPE 1 SOLVENT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Dry-film lubricated parts have been surface-treated and coated with thermo-setting (heat-cured) resin-bonded coating containing molybdenum disulfide. Do not lubricate such parts with conventional (wet) oils or greases unless specifically called for. Remove such contaminants with cloth soaked in cleaning solvent (P-D-680).

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WARNING: : AIR CURED SOLID-FILM LUBRICANT IS AN AGENT THAT IS AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN AIR CURED SOLID-FILM LUBRICANT IS USED.

- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET AIR CURED SOLID-FILM LUBRICANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE DUST.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(2) For quick touchup of worn or blemished coatings, clean with lacquer thinner and spray with aerosol-type touchup coating such as Lubri-Bond 220 (Electrofilm, Inc.).

G. Large Diameter Flush Screw Countersinks, Exterior Surfaces

WARNING: CETYL ALCOHOL LUBRICANT IS AN AGENT THAT IS FLAMMABLE AND POISONOUS. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN CETYL ALCOHOL LUBRICANT IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET CETYL ALCOHOL LUBRICANT IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

CAUTION: DO NOT APPLY LUBRICANT TO SCREWS OR INNER SURFACES OF COVER PLATES, ACCESS DOORS, AND LEADING EDGES.

(1) Apply one coat of Cetyl alcohol solution to countersink of flush screws (1/4-inch (6.4 mm) diameter or larger), which are used to install cover plates, access doors, and leading edges.

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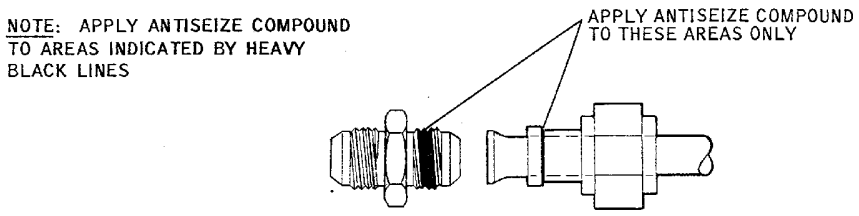
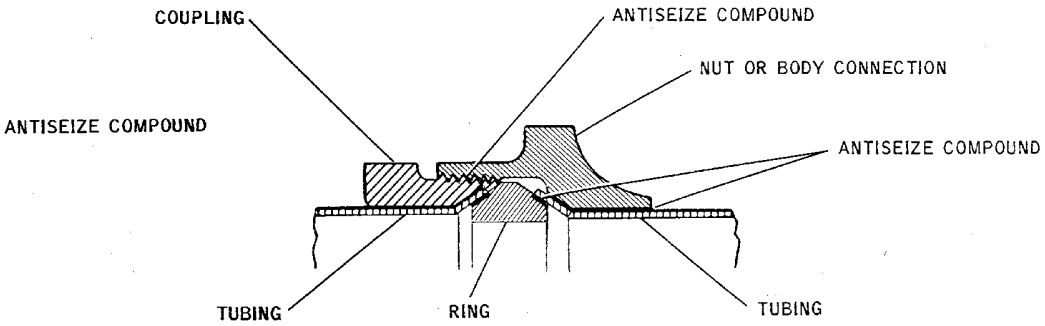
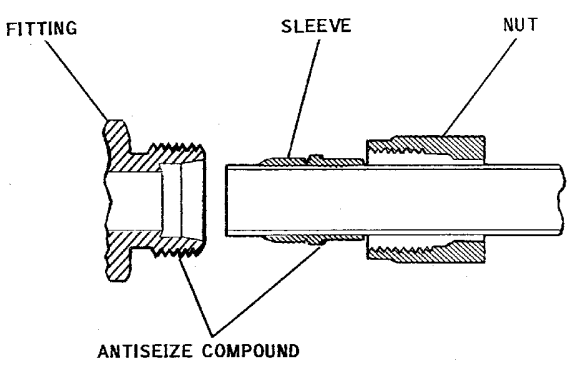


