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STANDARD PRACTICES – GENERAL – DESCRIPTION AND OPERATION

1. General
   A. The standard practices chapter includes the following main sections: standard practices (AMM 20-00-00), standard torque values (AMM 20-11-00), specifications and materials (AMM 20-30-00), and grounding (AMM 20-41-00).
      (1) The standard practices section contains general procedures which apply to many areas of the airplane. General maintenance practices, removal and installation, and cleaning and painting procedures are presented in this section.
      (2) The standard torque values section covers standard torque values for bolts, nuts, clamps, couplings, and tube fittings. Also, standard torque values contains the procedure for determining the torque produced using torque wrenches and associated equipment.
      (3) The inspection/check section covers control cable.
      (4) The specifications and materials section contains all consumable materials called out in the maintenance manual. The materials list is broken down into seven separate sections: adhesives, cements, and sealers; cleaners and polishes; finishing materials; lubricants, strippers, welding materials; and miscellaneous materials.
      (5) The grounding section contains procedures for statically grounding the airplane and a special procedure for handling electrostatic sensitive devices.
   B. The standard practices in this chapter also apply to the engine buildup components installed on the basic engine. Standard practices that apply to the basic engine are provided in Chapter 70, Standard Practices – Engine.

TASK 20-00-00-912-001

1. Airworthiness Limitation Precautions

A. General

(1) Critical Design Configuration Control Limitations (CDCCLs)

(a) All occurrences of CDCCLs found in this chapter of the AMM are identified by this note after each applicable CDCCL design feature:

1) NOTE: CDCCL - Refer to the task: Airworthiness Limitation Precautions (AMM 20-00-00/201), for important information on Critical Design Configuration Control Limitations (CDCCLs).

(b) Design features that are CDCCLs are defined and controlled by Special Federal Aviation Regulation (SFAR) 88, and can be found in Section 9 of the Maintenance Planning Data (MPD) document. CDCCLs are a means of identifying certain design configuration features intended to preclude a fuel tank ignition source for the operational life of the airplane. CDCCLs are mandatory and cannot be changed or deleted without the approval of the FAA office that is responsible for the airplane model Type Certificate, or applicable regulatory agency. A critical fuel tank ignition source prevention feature may exist in the fuel system and its related installation or in systems that, if a failure condition were to develop, could interact with the fuel system in such a way that an unsafe condition would develop without this limitation. Strict adherence to configuration, methods, techniques, and practices as prescribed is required to ensure the CDCCL is complied with. Any use of parts, methods, techniques or practices not contained in the applicable CDCCL must be approved by the FAA office that is responsible for the airplane model Type Certificate, or applicable regulatory agency.

(2) Airworthiness Limitation Instructions (ALIs)

(a) All occurrences of fuel tank system ALIs found in this chapter of the AMM are identified by this step after the General section in the applicable ALI inspection task:

1) ALI - Refer to the task: Airworthiness Limitation Precautions (AMM 20-00-00/201), for important information on airworthiness limitation instructions (ALIs).

(b) Inspection tasks that are ALIs are defined and controlled by Special Federal Aviation Regulation (SFAR) 88, and can be found in Section 9 of the Maintenance Planning Data (MPD) document. These ALIs identify inspection tasks related to fuel tank ignition source prevention which must be done to maintain the design level of safety for the operational life of the airplane. These ALIs are mandatory and cannot be changed or deleted without the approval of the FAA officethat is responsible for the airplane model Type Certificate, or applicable regulatory agency. Strict adherence to methods, techniques and practices as prescribed is required to ensure the ALI is complied with. Any use of methods, techniques or practices not contained in these ALIs must be approved by the FAA office that is responsible for the airplane model Type Certificate, or applicable regulatory agency.

B. Access

(1) Location Zones

100	Lower Half of Fuselage
200	Upper Half of Fuselage
500	Left Wing
600	Right Wing

C. Critical Design Configuration Control Limitations (CDCCLs)

S 912-004

WARNING: OBEY THE MANUFACTURER'S PROCEDURES WHEN YOU DO ANY MAINTENANCE THAT MAY AFFECT A CDCCL. IF YOU DO NOT FOLLOW THE PROCEDURES, IT CAN INCREASE THE RISK OF A FUEL TANK IGNITION SOURCE.

(1) Make sure you follow the procedures for items identified as CDCCLs.

D. Airworthiness Limitation Instructions (ALIs)

S 912-005

WARNING: OBEY THE MANUFACTURER'S PROCEDURES WHEN YOU DO ANY MAINTENANCE THAT MAY AFFECT AN ALI. IF YOU DO NOT FOLLOW THE PROCEDURES, IT CAN INCREASE THE RISK OF A FUEL TANK IGNITION SOURCE.

(1) Make sure you follow the procedures for tasks identified as ALIs.

E/E RACK-MOUNTED COMPONENTS - REMOVAL/INSTALLATION

1. General
   A. This procedure contains four tasks:
      (1) The first task is the removal of the rack-mounted electrical/electronic (E/E) boxes.
      (2) The second task is installation of the rack-mounted (E/E) boxes.
      (3) The third task is the removal of the circuit card assemblies.
      (4) The fourth task is the installation of the circuit card assemblies.

TASK 20-10-01-004-005

2. Remove the Rack Mounted E/E Box (Fig. 401)
   A. Reference
      (1) AMM 20-41-01/201, Electro-Static Sensitive Devices
   B. Access
      (1) Location Zone
          100 Lower Half of Fuselage

   C. Procedure

      S 864-002
      (1) Open the applicable circuit breakers to remove electrical power.

      S 044-003
      (2) Disconnect the electrical connectors from the E/E box.

      S 034-004
      (3) Turn the front hold-down extractor knob counterclockwise to disengage the extractor clutch. Turn the keeper to align the deep slot with the T-hook. Lower the extractor off the T-hook.

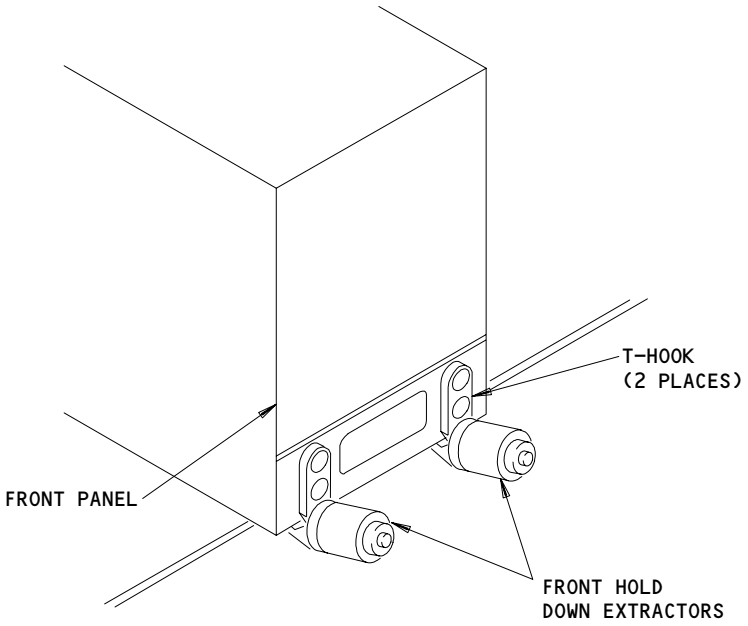
      NOTE: Apply a sufficient amount of pressure down on the front-face of the E/E box during removal.

      S 034-006

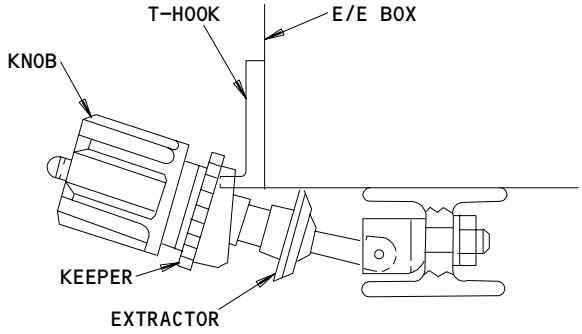
      CAUTION: SOME E/E BOXES ARE STATIC SENSITIVE. TAKE THE NECESSARY PRECAUTIONS WHEN YOU ARE TO HOLD THE E/E BOXES. READ THE PROCEDURE ON HOW TO HOLD ELECTROSTATIC-DISCHARGE SENSITIVE DEVICES (AMM 20-41-01/201). THE E/E BOXES CONTAIN DEVICES THAT CAN BE DAMAGED BY STATIC DISCHARGE.

      (4) Carefully remove the E/E box out from the tray.

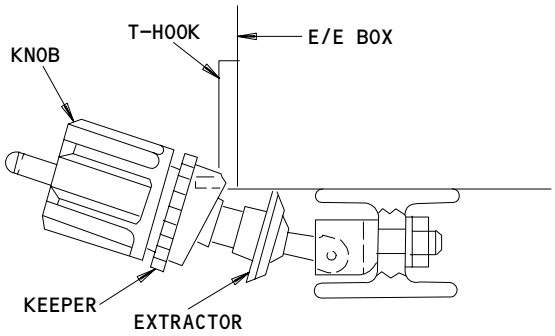
      NOTE: The E/E box front face can be moved right to left (about 1/8 inch). This will help disconnect the E/E box from the electrical connection.



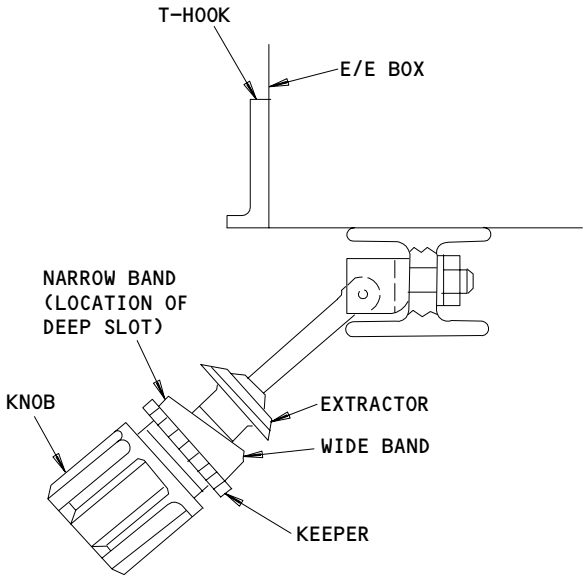
INSTALLED E/E BOX



INSTALLED E/E BOX WITH EXTRACTOR LOOSENED



INSTALLED E/E BOX WITH EXTRACTOR TIGHTENED

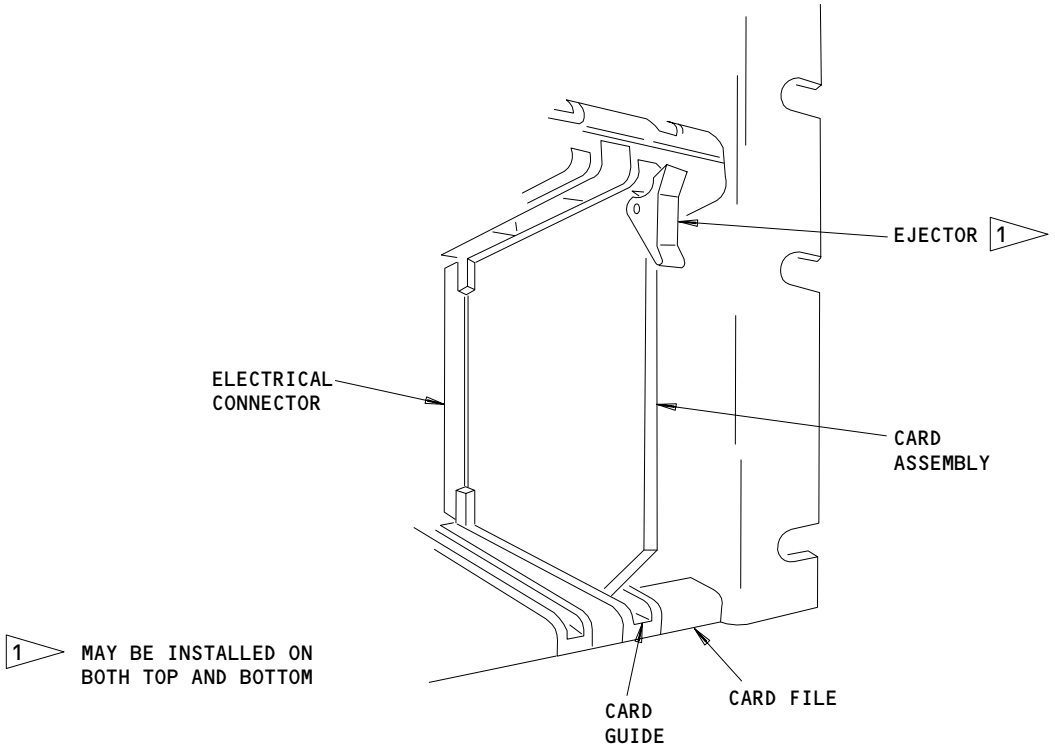


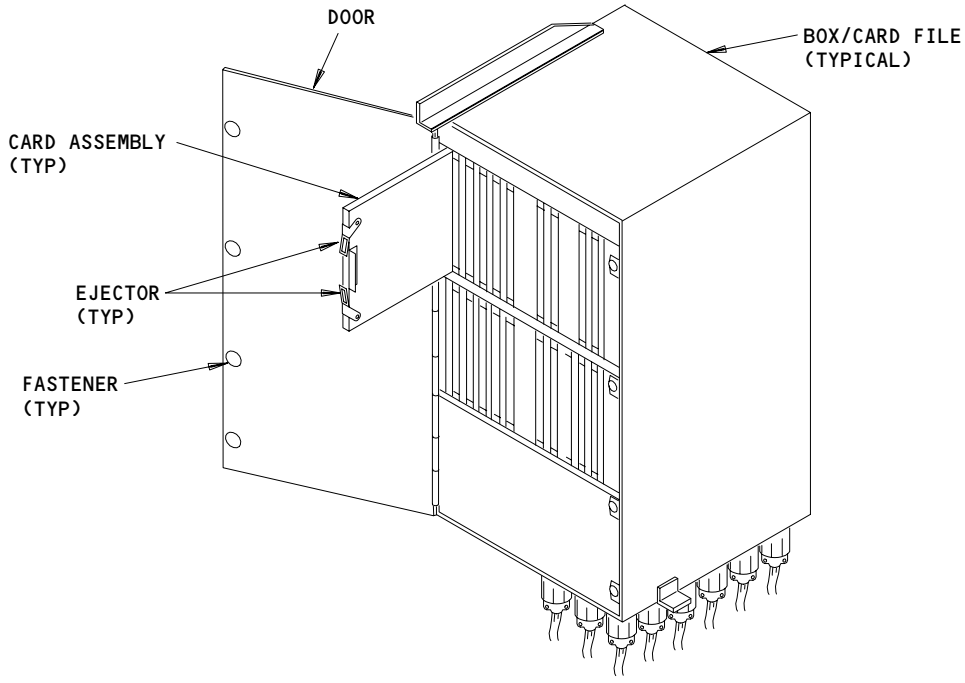
EXTRACTOR FREE POSITION

TRIDAIR EXTRACTORS

E/E Box Installation
Figure 401

68272





E/E Card Assembly Installation
Figure 402

S 214-008
(5) Make sure that the connector is fully disengaged before the removal of the E/E box.

S 434-009
(6) Install dust caps on the E/E box electrical connector and on the tray electrical connector.

TASK 20-10-01-424-011

3. Install Rack Mounted E/E Box (Fig. 401)
   A. Reference
      (1) AMM 20-41-01/201, Electro-Static Sensitive Devices
   B. Access
      (1) Location Zone
          100 Lower Half of Fuselage

   C. Procedure

S 214-012
(1) Make sure that the rubber plugs are installed in the metering tray at the correct locations. Compare the tray orifice configuration with that shown on the decal.

S 034-013
(2) Remove the dust caps.

S 214-014
(3) Make sure that the tray gasket and restrictor plugs (adjustment number) did not move. Install if necessary.

S 214-015
(4) Make sure that the guide pins on the tray will engage with the E/E box.

S 214-016

CAUTION: ELECTRICAL PINS ON THE E/E BOX CONNECTOR AND THE TRAY CONNECTOR MUST NOT BE BENT OR DAMAGED. INSTALLATION OF THE E/E BOX WITH DAMAGED PINS COULD RESULT IN DAMAGE TO THE E/E BOX, THE TRAY ELECTRICAL CONNECTOR, OR THE SYSTEM COMPONENTS.

(5) Make sure that the electrical pins of the E/E box and the tray connector are not bent or damaged. Replace damaged components.

S 434-017

CAUTION: SOME E/E BOXES ARE STATIC SENSITIVE. TAKE THE NECESSARY PRECAUTIONS WHEN YOU ARE TO HOLD THE E/E BOXES. READ THE PROCEDURE ON HOW TO HOLD ELECTROSTATIC-DISCHARGE SENSITIVE DEVICES (AMM 20-41-01/201). THE E/E BOXES CONTAIN DEVICES THAT CAN BE DAMAGED BY STATIC DISCHARGE.

(6) Carefully move the E/E box in the tray and engage the electrical connector.

NOTE: The E/E box front-face can be lifted about 1/8 inch above the tray surface. This will permit better installation.

The E/E box front-face can be moved right to left (about 1/8 inch). This will help engage the electrical connector. During installation apply a light pressure to the front-face of the E/E box. Do not use force during installation.

S 434-018

(7) Turn the keeper to align the deep slot with the T-hook.

S 434-019

(8) Set the extractor on the T-hook and turn the keeper 180 degrees.

S 434-020

(9) Tighten the front hold-down extractor. Turn the front hold-down extractor clockwise until the extractor clutch is fully engaged.

S 714-021

(10) Move the E/E box left to right. Make sure that the E/E box is tight.

S 434-022

(11) Tighten the extractor.

S 214-023

(12) Make sure that the electrical connector is engaged.

S 434-024

(13) Install the connections to the E/E box front if applicable.

S 864-025

(14) Close all applicable circuit breakers.

TASK 20-10-01-024-026

4. Remove the Circuit Card Assembly

A. Reference

(1) AMM 20-41-01/201, Electro-Static Sensitive Devices

B. Access
(1) Location Zone
100 Lower Half of Fuselage

C. Procedure (Fig. 402)

S 864-027
(1) Open the applicable circuit breakers to remove electrical power.

S 014-028
(2) Open the card file door.

S 034-029

CAUTION: CARD ASSEMBLIES ARE STATIC SENSITIVE. TAKE THE NECESSARY PRECAUTIONS WHEN YOU ARE TO HOLD THE CARD ASSEMBLIES. READ THE PROCEDURE ON HOW TO HOLD ELECTROSTATIC-DISCHARGE SENSITIVE DEVICES (AMM 20-41-01/201). THE CARD ASSEMBLIES CONTAIN DEVICES THAT CAN BE DAMAGED BY STATIC DISCHARGE.

(3) Turn the ejectors on the card assembly until the card is loose in the guides.

S 024-030
(4) Carefully slide the card out along the guides.

S 024-031
(5) Remove the card assembly.

TASK 20-10-01-424-032
5. Install the Card Assembly
A. Reference
(1) AMM 20-41-01/201, Electro-Static Sensitive Devices
B. Access
(1) Location Zone
100 Lower Half of Fuselage

C. Procedure

S 424-033

CAUTION: CARD ASSEMBLIES ARE STATIC SENSITIVE. TAKE THE NECESSARY PRECAUTIONS WHEN YOU ARE TO HOLD THE CARD ASSEMBLIES. READ THE PROCEDURE ON HOW TO HOLD ELECTROSTATIC-DISCHARGE SENSITIVE DEVICES (AMM 20-41-01/201). THE CARD ASSEMBLIES CONTAIN DEVICES THAT CAN BE DAMAGED BY STATIC DISCHARGE.

(1) Install the card assembly in the guides. Carefully push the card in until the card is tightly engaged in the electrical connector.

S 214-034

(2) Make sure that the ejectors are level against the card.

S 864-035

(3) Close the applicable circuit breakers.

S 414-036

(4) Close the card file door.

BEARINGS AND BUSHINGS - REMOVAL/INSTALLATION

TASK 20-10-02-904-003

1. Bearings and Bushings - Removal/Installation

A. Procedure

S 904-004

(1) For the removal and installation of bearings and bushings (SOPM 20-50-03).

CONTROL CABLES - REMOVAL/INSTALLATION

1. General
   A. This procedure contains two tasks. The first task is the removal of control cables. The second task is the installation of control cables.
   B. This procedure includes instructions for prefabricated and not prefabricated cables to make installation easier when portable swaging machines are available.
   C. If this procedure does not agree with specified maintenance procedures, use the specified maintenance procedure.
   D. The maintenance manual location for control cable fabrication data is found in Table I

TABLE I

CABLE	MM LOCATION
*[1] ENGINE THRUST CONTROL	76-11-03-2
FLIGHT CONTROLS	
- AILERON	27-00-01-2
- ELEVATOR	27-00-01-2
- FLAP/SLAT	27-00-01-2
- RUDDER	27-00-01-2
- STABILIZER TRIM	27-00-01-2
LANDING GEAR	
- ALTERNATE EXTENSION	32-00-05-2
- BRAKES	32-00-05-2
- DOOR GROUND RELEASE	32-00-05-2
- EXTENSION/RETRACTION	32-00-05-2
- NOSE WHEEL STEERING	32-00-05-2

*[1] For engines that are not FADEC.

TASK 20-10-03-004-001

2. Remove Control Cables (Fig. 401)
   A. Equipment
      (1) Cable Clamps - A20005-9
   B. Consumable Materials
      (1) G00270 Tape - Masking
   C. References
      (1) AMM 20-10-04/401, Control Cable Air Seal
      (2) AMM 20-10-05/401, Clips - Turnbuckle Locking
      (3) AMM 20-10-07/401, Control Cable Pulleys
      (4) AMM 20-10-08/401, Control Cable Quick Stops

D. Procedure

S 934-002
(1) Use masking tape to make a mark on the cable end fittings.

NOTE: The mark lets you refer to the initial position when you install new cable.

S 034-003
(2) Loosen the turnbuckles to release tension (AMM 20-10-05/401).

S 034-004
(3) If you will remove the applicable engine control cable section, remove the cable stops (AMM 20-10-08/401).

S 034-005
(4) If applicable, remove the control cable air seals (AMM 20-10-04/401).

S 494-006
(5) Install cable clamps on the cables you do not remove to keep light tension on the cables. If you can isolate the cables between rig pin locations, install the rig pins through the applicable drum or quadrant.

NOTE: Keep light tension on the cables to prevent windoff on the cable drums and to keep the cables in the pulley guides.

S 964-007
(6) Install the new cable at the same time you remove the old cable. Use the old cable to pull the new cable into position.

NOTE: If you do not attach the new cable to the old cable before you remove the old cable, you will have a problem routing the new cable.

TASK 20-10-03-404-008

3. Install Control Cables (Fig. 401)
A. Equipment
(1) Tensiometer - Commercially Available.
(2) Cable Clamps - A20005-9

WIRE ROPE TYPE		CABLE DIAMETER (INCHES) 1									
		1/16	3/32	1/8	5/32	3/16	7/32	1/4	9/32	5/16	3/8
		PROOF LOAD (POUNDS)									
BMS 7-265 OR MIL-W-83420 COMP. "A" (CARBON STEEL)	7 x 7	288 +25 -0	552 +25 0	---	---	---	---	---	---	---	---
	7 x 19	---	600 +25 -0	1200 +60 -0	1680 +85 -0	2520 +125 -0	3360 +170 -0	4200 +210 -0	4800 +240 -0	5880 +295 -0	8640 +435 -0
BMS 7-265 OR MIL-W-83420 COMP. "B" (CRES)	7 x 7	288 +25 -0	552 +25 -0	---	---	---	---	---	---	---	---
	7 x 19	---	552 +25 -0	1056 +50 -0	1440 +70 -0	2220 +110 -0	3000 +150 -0	3840 +190 -0	4680 +230 -0	5400 +270 -0	7200 +360 -0

PROOF LOADS FOR CABLE ASSEMBLIES

MATERIAL:

CABLE - CARBON STEEL PER BMS 7-265, TYPE I, COMPOSITION A (TZ) (PREFERRED)
- CARBON STEEL PER BMS 7-265, TYPE I, COMPOSITION A (FIRST OPTION)
- CARBON STEEL PER MIL-W-83420, TYPE I, COMPOSITION A (SECOND OPTION)
- CARBON STEEL PER MIL-W-1511 (THIRD OPTION)

INTERCHANGABILITY INFORMATION:

YOU SHOULD REPLACE CABLES FOR BOTH SIDES OF A SYSTEM IF ONE OR BOTH SIDES HAS A BAD CABLE. USE CABLES OF THE SAME TYPE FOR BOTH SIDES. THIS WILL PREVENT UNEVEN CABLE STRETCH THAT CAN CAUSE PROBLEMS WITH THE RIGGING OF THE SYSTEM.