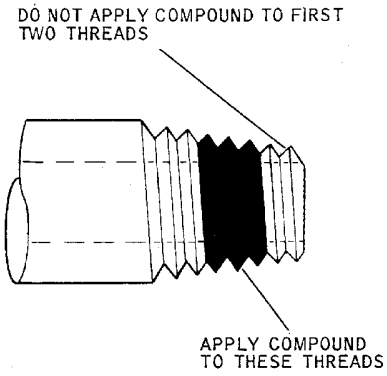
FLUID LINE ASSEMBLY - TYPICAL



SPECIAL TUBE JOINT COUPLING



FLARELESS ASSEMBLIES



TAPERED PIPE THREADS

BBB2-20-56

Application of Antiseize Materials
Figure 201/20-60-05-990-801

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5. Fluid System Fittings

	Application	Material/Specification	Remarks
A.	General		
	All lines carrying fuel, engine oil, (including vent lines), water (other than for drinking purposes), alcohol, carbon dioxide (or other fire extinguisher fluid) and DMS 2117 galley coolant	Antiseize, high temperature, (MIL-A-907)	Do not use above 148.9°C (300°F).
	Steel or brass tapered (pipe) threads; difficult to tighten		Tin if permitted Paragraph 4..
B.	Instrument Lines (Including Pitot Tubes)		
	Straight and tapered threaded joints	Antiseize, high temperature (MIL-A-907)	Use only when no other lubricant is specified.
C.	High-Temperature Lines		
	Miscellaneous assemblies such as hot air ducts, combustion heaters, and exhaust systems, all joints	Lubricant moly/ silicone (DOD-L-25681)	Apply sparingly only where needed.
D.	Hydraulic, Petroleum		
	Tapered, aluminum or magnesium joints, and straight threaded joints	Hydraulic fluid (MIL-H-5606)	Petrolatum is acceptable substitute.
	Steel or brass tapered (pipe threads, difficult to tighten		Tin threads Paragraph 4... Hydraulic fluid may be used in addition to tinning.
	Aircraft ground handling equipment		Tinning optional. Hydraulic oil may be used.
E.	Hydraulic, DMS2014 Fluid		
	Tapered, aluminum, magnesium or titanium joints, and straight threaded joints	Skydrol assembly lube MCS352, or hydraulic fluid (Skydrol 500B)	Apply sparingly only where needed.
	MS flareless fittings	Skydrol Assembly lube MCS352	Apply sparingly.
	Steel or brass tapered (pipe) threads; difficult to tighten		Tin threads Paragraph 4.. Skydrol Assembly Lube MCS352, or Skydrol 500B may be used in addition to tinning.
F.	Freon Lines		
	Tapered aluminum, magnesium, or titanium joints	Lubricant, oil, preservative VV-L-800	
	MS Fittings	Lubricant, Skydrol assembly MCS352	
G	Drinking Water		
	Threaded joints	Normally none	Use petrolatum VV-P-236 or polytetrafluoro-ethylene tape, (MIL-T-27730) to prevent seizure.
H.	Pneumatic		

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(Continued)

	Application	Material/Specification	Remarks
WARNING: IGNITION CABLE RUBBER BUSHINGS AND ADJACENT PARTS MAY CONTAIN RESIDUE OF KRYTOX 240 AC GREASE. DO NOT CONTAMINATE SMOKING MATERIALS (CIGARETTES, CIGARS, ETC.) WITH KRYTOX 240 AC GREASE. COMBUSTION PRODUCTS OF KRYTOX 240 AC GREASE COULD BE HARMFUL IF INHALED. AVOID SKIN CONTACT. WASH HANDS IMMEDIATELY AFTER CONTACT WITH KRYTOX 240 AC GREASE. THIS GREASE IS NO LONGER USED ON IGNITION CABLES.			
	All threads	Lubricant, oxygen antiseize (Krytox 240 AC)	Apply sparingly only where needed.
I.	Hazardous Systems		
J.	Breathing Oxygen		
WARNING: IGNITION CABLE RUBBER BUSHINGS AND ADJACENT PARTS MAY CONTAIN RESIDUE OF KRYTOX 240 AC GREASE. DO NOT CONTAMINATE SMOKING MATERIALS (CIGARETTES, CIGARS, ETC.) WITH KRYTOX 240 AC GREASE. COMBUSTION PRODUCTS OF KRYTOX 240 AC GREASE COULD BE HARMFUL IF INHALED. AVOID SKIN CONTACT. WASH HANDS IMMEDIATELY AFTER CONTACT WITH KRYTOX 240 AC GREASE. THIS GREASE IS NO LONGER USED ON IGNITION CABLES.			
	Tapered thread fittings	Lubricant, oxygen antiseize (Krytox 240 AC)	Use sparingly and only on tapered threads. Figure 201.
K.	Miscellaneous Threaded Sections		
L.	General		
	Bolts, studs and nuts	Antiseize, high temperature (MIL-A-907)	Use no lubricant unless specified on engineering drawing or in this manual.
M.	Static Joints		
	Static mating surfaces and hydraulic assembly rod ends	Parker O-Lube	Apply on installation.
N.	Engine Hot Section and Thrust Reversers		
	Nuts, bolts, studs, etc.	Lubricant, moly/silicone (DOD-L-25681)	Coat shanks, threads, nuts, and heads of bolts.
O.	Brakes		
	Bolts, studs and nuts	Lubricant, moly/ silicone (DOD-L-25681) or antiseize, high temperature (MIL-A-907)	Coat threads of nuts, bolts and studs.
P.	Starter Spline Shaft	Compound Anti- fretting (MIL-M-7866)	Apply to shaft on installation.

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BRUSH CADMIUM PLATING - MAINTENANCE PRACTICES

1. General

A. This procedure has the maintenance practice instructions to replate small areas of high strength steels on the nose and main landing gear, where the existing electroless nickel plating areas has been damaged or removed.

B. This procedure is a temporary repair for high strength steel only. Use only for touchup-type cadmium plating of small areas not to exceed 3 square inches of damaged electroless nickel. If damage exceeds three 3 square inches of electroless nickel the part must be replaced.

C. Perform brush cadmium plating only in work areas free from airborne contaminants caused by grinding, polishing, or buffing, and from corrosive atmospheres.

2. Equipment and Materials

NOTE: Equivalent substitutes may be used instead of the following listed items:

NOTE: It is possible that some materials in the Equipment and Materials List cannot be used for some or all of their necessary applications. Before you use the materials, make sure the types, quantities, and applications of the materials necessary are legally permitted in your location. All persons must obey all applicable federal, state, local, and provincial laws and regulations when it is necessary to work with these materials.

Table 201

Name and Number	Manufacturer
Abrasive blast equipment, vacu-blast Not specified	
Anode Graphite ID-13 13001013	
Anode Graphite FT-65 13005065	
Anode Graphite FT-75 13005075	
Power Pack 10061000	
Cleaner, handwipe DPM 6380-1	
Cotton sleeving 34C 11800100	
Cotton batting 304 63000000	
DALIC cadmium CODE 2023	
Electrocleaning 70410005 SCM-4100	
Electrocleaning LDC code No.-01	
Electrocleaning DALIC code 1010	
Handle 75 AMP Molded 12302075	
Jacket ID-13C cotton 11903013	
LDC cadmium S LDC-4803	
Pads, abrasive nylon web Scotch-Brite Type A, Very Fine	
Polyurethane, clear 100-142/CA-113	
Selectron cadmium, LHE 5070	
Tape, aluminum 11600000	
Tape, vinyl 11601000	

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Table 201 (Continued)

Name and Number	Manufacturer
Vacuum cleaner Not specified	
Wool, aluminum Not specified	

3. **Procedure - Brush Cadmium Plating Application**

A. Perform Brush Cadmium Plating Application

(1) Prepare the surface for plating.

(a) Remove corrosion by abrasive blasting with specified equipment.

WARNING: HANDWIPE CLEANER IS AN AGENT THAT IS FLAMMABLE, A SENSITIZER, AN ASPHYXIANT, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY THE PRECAUTIONS WHEN HANDWIPE CLEANER IS USED.

- DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS OR FLAMES.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HANDWIPE CLEANER IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIER'S MSDS FOR:

- MORE PRECAUTIONARY DATA
- APPROVED SAFETY EQUIPMENT
- EMERGENCY MEDICAL AID.

TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(b) Remove residue with vacuum, specified handwipe cleaner or clean, dry air.

(c) Mask areas that may entrap or become damaged by plating solution with specified tape.

(d) Electroclean the area with electrocleaner until water-break free surface is developed. Use reverse current at 10 to 20 volts with a cathode to anode speed of 20 to 50 feet per minute.

NOTE: Permanently identify anodes used on reverse polarity. Do not use these anodes on forward polarity. Permanently identify anodes used with cadmium, nickel, tin or any given solution. Do not use with any other solution.

NOTE: Do not use this solution on forward polarity that have been used on reverse polarity and vice versa.

(e) Rinse thoroughly in tap water with minimum amount of time to prevent oxidation of surfaces.

(f) Use specified anode wrapped with specified cotton, brush cadmium plate as required.

(g) Calculate the number of amperes-hours needed to plate the required thickness by multiplying the number of tenths (of a Mil) by the factor 0.008 times the number of square inches to be plated.

Example:

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To deposit 0.0005 inch of cadmium on three square inches of surface:

Thickness (ten thousandths) = 5

Factor = 0.008

Area to be plated (sq. inch) = 3

5 x 0.008 x 3 = 0.12 ampere-hours

NOTE: Convert anode to cathode speeds to RPM for plating ID or OD of cylindrical parts when variable speed turning head or anode rotating tool is used. The required RPM is equal to speed in feet per minute divided by circumference in feet of rotating member.

(h) Start cadmium plating at highest current density to quickly form a barrier layer, then reduce current density to standard amperage.

(i) Hold or position the stylus and anode assembly to thoroughly contact the area being plated. Use minimum pressure to prevent solution loss and excessive wear on the stylus anode covering.

(j) Do not allow anode to come to rest while current is applied.

NOTE: The function of the stylus and anode assembly is to carry current and serve as a reservoir for solution.

(k) Wet area to be plated, make thorough contact between anode and workpiece.

(l) Use a circular or modified figure eight motion while plating. Plate at uniform rate of speed.

(m) Use the calculated relative anode to cathode speed. Slower speeds may cause burning.

(n) Where motion is impaired, reduce voltage or use a motor driven, variable speed rotary anode tool.

NOTE: Straight back and forth motion is to be avoided. The pause when motion is reversed causes the reverse area to burn.

(o) Use an anode well soaked in plating solution and resoak or exchange the anode regularly, while plating, to prevent solution from boiling, and avoid drying the cotton anode cover.

(p) Where applicable, water cooled, jacketed anodes may be used to prevent overheating.

(q) Rinse thoroughly in cold water.

(r) Dry with a blast of clean air or nitrogen.

NOTE: Embrittlement relief is not required after brush plating on any high strength steel parts provided Dalic Cadmium Code 2023, LDC Cadmium S LDC-4803 or Selectron LHE Cadmium 5070 is used.

(s) Mix one part by volume of base component to one part by volume of catalyst component of clear polyurethane.

NOTE: Once mixed, the pot life of the mixed clear polyurethane is 3 hours.

(t) Brush one uniform thin coat of clear polyurethane on the repair area.

(u) Allow 30 minutes for coat to dry.

(v) Brush a second uniform thin coat of clear polyurethane on the repair area.

(w) Allow 30 minutes for coat to dry.

(x) Air dry for 24 hours or apply a 100 to 120 degree heat source to the area for 6 hours before part is returned to service.

(y) Remove tape from masked area. Discard tape.

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B. Remove all tools and equipment from the work area. Make sure the area is clean.

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HEAT AND FLUID RESISTANT URETHANE COATING - MAINTENANCE PRACTICES

1. General

A. This section contains procedures for applying heat and fluid resistant urethane coating to noncorrosive steel alloys and dissimilar metals, and for protection of components of the engine pod and pylon areas.

B. The urethane coating is intended for use on parts or surfaces subjected to continuous service temperatures up to 500°F (260.0°C), and provides resistance to corrosion and aircraft fluids, including Skydrol hydraulic fluid. It shall be used when specified by applicable Maintenance Manual.