1 PROOF-LOADING OF NYLON JACKETED CABLE SHALL BE BASED UPON THE DIAMETER OF THE WIRE ROPE ONLY. DO NOT INCLUDE THE JACKET AS PART OF THE DIAMETER

Control Cable Installation
Figure 401

(3) Cable swager Kit - AT520JK

B. Consumable Materials
(1) D00633 Grease - general purpose airplane grease, corrosion preventive, BMS 3-33 (preferred)
(2) D00016 Grease - airplane ball and roller bearings, cables, corrosion preventive, BMS 3-24 (alternative)
(3) G00034 Cheesecloth - Lint-free, dry
(4) G00270 Tape - Masking

C. References
(1) AMM 20-10-04/401, Control Cable Air Seal
(2) AMM 20-10-07/401, Control Cable Pulleys

D. Procedure

S 424-009
(1) To install a prefabricated cable, do these steps:

NOTE: You may wish to replace zinc-only coated cables with tin-over-zinc coated cables to minimize the amount of initial cable stretch.

(a) Remove the necessary pulleys (AMM 20-10-07/401) and control cable air seals (AMM 20-10-04/401). Refer to the applicable chapter for cable location.
(b) Attach the new cable to the old cable.
(c) Pull the old cable out which also pulls the new cable through. Keep light tension on the new cable.
(d) Install the pulleys (AMM 20-10-07/401) and air seals (AMM 20-10-04/401).
(e) Finish installation according to procedures given in Section (3).

S 424-010
(2) To install a not prefabricated cable, do these steps:

NOTE: You may wish to replace zinc-only coated cables with tin-over-zinc coated cables to minimize the amount of initial cable stretch.

(a) Identify the cable that you will remove.
(b) Prepare the new cable as told in the applicable system chapter.
(c) Install only those fittings that will permit cable installation.
1) You can use a portable cable swager to install the fittings.

(d) Apply a proof load to the cable and installed fittings to do a check on swaging and to prestretch cable. See Fig. 401 for proof loads.

NOTE: If you use prestretched cable, it is not necessary to put a load on all of the cable.

(e) Rub the full length of the cable with a dry, lint-free cloth.
(f) Apply a light thin layer of BMS 3-33 (preferred) or BMS 3-24 (alternative) grease to carbon steel cables, then wipe the cable with a clean rag to leave a thin film of grease between the wires on the cable. Do not grease cres cables, it may be only cleaned with clean rag.
(g) Make marks on the positions of the fittings not installed on the cable before installation.
(h) Put a wrap on the old cable to keep it together.
(i) Cut off the cable-end fitting of the old cable.
(j) Make a splice to attach the old cable to the new cable.

NOTE: Make the splice of minimum diameter and sufficiently strong not to break when pulled through. Make a splice only on the center strands of the cable and put tape on the loose outer strands.

(k) Make sure the new cable is attached to the old cable.
(l) Pull the old cable out while you keep light tension on the new cable.
(m) Install the remaining fittings and apply a proof load to the fittings as shown in Fig. 401.

NOTE: You must apply the full proof load gradually. You must apply the full proof load in more than three seconds. You must hold the full proof load for at least five seconds.

(n) Finish installation according to procedures given in Section (3).

S 424-025

(3) Finish Installation (general)
(a) If necessary, remove unwanted material from the surface of the control cable for full length of travel through fairleads, air seals, over pulleys, quadrants, and drums. Use a dry, lint-free cloth.
(b) Apply a light thin layer of BMS 3-33 (preferred) or BMS 3-24 (alternative) grease to carbon steel cables, then wipe the cable with a clean rag to leave a thin film of grease between the wires on the cable. Do not grease cres cables, it may be only cleaned with clean rag.

(c) Install the turnbuckles, with the turnbuckle barrel installed an equal distance on the two threaded terminals. Do not let more than three threads show out of the barrel.
(d) Remove the cable clamps and rig pins from the control cable and drums.
(e) To tighten the cable, refer to the temperature - tension chart in the system chapter.

NOTE: Use a tensiometer to do a check on the cable tension. Apply the tensiometer to the cable a minimum of six inches from the turnbuckle terminal or other fittings. To make sure you get the correct cable tension, permit a minimum of one hour at constant ambient temperature (±5°F) for the airplane temperature to become stable.

(f) If you installed a new cable, operate the system for some test cycles with the cables tightened to two times the usual operation tension. Refer to applicable chapter for tension specifications.
(g) Make the last rigging adjustments. Refer to the applicable chapter for rigging load and test cycle tables.
(h) Make sure the air seals are correctly adjusted to prevent deflection of the cable and to make sure the cable moves freely (AMM 20-10-04/401).
(i) The minimum clearance from the adjacent structure shall be as follows.

NOTE: The clearances that follow are general guidelines only.

Refer to the applicable chapter to find any special conditions for a specific system.

1) Between different cable systems - 0.50 inch

NOTE: A clearance of 2.00 inches is recommended.

2) Between structure, wiring, tubing and fixed equipment:
At a fairlead - 0.50 inch
At a rubstrip - 0.10 inch

NOTE: A clearance of 1.50 inches is recommended below the cable, and 1.00 inch is recommended in the other directions.

3) Between doors, landing gear, and components that move - 2.00 inches.

NOTE: A clearance of 4.00 inches is recommended.

(j) Install the turnbuckle locking clips on all the adjusted turnbuckles (Ref 20-10-05).
(k) Install the cable stop if applicable (Ref 20-10-08).
(l) Operate the controls through full travel.
(m) Make sure the controls and control cables move freely.
(n) Make sure too much force is not necessary to move the controls.

AIR SEAL OF THE CONTROL CABLE - REMOVAL/INSTALLATION

1. General
   A. This procedure contains two tasks. The first task is the removal of the air seal of the control cable. The second task is the installation of the air seal of the control cable.

TASK 20-10-04-004-001

2. Remove the Air Seal of the Control Cable (Fig. 401)
   A. Procedure

S 034-002
(1) Remove the seal retaining bolts.

S 034-003
(2) Remove the ball (2 pieces) from the seal cover.

S 034-004
(3) If it is necessary to replace the seal plate or the seal cover, disconnect the turnbuckle adjacent to the pressure bulkhead.

S 034-013
(4) Remove the seal cover and the seal plate from the bulkhead.

TASK 20-10-04-404-005

3. Install the Air Seal of the Control Cable (Fig. 401)
   A. Consumable Materials
      (1) D00633 Grease - general purpose airplane grease, corrosion preventive, BMS 3-33 (preferred)
      (2) D00015 Grease - Airplane ball and roller bearings, cables, corrosion preventive, large temperature range BMS 3-24 (alternative)
   B. Procedure

S 434-006
(1) If the seal plate or the seal cover are removed, replace them on the control cable and adjust the control cable. Refer to the system adjustment instructions.

S 644-007
(2) Apply grease on the cable for its full length of travel in the seal.

NOTE: Do not fill the seal with grease.

NOTE: Do not apply grease to CRES cables. CRES cables should not be lubricated.

S 434-008
(3) Install the gasket on the pressure bulkhead.

S 434-009
(4) Connect the two ball sides on the cable between the seal cover and the seal plate.

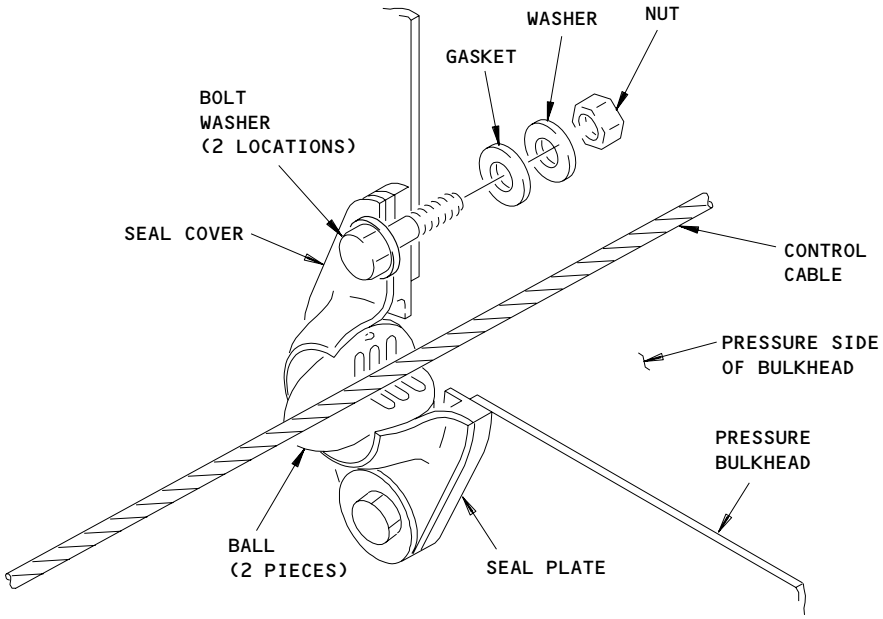
S 434-010
(5) Install the seal retaining bolts with the washers.

S 434-011
(6) Tighten the seal retaining bolts.

NOTE: Make sure that the seal is adjusted to give the correct cable movement.

S 214-012
(7) Make sure that all cable pressure seals are correctly adjusted.

NOTE: If the cable pressure seals are incorrectly adjusted, the cable cannot move freely.



Control Cable Air Seal Installation
Figure 401

CLIPS - TURNBUCKLE LOCKING - REMOVAL/INSTALLATION

1. General
   A. This procedure contains two tasks. The first task is the removal of the turnbuckle locking clips. The second task is the installation of the turnbuckle locking clips.

TASK 20-10-05-004-001

2. Remove Turnbuckle Locking Clips (Fig. 401)
   A. Procedure

S 024-002

(1) Twist the locking clip and force the locking hook out of the hole in the center of the turnbuckle barrel.

S 024-003

(2) Move the locking clip out from the turnbuckle slot.

TASK 20-10-05-404-004

3. Install Turnbuckle Locking Clips (Fig. 401)
   A. Procedure

S 434-005

CAUTION: DO NOT USE TURNBUCKLE LOCKING CLIPS AGAIN. IF THEY ARE USED AGAIN, THE RISK OF FAILURE INCREASES.

(1) Tighten the turnbuckle until not more than three threads are out of the barrel and the cable tension is correct.

S 824-006

(2) Align the slot in the barrel and cable terminal.

S 434-007

(3) Install the straight end of the locking clip into the aligned slot.

S 424-008

(4) Put the locking clip hook over the hole in the center of the turnbuckle. Put the hook into the hole.

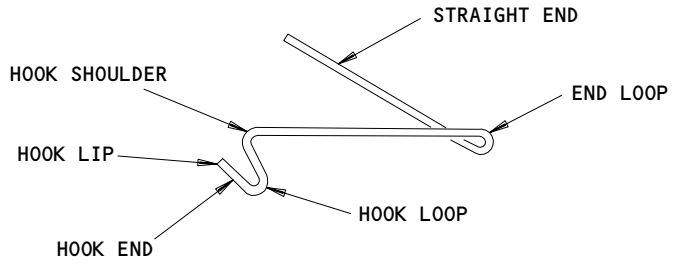
S 424-009

(5) Push the shoulder to engage the hook in the turnbuckle.

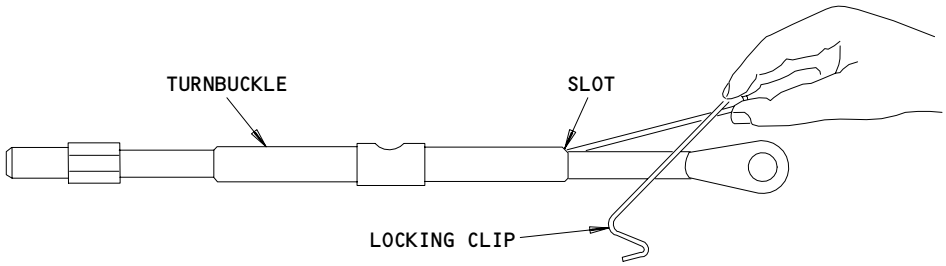
S 424-010

(6) Do the last four steps again to lock the second terminal.