NOTE: Heat and fluid resistant urethane coating may be used for replacement and repair of phenolic primer. Urethane coating does not require a bake (cure) to ensure fluid resistance.

2. Equipment and Materials

WARNING: ITEMS IDENTIFIED WITH AN ASTERISK(*) ARE FLAMMABLE. SUPPLY ADEQUATE VENTILATION AND EXERCISE APPROPRIATE PRECAUTIONARY MEASURES. CONSULT LOCAL AUTHORITY OR REGULATORY AGENCY, FOR FIRE PREVENTION AND PERSONNEL HEALTH AND SAFETY WHEN USING THESE MATERIALS.

NOTE: Equivalent substitutes may be used instead of following listed items:

NOTE: Some materials in the Equipment and Materials list may not be permitted to be used in your location. Persons in each location must make sure they are permitted to use these materials. All persons must obey all applicable federal, state, local, and provincial regulations for their location.

Table 201

Name and Number	Manufacturer
Coating, urethane, heat and fluid resistant, No. 825-009 base with catalyst No. 910-175 DPM 5893	De Soto Inc., Pacific Plant Berkeley, CA
Paper, kraft, neutral DPM 640, or white DPM 640-6	Commercially available
Paper, abrasive, silicon carbide, wet-or-dry, Tri-M-ite	Minnesota Mining and Mfg. Co. Los Angeles, CA
Pads, abrasive nylon web, Scotch Brite, Type A, very fine	Minnesota Mining and Mfg. Co. Los Angeles, CA
Tape, poly- ethylene coated paper, Mystik No. 6223	Mystik Tape Div. of Borden Chemicals Northfield, IL
Abrasive, aluminum oxide, 180- grit, Blastite or Niagara Blast	The Carborundum Co. Coated Abrasives Div. Niagara Falls, NY
Wipers, cotton, lint-free	Commercially available
Fabric, straining, white batiste	Industrial Textiles Corp. Los Angeles, CA
Tape, masking (anodized surfaces), P-782D DPM 3208	Permacel Div. of Johnson & Johnson Co. New Brunswick, NJ
MPK Blend Solvent DMS 2458	Chemetall Oakite, La Mirada, CA
Tape, masking, P-703A DPM 1861	Permacel Div. of Johnson & Johnson Co. New Brunswick, NJ
*Thinner, heat and fluid resistant urethane coating, No. 020-044 DPM 5893	De Soto Inc., Pacific Plant Berkeley, CA

3. Mixing and Handling

A. Mixing

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WARNING: HEAT AND FLUID RESISTANT COATING IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN HEAT AND FLUID RESISTANT COATING IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR AND HAVE A GOOD FLOW OF AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HEAT AND FLUID RESISTANT COATING IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS OR MIST.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) Thoroughly mix or agitate base material of heat and fluid resistant urethane coating before dispensing or adding catalyst. Continue mixing base material while slowly adding catalyst.

NOTE: Always add catalyst to base material, never add in reverse, or gelation of material may occur.

(2) Thinning Ratio

(a) For brush application, omit thinner.

CAUTION: MIXING RATIOS ARE CRITICAL. USE A GRADUATED CONTAINER TO ACCURATELY MEASURE EACH COMPONENT WHEN MIXING LESS THAN A FULL CONTAINER OR COMPLETE KIT. DO NOT ATTEMPT TO MIX LESS THAN ONE PINT OF MIXTURE. DO NOT EXCEED MAXIMUM AMOUNT OF THINNER.

(b) For spray application, mix 2.5 parts by volume thinner (maximum) and 1.0 part by volume catalyst with 4.0 parts by volume base material of heat and fluid resistant urethane coating.

(c) Allow catalyzed mixture to chemically react for 15 minutes minimum before using. Catalyzed mixture has a usable work life of 8 hours; discard mixture after 8 hours regardless of appearance.

(3) Thoroughly stir or agitate catalyzed mixture before and during use.

B. Handling

(1) Strain catalyzed mixture through two layers of white batiste fabric when filling spray gun container or pressure pot.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

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(WARNING PRECEDES)

HAZMAT 1588, SOLVENT/MPK BLEND (DMS QPL 2458)

HAZMAT 1000, REFER TO MSDS

(2) Immediately after use, clean hoses, spray guns, and equipment with MPK Blend Solvent DMS 2458.

4. Surface Preparation

A. General

(1) All parts must be surface treated, such as plating, anodic, etc., prior to application of urethane coating.

(2) Mask all bushings, bearings, and areas which do not require coating with tape and paper.

B. Steel, Aluminum, and Magnesium Parts

(1) Prepare plated steel, aluminum, and magnesium parts as follows:

(a) Parts must be coated within 48 hours of surface treatment.

(b) Parts which are not contaminated with fingerprints or other foreign substances do not require further preparation other than surface preparation prior to coating.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1588, SOLVENT/MPK BLEND (DMS QPL 2458)

HAZMAT 1000, REFER TO MSDS

CAUTION: DO NOT USE ACID-TYPE CLEANERS OR PAINT STRIPPERS ON PLATED STEEL PARTS.

(c) Parts not coated within 48 hours limitation, or those contaminated with fingerprints or other foreign substances must be cleaned with MPK Blend Solvent DMS 2458 and clean wipers. Do not allow solvent to evaporate dry on surfaces of parts.

(2) Prepare unplated steel parts as follows:

CAUTION: PREVENT LOCALIZED OVERHEATING AND EXCESSIVE METAL REMOVAL BY USING A CONTINUOUS MOVEMENT OF BLAST NOZZLE ACROSS PART SURFACE.

(a) Unplated steel parts must be grit blasted prior to coating. Use 180-mesh aluminum oxide blasting abrasive.

(b) Parts must be coated within 4 hours after grit blasting, if not, repeat grit blasting operation.

(c) Protect parts until ready for coating, by wrapping in kraft paper, DPM 640, or DPM 640-6.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

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(WARNING PRECEDES)

HAZMAT 1588, SOLVENT/MPK BLEND (DMS QPL 2458)

HAZMAT 1000, REFER TO MSDS

(d) Solvent clean parts just before coating, using clean wipers moistened with MPK Blend Solvent DMS 2458. Do not allow solvent to evaporate dry on surface. Wipe dry with clean wipers.

C. Titanium Parts

(1) Prepare titanium parts as follows:

CAUTION: PREVENT LOCALIZED OVERHEATING AND EXCESSIVE METAL REMOVAL BY USING A CONTINUOUS MOVEMENT OF BLAST NOZZLE ACROSS PART SURFACE.

(a) Titanium parts must be grit blasted prior to coating. Use 180-mesh aluminum oxide blasting abrasive.

(b) Parts must be coated within 48 hours after grit blasting, if not, repeat grit blasting operation.

(c) Protect parts until ready for coating, by wrapping in kraft paper, neutral, DPM 640, or white, DPM 640-6.

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1588, SOLVENT/MPK BLEND (DMS QPL 2458)

HAZMAT 1000, REFER TO MSDS

CAUTION: DO NOT USE CHLORINATED SOLVENTS ON TITANIUM.

(d) Solvent clean parts just before coating, using clean wipers moistened with MPK Blend Solvent DMS 2458. Do not allow solvent to evaporate dry on surface. Wipe dry with clean wipers.

5. Application

WARNING: SUITABLE RESPIRATORS MUST BE WORN BY SPRAY GUN OPERATOR. IF URETHANE COATING CONTACTS EYES OR SKIN, IMMEDIATELY WASH WITH CLEAN WATER. MEDICAL ATTENTION IS REQUIRED FOR EYES AS SOON AS POSSIBLE.

A. Spray Gun or Brush

(1) Use brush on small areas or enclosed surfaces where spray gun would cause overspray to adjacent surface.

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WARNING: HEAT AND FLUID RESISTANT COATING IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN HEAT AND FLUID RESISTANT COATING IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR AND HAVE A GOOD FLOW OF AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HEAT AND FLUID RESISTANT COATING IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS OR MIST.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(2) Use spray gun and apply one uniform, wet, cross coat of urethane coating to obtain a total dry film thickness of 0.8 to 1.5 mils.

NOTE: Apply coating in a manner that will ensure coating is uniform, smooth, and free of irregularities that would affect its performance.