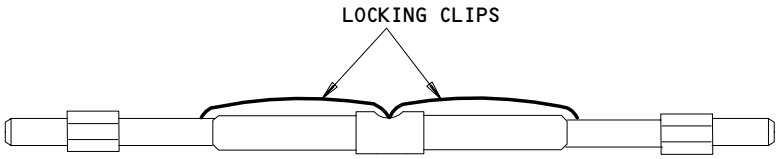
NOTE: You can install the locking clips in the same side or the opposite side of the turnbuckle holes.



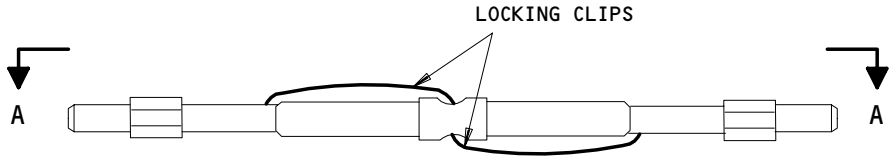
LOCKING CLIP



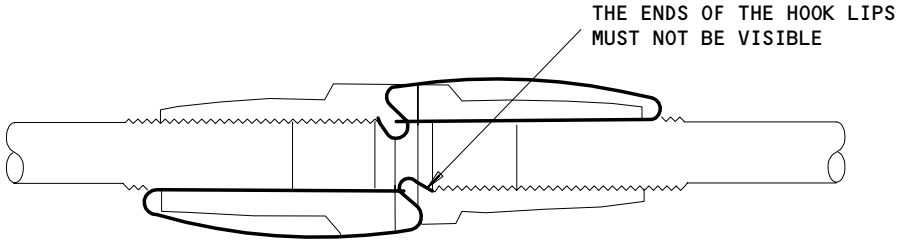
LOCKING CLIP INSTALLED IN THE SLOT



LOCKING CLIP INSTALLED IN THE SAME TURNBUCKLE BARREL HOLE



LOCKING CLIP INSTALLED IN THE OPPOSITE TURNBUCKLE BARREL HOLE



A–A

Turnbuckle Locking Clip Installation
Figure 401

S 214-011

(7) To make sure the two locking clips are correctly installed, turn the turnbuckle a small distance.

S 214-012

(8) Visually examine the locking clip to make sure the hook is engaged in the turnbuckle.

CONTROL CABLE GROMMET - REMOVAL/INSTALLATION

1. General
   A. This procedure contains two tasks. The first task is the removal of the control cable grommet. The second task is the installation of the control cable grommet.
   B. You can replace the control cable grommets in the 3/4, 1, and 1 1/4 inch holes with the control cable removed or installed. You have two alternatives for the replacement of an NAS1368 plastic grommet with the control cable installed:
      - You can use a replacement NAS1368 grommet and cut one side of the grommet for installation
      - You can use a BACG20H nylon grommet, which is a divided grommet.

   TASK 20-10-06-964-001

2. Replacement of the Grommets
   A. Equipment
      (1) Sharp Knife, Razor Blade, or Equivalent Equipment

      (2) Grommet Installation Set - A20006-32
   B. Consumable Materials
      (1) A00273 Adhesive, BMS 5-126 Type 2 Class 1 or Type 3 Class 1
      (2) A00119 Adhesive, BMS 5-55
      (3) B00148 Solvent - Cleaning of Phenolics or Nylon (Series 98-1) (AMM 20-30-98/201).
   C. Remove the Grommet

      S 024-002
      (1) Cut the grommet to remove the grommet from the bulkhead.
   D. Install the Grommet with the Control Cable Removed (Fig. 401).

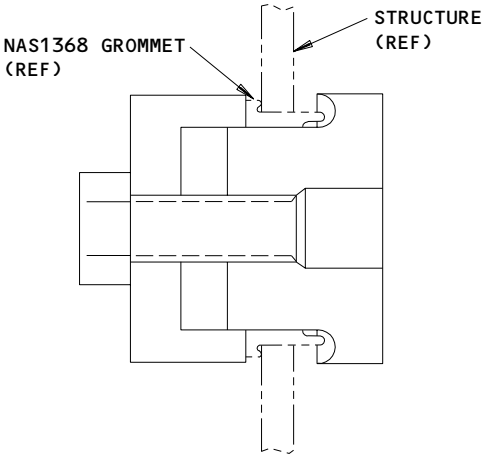
      S 114-003

      WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

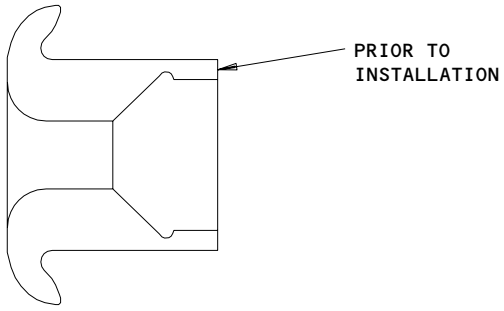
      (1) Clean the bulkhead area that will touch the grommet with solvent (Series 98-1) (AMM 20-30-98/201).

      S 354-004
      (2) Apply BMS 5-126 adhesive on the NAS1368 grommet area that will touch the bulkhead.

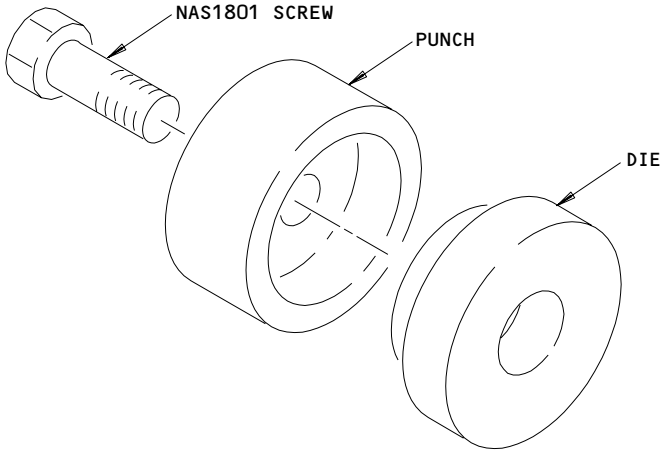
      S 424-005
      (3) Install the grommet in the bulkhead hole.



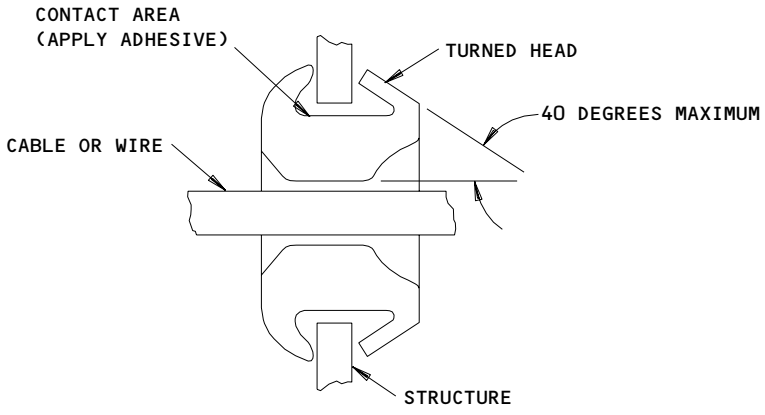
GROMMET DURING INSTALLATION



NAS1368 GROMMET



A20006-32 GROMMET INSTALLATION SET



GROMMET INSTALLED

FLIP-TYPE CABLE GROMMET (NAS1368)

Control Cable Grommets Installation
Figure 401

S 424-006

(4) Put the Grommet Installation Set tool around the grommet and tighten the NAS1801 screw.

S 024-012

(5) Remove the Grommet Installation Set tool.

NOTE: The grommet can be loose in the bulkhead hole, but you have to cut the grommet to remove the grommet from the hole.

E. Install the Grommet with the Control Cable Installed (Fig. 401).

S 114-014

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

(1) Clean the bulkhead area that will touch the grommet with solvent (Series 98-1) (AMM 20-30-98/201).

S 434-008

(2) Use these steps to install the NAS1368 grommet:
   (a) Put the Grommet Installation set tool around the grommet and tighten the NAS1801 screw.
   (b) Remove the Grommet Installation Set tool.
   (c) Cut one side of the NAS1368 grommet.
   (d) Apply BMS 5-126 adhesive on the NAS1368 grommet area that will touch the bulkhead.
   (e) Install the grommet in the bulkhead hole.
   (f) Align the slit part of the grommet at the 12 o'clock position.

S 434-009

(3) Do this step to install the BACG20H grommet:
   (a) Apply BMS 5-55 adhesive on the BACG20H grommet area that will touch the bulkhead.
   (b) Install the grommet in the bulkhead hole.
   (c) Align the slit part of the grommet at the 12 o'clock position.

CONTROL CABLE PULLEYS - REMOVAL/INSTALLATION

1. General
   A. This procedure contains two tasks. The first task is the removal of the control cable pulley. The second task is the installation of the control cable pulley.
   B. This procedure is the general procedure for removal and installation of pulleys. Fig. 401 shows examples of pulleys.
   C. If this procedure does not agree with specified maintenance procedures, use the specified maintenance procedure.

TASK 20-10-07-004-001

2. Remove the Control Cable Pulleys (Fig. 401)
   A. Equipment
      (1) Control Cable Clamp - A20005-9
   B. References
      (1) 20/10/05, Clips - Turnbuckle Locking
   C. Procedure

S 034-002

(1) Loosen the turnbuckle that is closest to the pulley to release tension (Ref 20-10-05).

S 434-003

(2) Install cable clamps on the cable between the pulley to keep light tension.

NOTE: Light tension on the cables where you will not do work will prevent wind off on the cable drums and keep the cable in the pulley guides.

S 434-004

(3) If you can isolate the cable between the rigging pin locations, install the rigging pins through the applicable drum or quadrant.

S 034-005

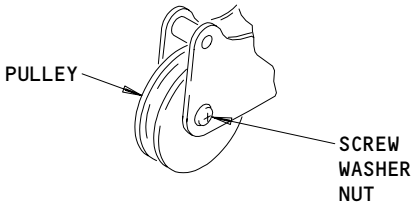
(4) Remove the bolt from the pulley disk.

S 024-006

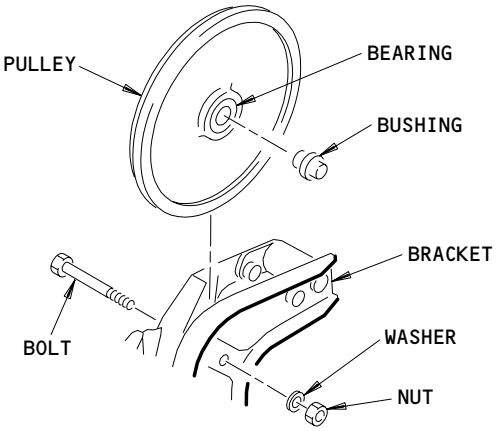
(5) Remove the pulley disk.

TASK 20-10-07-404-007

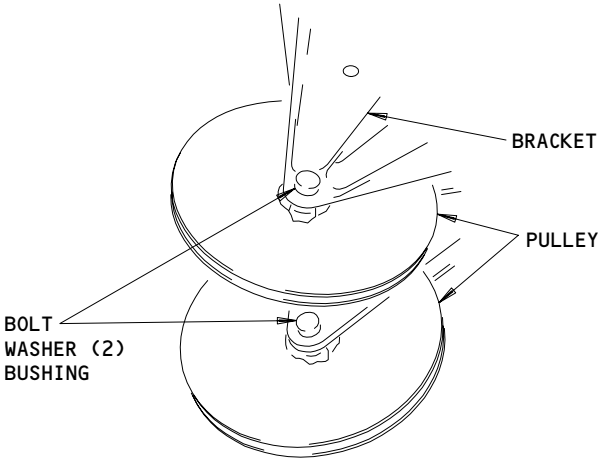
3. Install the Control Cable Pulley (Fig. 401)
   A. Equipment
      (1) Tensiometer - Commercially Available



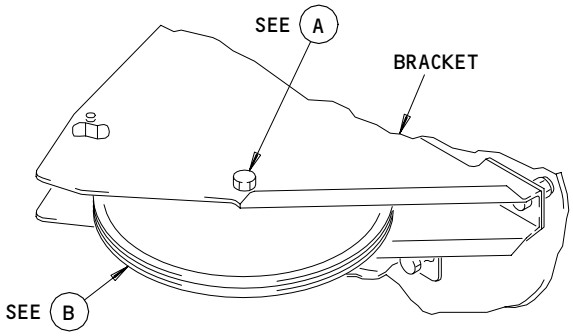
SINGLE PULLEY INSTALLATION



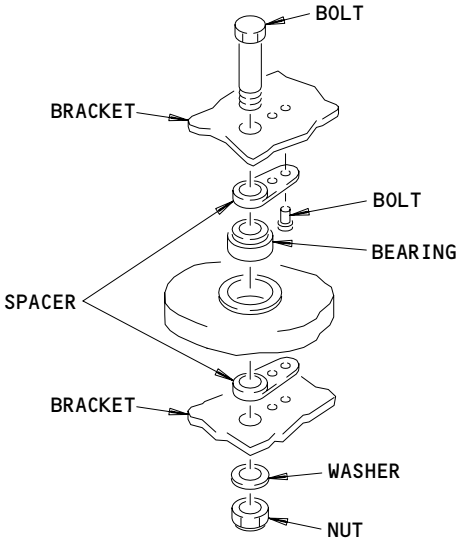
PULLEY WITH BEARING AND BUSHING



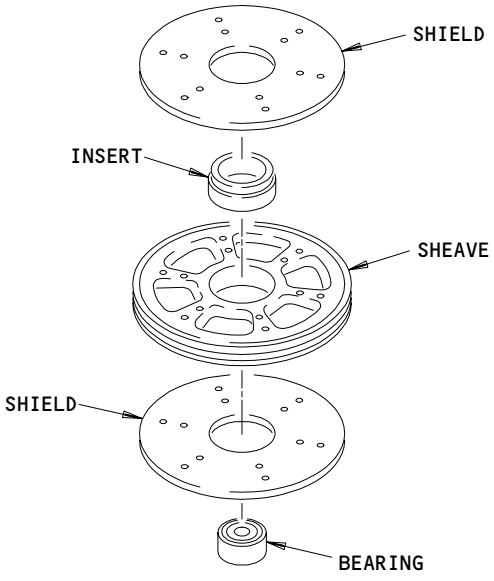
DOUBLE PULLEY INSTALLATION



DETAILED PULLEY



A



B

Control Cable Pulleys Installation
Figure 401

B. Procedure

S 434-008
(1) Install the components applicable to your control cable pulley.

S 434-009
(2) Install the turnbuckles with the turnbuckle barrel installed an equal distance on the two treated terminals. Do not let more than three threads be out of the barrel.

S 034-010
(3) Remove the cable clamps and rig pins from the control cable and drums.

S 434-011
(4) Tighten the cable as told in the temperature - tension chart in the system chapter.

NOTE: Use a tensiometer to do a check on the cable tension. Apply the tensiometer to the cable a minimum of 6 inches from the turnbuckle terminal or other fittings. To make sure you get the correct cable tension, permit a minimum of 1 hour at constant ambient temperature (±5°F) for the airframe temperature to become stable.

S 434-012
(5) Install the turnbuckle locking clips on all the adjusted turnbuckles (Ref 20-10-05).

S 714-013
(6) Operate the controls (refer to the applicable system chapter) through full travel.
(a) Make sure the controls move freely.
(b) Make sure too much force is not necessary.

CONTROL CABLE QUICK STOPS - REMOVAL/INSTALLATION

1. General
   A. This procedure contains one task. The task is the replacement of the control cable quick stops (referred to as cable stops in this procedure).
   B. Cable stops give protection to the control stand cable drums if an engine separation occurs.

   TASK 20-10-08-964-001

2. Replace the Cable Stop (Fig. 401).
   A. References
      (1) 20-10-23/401, Lockwires
   B. Remove the Cable Stop

      S 034-002
      (1) Remove the lockwire that connects the cable stop to the swaged cable terminal stud.

      S 024-003
      (2) Move the cable stop longitudinally away from the terminal stud until the cable stop disengages.

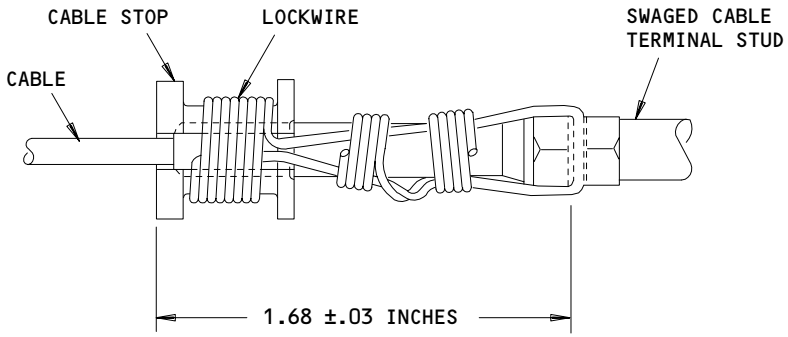
      S 024-004
      (3) Move the cable stop laterally and let the cable go through the slot in the cable stop.
   C. Install the Cable Stop

      S 424-005
      (1) With the large center hole of the cable stop to the swaged cable terminal stud, move the slot of the cable stop over the cable.

      S 424-006
      (2) Push the cable stop on the end of the swaged cable terminal stud until the cable stop fully engages.

      S 824-007
      (3) Twist the swaged cable terminal stud to get the dimension shown.

      S 434-008
      (4) Install the lockwire from the cable stop to the swaged cable terminal stud (Ref 20-10-23).



Control Cable Stops Installation
Figure 401

FLARELESS TUBING ASSEMBLY - REMOVAL/INSTALLATION

1. General
   A. This procedure contains six tasks:
   B. The following procedures do not apply to the Oxygen System Tubing. The customer should consult Boeing before performing any such repairs.
      (1) The first task is to remove the flareless tubing assembly.
      (2) The second task is to install the flareless tubing assembly.
      (3) The third task is electrical resistance specifications in the fuel tank.
      (4) The fourth task is the installation of flareless fittings in pressurized areas, fuel tanks or cargo areas.
      (5) The fifth task is tubing clearances.
      (6) The sixth task is the spacing between tubing clamps.
   C. This procedure is used to remove and install all flareless tubing. The tubing assembly configuration and the tubing material must be identified before removal.
   D. When you disconnect the tubing, always use the necessary precautions to prevent leakage of fluids. If fluids fall on the airplane, identify the fluid and clean the area as specified for that fluid (Ref Chapter 12, Clean and Polish).
   E. When you remove, install, or do work with hydraulic tube assemblies, obey the guidelines that follow:
      (1) When you remove tubes make sure the tubes and port fittings have tags that identify the correct connection locations.
      (2) Do not move or change the tube bends. If you move or change a bend in the tube, these bad effects can occur:
         (a) If you move or change a bend in the tube, it can become possible that the tube will align with the incorrect port. If this occurs, incorrect reconnection or cross-connection of the tubes can become possible,
         (b) If you move or change a bend in the tube, it can become possible that the tube will have too much stress when it is connected. Stress can cause cracks in the tubes.
   F. You can use the nuts and fittings again if the seal areas give a good seal on the assembly. Also, you can use the nuts and fittings again if they are not damaged. The threads on the nuts and fittings must turn smoothly.
   G. Flareless BACS13AP sleeves that are not correctly set can cause leaks. We recommend that you set flareless sleeves by machine. Set the flareless sleeves by hand only when you cannot set them by machine.

H. When you install the tubing, align the fittings and tubing. Tighten the B-nuts with your hand before you tighten them with a wrench. Do not use a wrench on the B-nuts to align the tubing and connections or you will cause damage to the threads.

NOTE: If you use the nut to increase the length or to align the tubing, move the sleeve until it touches the mating surface. Leakage from the fittings or the tubing can occur if you cause damage to the fittings or the tubing.

TASK 20-10-09-004-001

2. Flareless Tubing Assembly - Removal

A. Procedure

S 034-002

WARNING: REFER TO THE APPLICABLE MAINTENANCE INSTRUCTIONS AND REMOVE ALL PRESSURE FROM THE SYSTEM BEFORE YOU START THE REMOVAL OF THE FLARELESS TUBING ASSEMBLY. A PRESSURIZED SYSTEM CAN CAUSE INJURY OR DAMAGE.

WARNING: DO NOT USE THIS PROCEDURE ON OXYGEN TUBING. GREASE, DIRT, OR OTHER FLAMMABLE MATERIALS IN THE OXYGEN TUBING WHEN EXPOSED TO PRESSURIZED OXYGEN CAN IGNITE AND CAUSE AN EXPLOSION. A FIRE OR EXPLOSION CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(1) Remove the support clamps on the tubing you will remove and on the adjacent tubing assemblies if it is necessary.

S 804-043

WARNING: MAKE SURE EACH TUBE AND THE PORT FITTINGS HAVE TAGS TO IDENTIFY THE CORRECT CONNECTION LOCATIONS. IF YOU DO NOT PUT TAGS ON THE TUBES AND PORT FITTINGS, INCORRECT RECONNECTION OR CROSS-CONNECTION OF THE TUBES CAN BECOME POSSIBLE. IF THIS OCCURS, UNINTENTED OPERATION OR MALFUCTION OF AIRPLANE SYSTEMS CAN RESULT AND CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(2) Install tags on the tubes and on the port fittings to clearly identify the correct connection locations.

S 034-003

(3) Loosen the adjacent tubing assemblies and clamps if it is necessary.

S 024-004

(4) Remove the tubing assembly from the airplane.

S 434-005

CAUTION: KEEP THE HYDRAULIC LINES AND FITTINGS SEALED WITH CAPS. DIRT OR UNWANTED MATERIALS CAN CAUSE CONTAMINATION OF HYDRAULIC LINES, DAMAGE TO SYSTEM COMPONENTS, AND LEAKAGE OF HYDRAULIC FLUID CAN OCCUR.

REMOVE THE HYDRAULIC FLUID THAT FALLS ON THE AIRPLANE SURFACES. HYDRAULIC FLUID CAN DAMAGE THE AIRPLANE.

(5) Install the protective caps on the tube assemblies and mating connections.

TASK 20-10-09-404-006

3. Flareless Tubing Assembly - Installation

A. Consumable Materials

(1) Thread Compound - Use approved compound from Table 401.

Flareless Tubing Assembly Thread Compounds Table 401	
TYPE OF SYSTEM	APPROVED THREAD COMPOUNDS (STRAIGHT THREAD FITTINGS)
Compressed Gas (Not Oxygen Systems)	Antiseize Compound BMS 3-28
Deicing or (Anti-icing)	
Instrument Air	Antiseize Compound BMS 3-28
Pneumatic	Antiseize Compound BMS 3-28. D00062 Pneumatic Grease MIL-G-4343
Air Conditioning	
Fire Protection	Antiseize Compound BMS 3-28 or D00053 Grease MIL-G-6032
Coolant	
Water Injection	Antiseize Compound BMS 3-28
Fuel	D00070 Hydraulic Fluid MIL-H-5606
Lubrication	
Hydraulic MIL-H-5606	D00070 Hydraulic Fluid MIL-H-5606
Hydraulic BMS 3-11	D00054 Skydrol Assy Lube MCS 352B
Hydraulic MIL-H-6083	D00070 Hydraulic Fluid MIL-H-5606 or D00106 Hydraulic Fluid MIL-H-6083
Misc Tubing	Antiseize Compound BMS 3-28 or D00053 Grease MIL-G-6032

B. Procedure

S 214-050

WARNING: DO NOT USE THIS PROCEDURE ON OXYGEN TUBING. GREASE, DIRT, OR OTHER FLAMMABLE MATERIALS IN THE OXYGEN TUBING WHEN EXPOSED TO PRESSURIZED OXYGEN CAN IGNITE AND CAUSE AN EXPLOSION. A FIRE OR EXPLOSION CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(1) Examine the tube ends and fittings for any defects or contamination that can have bad effect on the seal of the installation.

S 214-037

(2) Look for worn areas or dents on the tube.

S 644-008

(3) Lubricate the sleeve and fittings.