(3) Air-cure for 24 hours minimum, or air-cure for 15 minutes minimum and force-cure for 30 minutes at 205° to 225°F (96.1° to 107.2°C).

B. Touchup

WARNING: USE THE HAZARDOUS MATERIAL WARNINGS GIVEN BELOW FOR THE STEPS THAT FOLLOW.

THE HAZARDOUS MATERIAL WARNINGS ARE LISTED AFTER THE INTRODUCTION SECTION IN THE FRONT OF THE AMM.

Hazardous Material Warnings

HAZMAT 1588, SOLVENT/MPK BLEND (DMS QPL 2458)

HAZMAT 1000, REFER TO MSDS

CAUTION: DO NOT USE CHLORINATED SOLVENTS ON TITANIUM.

(1) Clean area with MPK Blend Solvent DMS 2458 and clean wipers.

(2) Thoroughly abrade area to produce a matte appearance. Nicks, gouges, and scratches shall be feather edged.

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WARNING: METHYL ETHYL KETONE IS AN AGENT THAT IS FLAMMABLE, EXPLOSIVE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN METHYL ETHYL KETONE IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET METHYL ETHYL KETONE IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(3) Remove abrading residues, and reclean area with methyl ethyl ketone and wipers. Wipe dry with clean wipers.

WARNING: HEAT AND FLUID RESISTANT COATING IS AN AGENT THAT IS FLAMMABLE, POISONOUS, AND AN IRRITANT. MAKE SURE ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN HEAT AND FLUID RESISTANT COATING IS USED.

- GAS/AIR MIXTURES MORE THAN THE LOWER EXPLOSIVE LIMIT (LEL) CAN CAUSE AN EXPLOSION IF HIGH HEAT, SPARKS, OR FLAMES SUPPLY IGNITION.
- USE IN AN AREA OPEN TO THE AIR AND HAVE A GOOD FLOW OF AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HEAT AND FLUID RESISTANT COATING IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS OR MIST.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(4) Mask off touchup area as required, and apply urethane coating with brush or spray gun.

(5) Air-cure coated parts or assemblies in accordance with Paragraph 5.A.(3).

C. Dissimilar Metals Insulation

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- USE IN AN AREA OPEN TO THE AIR AND HAVE A GOOD FLOW OF AIR.
- CLOSE THE CONTAINER WHEN NOT USED.
- DO NOT GET HEAT AND FLUID RESISTANT COATING IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES.
- DO NOT BREATHE THE GAS OR MIST.

WARNING: REFER TO THE APPLICABLE MANUFACTURER'S OR SUPPLIERS MSDS FOR:

- MORE PRECAUTIONARY DATA.
- APPROVED SAFETY EQUIPMENT.
- EMERGENCY MEDICAL AID.
- TALK WITH THE LOCAL SAFETY DEPARTMENT OR AUTHORITIES FOR THE PROCEDURES TO DISCARD THIS HAZARDOUS AGENT.

(1) When urethane coating is used for dissimilar metals insulation, the coating may be brush applied, and parts may be assembled before coating has dried.

Table 202 Baking Schedule

Metal Substrate (Includes Alloys)	Temperature and Time To Cure Primer
Aluminum and Magnesium	285° to 315°F (140.6° to 157.2°C) for 45 to 60 minutes (see NOTE and CAUTION).
Steel and Titanium	285° to 315°F (140.6° to 157.2°C) for 60 minutes minimum, or 310° to 340°F (154.4° to 171.1°C) for 30 minutes minimum, or 335° to 365°F (168.3° to 185.0°C) for 15 minutes minimum.
CAUTION: TEMPERATURE OR TIME IN EXCESS OF THAT SPECIFIED FOR ALUMINUM AND MAGNESIUM CAN RESULT IN DAMAGE, SUCH AS LOSS OF STRENGTH PROPERTIES AND LOSS OF CORROSION RESISTANCE OF METAL SUBSTRATE. THESE LIMITS INCLUDE REBAKING DUE TO TOUCHUP OR REWORK OF PRIMER COATING.	
NOTE: Cognizant engineering approval is required for rebaking 2024 aluminum.	

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