S 394-009

(4) Apply the thread compound that is applicable to your system (Table 401) (Fig. 401). Apply the thread compound immediately before installation. Apply the thread compound to the external threads of the matting fitting and the shoulder and seal surface of the flareless sleeve.

NOTE: Do not get the thread compound on the internal surfaces of the tube or the inner surface of the bore of the fitting. Do not apply a thread compound when you assemble Dri-Lubed B-nuts.

S 424-010

(5) Put the tubing assembly in the airplane and keep the tube clamps loose to permit you to align the tube in the fitting.

S 214-044

(6) Look at the tags to make sure the tubes are aligned with the correct fittings.

S 824-011

(7) Align the tube and fitting with your hand and make the tube end touch the bottom of the fitting.

S 434-012

(8) Keep the tube end at the bottom and aligned in the fitting. Turn the B-nut with your hand until the B-nut touches the bottom of the sleeve shoulder.

S 434-038

(9) To tighten the assembly, hold the union with a wrench and torque tighten the B-nut to the recommended value (Fig. 403).

NOTE: Do not use the B-nut to align the tube. Do not let the B-nut touch the bottom of the sleeve shoulder. If you have a leak, you can loosen and tighten the B-nut again.

S 434-039

(10) Tighten with your hand the nuts which you cannot tighten with a wrench. Hand tighten until a clear increase in torque occurs, then tighten 1/6 to 1/3 turn more.

NOTE: Tighten the flareless fittings with the BACS13AP sleeves two times (tighten, loosen, and tighten again). The maximum tube collapse permitted after you torque the BACS13AP sleeves is 0.015 inch less than the tube diameter (Fig. 402).

S 434-015

CAUTION: ALWAYS KEEP THE CLAMPS TIGHT. TIGHT CLAMPS KEEP THE AREA BETWEEN THE TUBE AND THE CLAMP SURFACES FREE OF UNWANTED MATERIALS AND CONTAMINATION. IF SURFACES ARE NOT CLEAN, DAMAGE BY FRICTION CAN OCCUR.

(11) Tighten all of the tube clamps.

S 714-046

(12) If you disconnected more than one hydraulic tube and you think there is a possibility you connected the tubes incorrectly or cross-connected the tubes, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

(a) Do the post-installation test of one or more of the components to which the tubes are connected as a check.

S 714-045

(13) If you disconnected electrical wires to get access to the tubes and you think there is a possibility you connected the wires incorrectly or cross-connected the wires, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

(a) Do the post-installation test of one or more of the components to which the wires are connected as a check.

TASK 20-10-09-764-016

4. Electrical Resistance Specifications in the Fuel Tank

A. Equipment

(1) Bonding meter - Model T207 Microhm Bridge, Type W Bonding Meter, Avtron Manufacturing, Inc., Cleveland, Ohio

B. Procedure

S 434-049

WARNING: DO NOT USE TITANIUM FITTINGS IN THE OXYGEN SYSTEM. TITANIUM CAN CAUSE FIRES, AND INJURIES TO PERSONNEL.

(1) Obey this warning during all of this procedure.

NOTE: It is recommended that you use titanium or steel fittings to replace aluminum fittings in the high pressure and normal brake return systems between the antiskid module and parking brake module. You can use titanium or steel fittings replacements for aluminum fittings in other systems.

S 764-017

WARNING: MAKE SURE THAT THE BOND RESISTANCE IS NOT MORE THAN THE VALUES SHOWN. BOND RESISTANCE IS VERY IMPORTANT IF A LIGHTNING STRIKE OCCURS.

IF IT IS POSSIBLE, USE A METER THAT IS RESISTANT TO AN EXPLOSION. IF NOT, MAKE SURE THE AMOUNT OF DANGEROUS GAS, AS MEASURED BY A GAS DETECTOR, IS LESS THAN 10 PERCENT OF THE LOWER EXPLOSIVE LIMIT.

(2) Remove and install or replace the fittings which have resistances more than the values in Fig. 404 and 405.

(a) Do a check on the resistance again. Do not use bonding jumpers to connect high-resistance hydraulic installations.

S 764-018

(3) Measure the resistance between the bulkhead fittings and hydraulic tubes (Fig. 407). Make sure the resistance is less than the value in Fig. 404.

S 764-019

(4) Measure the resistance across the in-line union/tee fittings (tube-to-tube) (Fig. 408). Make sure the resistance is less than the value in Fig. 405.

TASK 20-10-09-404-020

5. Installation of Flareless Fittings in Pressurized Areas, Struts, Fuel Tanks, or Cargo Areas

A. Procedure

S 434-021

(1) Tighten the flareless fittings with the BACS13AP sleeves two times (tighten, loosen, and tighten again).

NOTE: Be careful to make sure that the fittings will not have leaks after you tighten the fittings.

(a) Tighten the flareless fittings with BACS13BX, BACS13BD, welded-on, or NAS1760-type sleeves as follows:
1) Tighten the fitting to the torque shown in Fig. 403.
2) Loosen the fitting to release the torque.
3) Tighten to the torque value specified in Fig. 406.

NOTE: Be careful to make sure the fittings will not have leaks after you tighten the fittings.

S 764-022

(2) For installation of the wing fuel tank, use the procedure, Electrical Resistance Specifications in the Fuel Tank.

S 354-023

(3) Make the necessary repairs. Use the procedure in Flareless Tubing Assembly - Approved Repairs (20-10-09/801).

S 794-024

(4) Do a leak test on the repair installations of the flareless fittings in pressurized areas:
(a) Pressurize the system for 15 minutes minimum.
(b) With the system pressurized, do a check on the tube-to-fitting interface for signs of hydraulic leakage. Use a clean white cloth to find hydraulic leakage.

NOTE: You can tighten the tube again to the specified torque value shown above, if you find leakage. If leakage occurs in subsequent leak tests, you must replace the repair installation.

S 714-047
(5) If you disconnected more than one hydraulic tube and you think there is a possibility you connected the tubes incorrectly or cross-connected the tubes, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

(a) Do the post-installation test of one or more of the components to which the tubes are connected as a check.

S 714-048
(6) If you disconnected electrical wires to get access to the tubes and you think there is a possibility you connected the wires incorrectly or cross-connected the wires, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

(a) Do the post-installation test of one or more of the components to which the wires are connected as a check.

TASK 20-10-09-224-025
6. Tubing Clearances
A. Clearances

S 224-041
(1) The minimum clearance for all mechanical systems except hydraulic tubing will be from adjacant structure, fixed structure, fixed and moving equipments and other tubing and fitting connectors will be as follows:
(a) Supported locations 0.10 inch
(b) Unsupported locations 0.20 inch
(c) Supported and unsupported locations for flammables, gas, and fuel systems will be 2.0 inches from electrical wires and cables

S 224-040
(2) Minimum clearance for hydraulic system.
(a) A minimum 0.06 inch for tubes supported to structure or other rigid members.
(b) A minimum of 0.25 inch with adjacent structure, tubing or connectors, or other installations.
(c) A minimum of 0.25 inch in areas where relative motion of adjoining components exists.
(d) A minimum of 0.06 inch between individual coils of all coiled tubes.
(e) A minimum of 0.50 inch from electrical wiring installations.

S 434-026

(3) Install hydraulic tubes with a minimum of force on the clamps or the tubes.

S 224-027

(4) Where the tubes are held by clamps to an adjacent structure, make sure the tubes are clear of the adjacent structure. The minimum clearance is 0.10 inch. Where the tube is attached directly with a clamp to the structure, the clearance can be the thickness of the clamp.

S 224-028

(5) Where tubes are not held by clamps to an adjacent structure, make sure all tubes are clear of the adjacent structure, equipment installations, and other items. The minimum clearance is 0.25 inch.

S 224-029

(6) Make sure the tubes are clear of any mechanism that operates. The minimum clearance is 0.38 inch. This clearance can be 0.25 inch where the tubes are attached by clamps to adjacent structure and the tubes will not rub or touch the mechanism that operates.

S 224-030

(7) If one tube goes across a tube or if two tubes are parallel, make sure there are sufficient clamps attached. The clearance must be 0.25 inch minimum or the thickness caused when two clamps are attached side-by-side.

NOTE: You can add side-by-side clamps to get the necessary clearance.

S 224-031

(8) To get the necessary clearances with the loop-type clamps, use BACS18AF3 or BACS18AF4 spacers to make the necessary height. On the U-type clamps, use BACS18AN spacers. Do not use NAS42 or NAS43 clamps on hydraulic tubes.

NOTE: Do not use more than four spacers together. If you use more than four spacers, find the cause and correct the problem.

S 224-033

(9) Make sure the tubes are clear of the control cables between the break points or the fairleads and the control cable linkage. The minimum clearance is 0.625 inch.

S 224-034

(10) Make sure the minimum clearance between the tubes in the clampblocks (65B80254) and the channels on the clampblocks is 0.060 inch. If this clearance is less, correct the spacer tube length (NAS43003-) or correct the force on the tubes in the clampblock.

TASK 20-10-09-224-035

7. Tubing Clamp Spacing

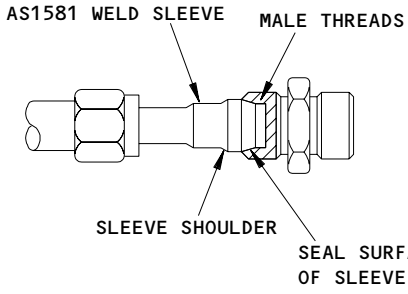
A. Procedure

S 224-036

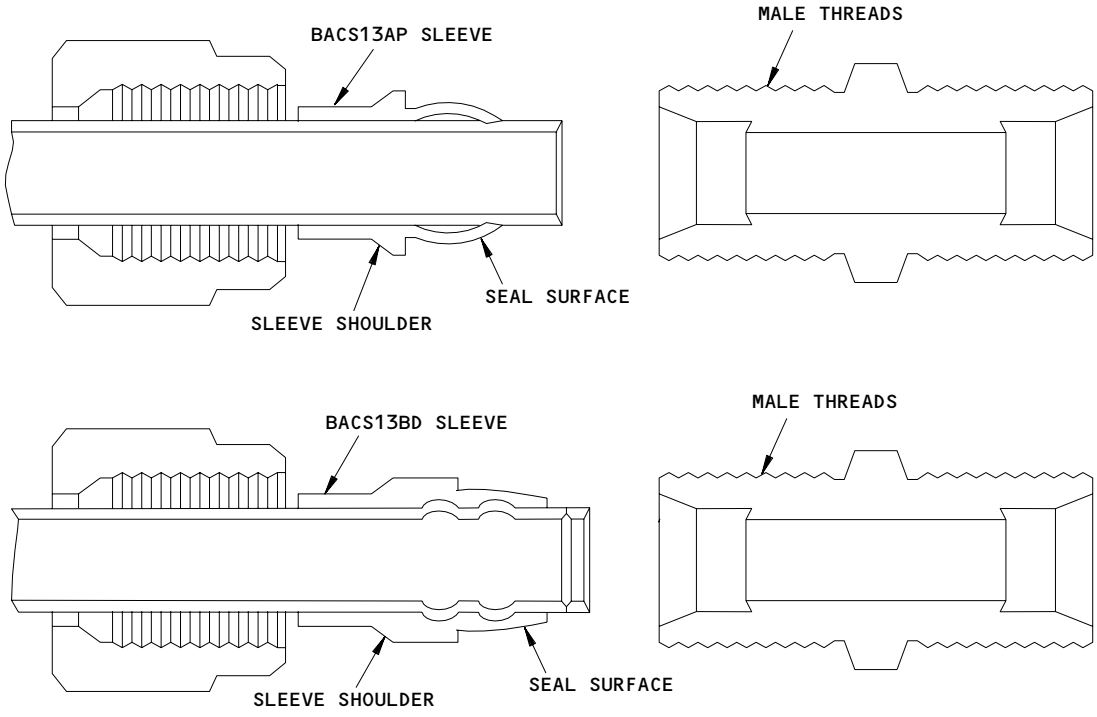
(1) Keep the space between the tubing clamps in the limits shown in Table 402, unless it is specified differently.

Normal Tube Clamp Maximum Spacing Table 402			
Tubing OD (Inches)	Material	Usual Clamp Spacing (Inches)	Special Clamp Spacing *[1]
1/4	Steel, Titanium	16.0	12.0
3/8	Steel, Titanium	20.0	15.0
3/8	Aluminum	16.5	12.0
1/2	Steel, Titanium	23.0	17.0
1/2	Aluminum	19.0	14.0
5/8	Steel, Titanium	22.0	18.5
5/8	Aluminum	22.0	16.5
3/4	Steel, Titanium	27.5	20.5
3/4	Aluminum	24.0	18.0
1.0	Steel, Titanium	30.0	22.5
1.0	Aluminum	26.5	19.5
1 1/4	Steel, Titanium	31.5	23.5
1 1/4	Aluminum	28.5	21.0

*[1] Use special clamp spacing for the Wing Rear Spar, Engine Strut, Engine Aft Fairing

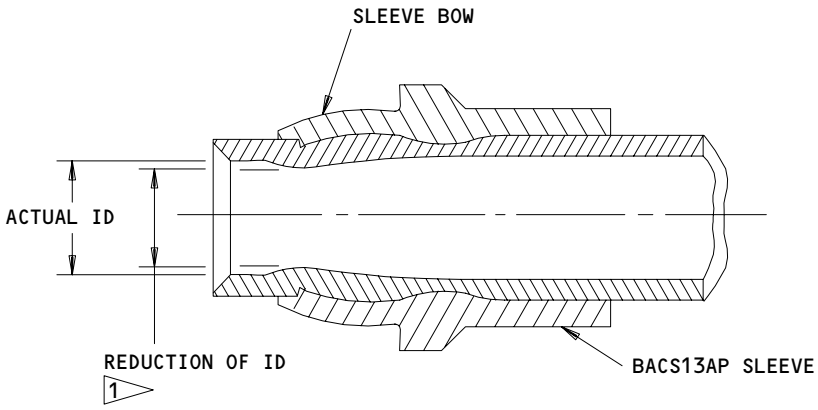


NOTE: APPLY LUBRICANT TO EXTERNAL THREADS OF MATING FITTING, SLEEVE SHOULDER AND SEAL SURFACE OF FLARELESS SLEEVE BEFORE TIGHTENING B-NUT (NOT REQUIRED WITH DRY FILM LUBRICATED B-NUTS).



LUBRICATION POINTS

Flareless Tubing Assembly Lubrication Points
Figure 401



1 CHECK THAT THE REDUCTION OF ID DOES NOT EXCEED 0.005 INCH AFTER PRESET OR 0.015 INCH AFTER NUMEROUS TIGHTENINGS

Maximum Preset Flareless Sleeve Collapse
Figure 402

TUBING SIZE (INCHES)		INSTALLATION TORQUE ON FLARELESS TUBING FITTINGS 3 4 (POUND-INCHES, ±5%) NOTE: USE CARE WHEN YOU SELECT THE CORRECT TORQUE FOR REDUCER FITTINGS. THE BOSS OR BULKHEAD SIZE GIVES THE FITTINGS INSTALLATION TORQUE.	
OD	TUBE DASH NO.	STEEL & TITANIUM TUBES 1	ALUMINUM & ANNEALED CRES TUBES 2
3/16	-3	100	80
1/4	-4	140	110
5/16	-5	190	140
3/8	-6	270	170
1/2	-8	500	280
5/8	-10	700	360
3/4	-12	900	450
1	-16	1200	750
1-1/4	-20	1600	900
1-1/2	-24	2000	900
2	-32	2000	---

1 TORQUE VALUES APPLICABLE TO THESE TUBE ENDS:
A. 21-6-9 CRES AND ALL OTHER CRES TUBE ENDS WITH BACS13BD, BACS13BX SWAGED SLEEVE AND 21-6-9 CRES TUBE ENDS WITH CRYOLIVE SLEEVE
B. MIL-T-6845, MIL-T-8504 AND MIL-T-8808 CRES FLARED TUBE ENDS
C. MIL-T-6845 CRES WITH PRESET BACS13AP 5 OR CRYOLIVE SLEEVES
D. HOSE END FITTINGS WITH STEEL INSERTS (NIPPLES)
E. ALL TITANIUM TUBE ENDS

2 TORQUE VALUES APPLICABLE TO THESE TUBE ENDS:
A. 6061-T6 ALUMINUM WITH BACS13BD OR BACS13BX SWAGED SLEEVES (SIZES 04 THROUGH 16) OR CRYOLIVE SLEEVE ASSEMBLIES (SIZES 04 THROUGH 12)
B. 6061-T6 ALUMINUM WITH PRESET BACS13AP SLEEVES 6
C. ANNEALED CRES WITH PRESET BACS13AP SLEEVES 6
D. FLARELESS TYPE HOSE END FITTINGS WITH ALUMINUM INSERTS (NIPPLES)
E. ALUMINUM FLARED TUBE ENDS

Installation Torque for Flareless Tubing Fittings
Figure 403 (Sheet 1)

78759

3 USE CARE WHEN YOU SELECT THE CORRECT TORQUE FOR REDUCER FITTINGS. THE BOSS OR BULKHEAD SIZE GIVES THE FITTING INSTALLATION TORQUE.

4 TUBE MATERIAL SPECIFICATIONS:
A. 6061-T6 ALUMINUM - MIL-T-7081, WW-T-700/6
B. ANNEALED CRES - MIL-T-8504, MIL-T-8606, MIL-T-8808
C. 1/8 HARD CRES - MIL-T-6845
D 21-6-9 CRES - BMS 7-185
E. TI-3AL-2.5V - BMS 7-234

5 TORQUE VALUES ARE APPLICABLE TO STANDARD MS FLARELESS TUBE ENDS (BACS13AP SLEEVES) ON MIL-T-6845 (304-1/8 HARD) TUBING WITH A MINIMUM WALL THICKNESS AS GIVEN BELOW:

SIZE	-4	-5	-6	-8	-10	-12
WALL THICKNESS	0.020	0.020	0.028	0.035	0.049	0.049

TORQUE FOR SPECIAL THIN WALL MIL-T-6845 (304-1/8h) TUBING IS AS FOLLOWS:

SIZE	-8	-10	-12
WALL THICKNESS	0.028	0.035	0.042
TORQUE (POUND-INCHES)	375	575	725

6 TORQUE VALUES ARE APPLICABLE TO STANDARD MS FLARELESS TUBE ENDS (BACS13AP SLEEVES) OR CRYOLIVE SLEEVES ON 6061-T6 ALUMINUM AND MS FLARELESS TUBE ENDS (BACS13AP SLEEVES) ON ANNEALED CRES TUBING WITH A MINIMUM WALL THICKNESS AS GIVEN BELOW:

SIZE	-3	-4	-5	-6	-8	-10	-12	-16
WALL THICKNESS	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.035

TORQUE FOR SPECIAL THIN WALL ANNEALED CRES TUBING IS AS FOLLOWS:

SIZE	-6	-10	-12
WALL THICKNESS	0.020	0.020	0.020
TORQUE (POUND-INCHES)	160	250	325

Installation Torque for Flareless Tubing Fittings
Figure 403 (Sheet 2)

TUBE SIZE	MAXIMUM RESISTANCE (MILLIOHM)		
	ALUMINUM	TITANIUM	
		PERMASWAGE	WELD-ON
-04	____	6	12
-06	0.70	4	8
-08	____	2.5	5
-10	0.41	1.5	3

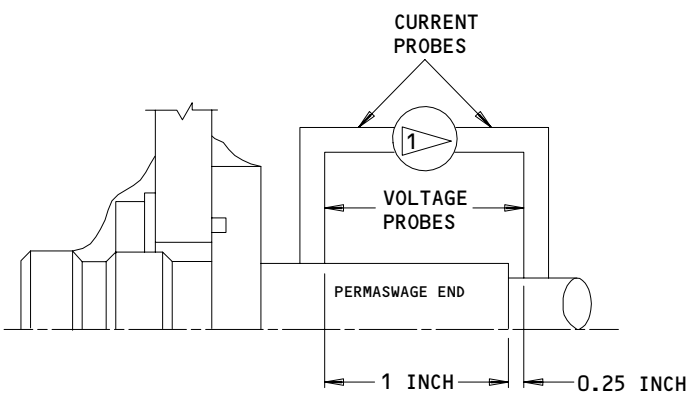
Resistance Between Bulkhead Fittings and Hydraulic Tubing
Figure 404

TUBE SIZE	MAXIMUM RESISTANCE (MILLIOHM)	
	ALUMINUM	TITANIUM
-04	--	12
-06	1.30	8
-08	--	5
-10	0.75	3

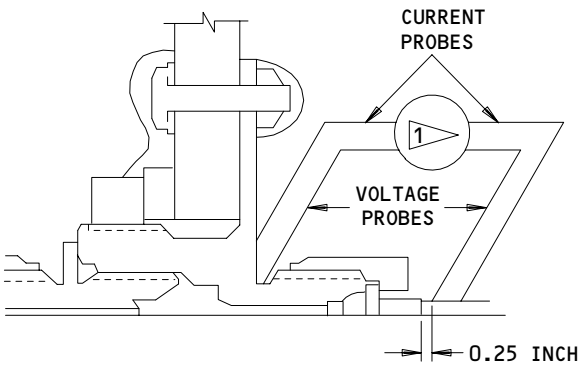
Resistance Across Union/Tee Fittings (Tube-To-Tube)
Figure 405

TUBE SIZE (INCH)	0.250	0.375	0.500	0.625	0.750	1.000
TITANIUM, CRES TUBE	210	400	750	1050	1350	1800
ALUMINUM TUBE	170	250	420	540	675	1125

Installation Torques for Flareless Fittings in Pressurized Areas
Figure 406



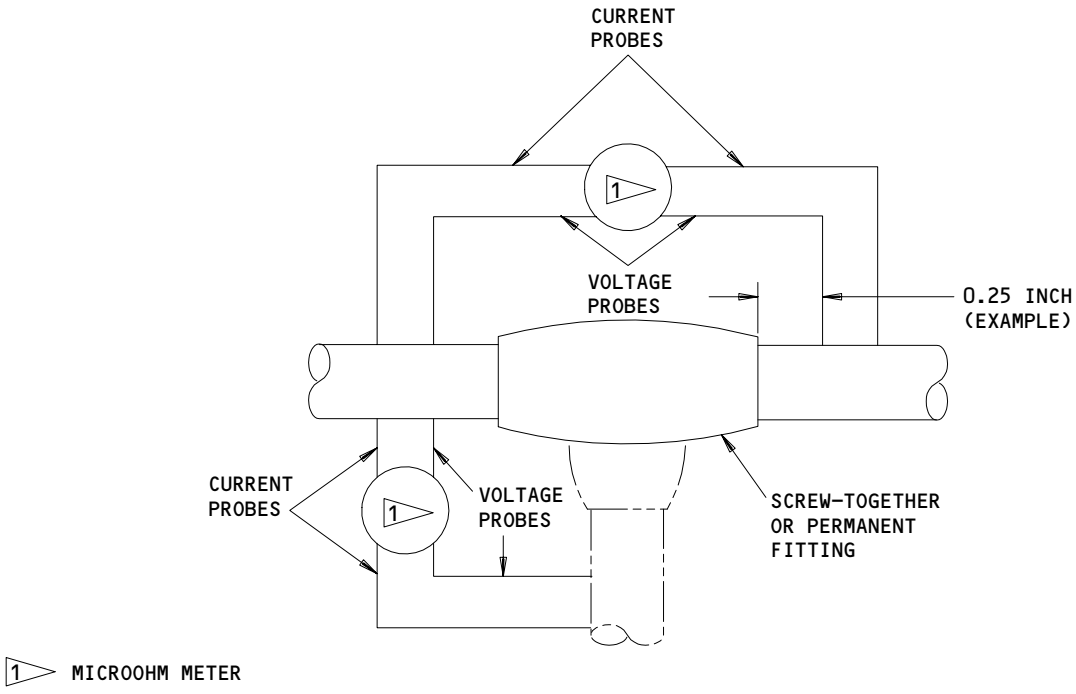
PERMASWAGE BULKHEAD FITTING



SCREW TOGETHER WELD-ON BULKHEAD FITTING

1 MICROOHM METER

Bulkhead Fittings
Figure 407



Union/Tee Fittings
Figure 408

FLARELESS TUBING ASSEMBLY - APPROVED REPAIRS

1. General
   A. This procedure does not apply to the Oxygen System Tubing. Consult with Boeing before performing any such repairs.
   B. This procedure contains these tasks:
      (1) Tube Repair.
      (2) Swage BACS13BX Flareless Sleeves with the Harrison Elastomer Swagers 5175, 5570, and 5720.
      (3) Swage BACS13BX Flareless Sleeves with the 6633K01 Harrison Roller Swaging Kit.
      (4) Swage Harrison 35211 sleeves and 35212 unions with the Harrison 6777 Roller Swage Machine.
      (5) Preset BACS13AP Flareless Sleeves.
      (6) Install the 921721 Cryolive Flareless Sleeve Assembly.
      (7) Install the BACC42W H-Coupling.
      (8) Install the 3P02111 or 3PHS111 cryofit couplings.
      (9) Install Permaswage Fittings.
      (10) Install the Rynglok 8010T permanent tube to tube union.
      (11) Repair 6061-T4/T6 Aluminum Tubing (Hydraulic or Pitot-Static Tubing Tubing).
      (12) Aluminum Fuel Tubes, temporary weld repair method.
   C. This procedure gives the approved repairs for hydraulic, pneumatic, water, fire extinguisher, electrical rigid conduit, and other tube assemblies, except oxygen tubing. Repair procedures include the replacement of damaged tube ends or the replacement of small damaged tube parts. You can use flareless tubes and sleeves, H-Coupling assemblies, Cryofit couplings, Permaswage fittings , Cryolive assemblies, or Rynglok unions.
   D. You can repair 6061-T4 aluminum tubes using 6061-T6 aluminum tube and flareless fittings. It is not acceptable to repair 6061-T6 aluminum tube with 6061-T4 aluminum tube or use 6061-T4 aluminum tube in place of 6061-T6 aluminum tube.
   E. You can use approved 304-1/8 Hard or 21-6-9 corrosion-resistant steel tube assemblies to replace titanium tube assemblies. You can also use approved 304-1/8 Hard corrosion-resistant steel tube assemblies to replace 21-6-9 corrosion-resistant steel tube assemblies.
   F. When you do repairs, the type of flareless tube sleeves will tell you the installation method to use.
      (1) Use approved power swaging equipment, or roller swaging, to do all swaged-on sleeves and fittings.
      (2) You can preset BACS13AP flareless sleeves by machine. Preset by hand only when a hydraulic or pneumatic-operated presetting tool is not available. If you must preset by hand, we recommend that you preset some samples. Cut the samples into sections longitudinally and make an inspection of the ring cut depth before you preset the part to be repaired.

(3) You can install the CRYOLIVE sleeve assembly, consisting of CRYOLIVE sleeve, coupling nut and protective cover/inspection tool, by removing the assembly from liquid nitrogen and sliding it on to the tube end. Note that the Size 10, Size 12 and Size 16 coupling nuts used with the CRYOLIVE sleeve are slightly longer than standard MS type coupling nuts and are not interchangeable with MS type coupling nuts.

G. The H-coupling assembly is a repair coupling which has a union coupling, a slide, and a nut. You can install the H-coupling assembly in straight sections of the tube. Use two end wrenches of applicable size. This assembly is approved for fuel and hydraulic high pressure lines of 21-6-9, titanium 3AL-2.5V, and 304-1/8 hard CRES tubing. The H-coupling assembly is also approved for the repair of 304 CRES annealed and 6061-T6 aluminum tubing lines of 3000 psi or less.

H. You can use a Cryofit coupling for the inline repair of 3AL-2.5V titanium tubing. To install the Cryofit coupling in a straight tube section, shrink fit the coupling in its position.

I. You can use the Permaswage coupling for inline repair of 6061-T6 aluminum, 21-6-9 CRES or 304-1/8 hard CRES, and 3AL-2.5V titanium tubing.

J. You can use the Rynglok union for inline repair of 6061-T6 aluminum, 21-6-9 CRES or 304-1/8 hard CRES, and 3AL-2.5V titanium tubing. Rynglok unions are made of lightweight 6AL-4V titanium alloy and are not to be used in oxygen systems, in fuel cells, or in repair of tubes installed in engines.

K. When you repair a section of a tube, correctly align the tube and the fittings. Make sure the fittings touch the bottom at the two ends of the repaired section. Do not use fitting nuts to align the fittings. Fitting nuts used to align fittings during the tube installation will increase the risk of leakage, blowoff, or other failure.

L. Do a leak check on all hydraulic tubes disconnected during the repair procedure.
   (1) Pressurize the hydraulic tubes for a mimimum of 5 minutes.
   (2) Rub all the fittings with a clean white cloth.
   (3) Look for hydraulic fluid on the cloth to find leakage.

M. When you remove, install, or do work with hydraulic tube assemblies, obey the guidelines that follow:
   (1) When you remove tubes, make sure the tubes and port fittings have tags that identify the correct connection locations.

(2) Do not move or change the tube bends. If you move or change the bend in the tube, these bad effects can occur:
  (a) If you move or change a bend in the tube, it can become possible that the tube will align with the incorrect port. If this occurs, incorrect reconnection or cross-connection of the tubes can become possible.
  (b) If you move or change the bend in the tube, it can be possible that the tube will have too much stress when it is connected. Stress can cause cracks in the tubes.

(3) If you disconnected more than one hydraulic tube and you think there is a possibility you connected the tubes incorrectly or cross-connected the tubes, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

  (a) Do the post-installation test of one or more of the components to which the tubes are connected as a check.

(4) If you disconnected electrical wires to get access to the tubes and you think there is a possibility you connected the wires incorrectly or cross-connected the wires, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

  (a) Do the post-installation test of one or more of the components to which the wires are connected as a check.

N. Hydraulic system pressure definitions are below.
  (1) Maximum working pressure:
    (a) Anytime repairs to the tubes are made on the airplane, or when any hydraulic component is to be checked.
  (2) Proof Pressure:
    (a) If the tubes are repaired and to be tested in the shop.
  (3) Burst Pressure:
    (a) This is for design reference only.

O. B-Nut torquing:
  (1) The correct torquing can be applied to B-nuts only if the tubing material is identified correctly (aluminum, titanium or steel).
  (2) If the normal finish color of the B-nut is covered by the grey drilube coating, a color-coded ring is applied to the back side of the B-nut.

TUBE MATERIAL	TUBE FINISH/COLOR	B-NUT (MAY BE COVERED WITH DRILUBE)
ALUMINUM	STANDARD 767 - GREEN PRIME	GOLD OR BROWN
CRES	STANDARD 767 - NO FINISH	Silver, Bright
TITANIUM	NO FINISH	Dull Gray

(3) If a steel or titanium B-nut connects to an aluminum tube or fitting, use the lower torque value (aluminum).

P. Deleted step.

Q. Use the tube materials as shown in Table I. Use the approved tube materials/tube sizes/tube wall thicknesses as shown in Table IA for 3000 psi hydraulic systems.

TABLE I
CROSS REFERENCE OF TUBING TO BMS/MIL SPECIFICATION

TUBING MATERIAL	BMS	MIL	OTHER
ALUMINUM 6061-T4, 6061-T6	---	WW-T-700/6 WW-T-7081 *[1]	--- AMS 4083
CRES 21-6-9	7-185	---	---
1/8 HARD CRES 304-1/8h	---	T-6845	AMS 5566
ANNEALED CRES 304	---	T-8504	AMS 5567
ANNEALED CRES 321	---	T-8808	AMS 5556 AMS 5557
TITANIUM 3AL-2.5V	7-234	---	AMS 4945

*[1] LOW PRESSURE, NON-HYDRAULIC SYSTEMS ONLY

Table IA Approved Tube Materials							
	Tube Size	04	06	08	10	12	16
Tube Material	21-6-9 CRES (BMS 7-185)	0.016	0.020	0.026	0.033	0.039	0.052
	3AL-2.5V Titanium (AMS 4945)	0.016	0.019	0.026	0.032	0.039	0.051
	304 1/8 Hard CRES (MIL-T-6845)	0.020	0.028	0.035	0.049	0.058	0.065
	6061-T6 Aluminum AMS 4083 (MIL-T-7081) Return/Supply/ Suction Only	0.035	0.035	0.035	0.035	0.035	0.035

NOTE: CONSULT BOEING BEFORE USING ALTERNATE TUBE MATERIAL/WALL THICKNESS COMBINATIONS FOR 3000 PSI HYDRAULIC SYSTEM APPLICATIONS

R. Repair Options for ETOPS Sensitive Tube Assemblies

(1) The tube repairs covered in AMM 20-10-09/801 are acceptable for use on any hydraulic tube assembly in the airplane, including ETOPS Sensitive tube assemblies except for ETOPS Sensitive tube assemblies that were subjected to an additional autofrettage process during manufacture. ETOPS Sensitive tube assemblies that were subjected to an additional autofrettage process during manufacture may be temporarily repaired but must be replaced with a new tube of the same P/N at the earliest maintenance opportunity, no later than the next "C" check on the airplane.

NOTE: Autofrettage is a process whereby a tube assembly is subjected to four times the rated tube operating pressure for five minutes after forming. The process relieves bending stresses in the tube assembly that are induced during tube forming. Results from laboratory tests of tube ##assemblies subjected to the autofrettage process have shown improvement to the service life of the tube.

(2) The following ETOPS Sensitive Tube Assemblies that were subjected to the autofrettage process during manufacture may be temporarily repaired per the instructions below but should be replaced with a new tube of the same P/N at the earliest maintenance opportunity. The tubes function as stab trim brake release lines in the left and right tail sections of the airplane (Section 48, STA 1720 -STA 1862.70).

(3) List of ETOPS Sensitive Stab Trim Brake Release Tubes that were Subjected to the Autofrettage Process During Tube Manufacture:
271N6481-1119, -1120, -1121, -1128, -1132
271N6482-1114, -1115, -1116, -1124, -1130

(4) Repair options for ETOPS Sensitive Tube Assemblies that were subjected to the Autofrettage Process during manufacture:

(a) It is satisfactory to temporarily replace one of the ETOPS sensitive tubes that has been subjected to the autofrettage the process with a hydraulic hose (reference task: Repair Hydraulic Tubing With Flexible Hoses) as long as you make sure the hose clearances to adjacent parts/moving part are adequate. The hydraulic hose should be replaced with a new tube of the correct P/N at the earliest maintenance opportunity, no later that the next "C" check of the airplane.

(b) It is also satisfactory to perform a temporary repair in a straight section of the tube per this procedure on an ETOPS sensitive tube that was subjected to the autofrettage process during tube manufacture as long as the repaired tube is replaced with a new tube of the same P/N at the earliest maintenance opportunity, no later than the next "C" check of the airplane.

TASK 20-10-09-308-225

2. Tube Repair

A. General

(1) Use Hydraulic System Desgin Pressure/IN PSI/ as shown in Table 2 during repairs.

TABLE 2
HYDRAULIC SYSTEM DESIGN PRESSURES

COMPONENT	Maximum Working Pressure psi	Proof Pressure psi	Burst Pressure psi
Pressure lines (including hoses and fittings) and units with air under full system pressure (such as accumulators).	3000	6000	12000
Return and case drain lines, fittings and units	600	900	1500
Return line hoses	600	1500	3000
Pump Supply reservoirs, units, lines and fittings	65	100	200
Airbleed Line (Upstream of regulator)	250	500	1000
Drains and vents open to atmosphere	15	50	75

(2) When you remove, install, or do work with hydraulic tube assemblies, obey the guidelines that follow:
   (a) When you remove tubes, you must make sure the tubes and port fitings have tags that identify the correct connection location.
   (b) Do not move or change the tube bends. If you move or change the bend in the tube, these bad effects can occur:
      1) If you move or change a bend in the tube, it can become possible that the tube will align with the incorrect port. If this occurs, incorrect reconnection or cross-correction of the tubes can become possible.
      2) If you move or change the bend in the tube, it can be possible that the tube will have too much stress when it is connected. Stress can cause cracks in the tubes.
   (c) If you must bend the tube assemblies to fit the installation, do not bend more than permitted by the ovality limits in Fig. 801. We recommend that you use a bend block or tool equivalent to the Parker G-824 hand bender. Make sure the bend block supports the tube bend beyond the neutral axis of the bend, as shown in Fig. 801 , and that bend ovality allowables are not exceeded.

(d) Do not repair dents or chafed areas. Replace the tube or tube section if the defect depth is more than the values in Fig. 803. It is not necessary for you to repair or replace tubes with defect depth less than these values.

(3) Electrical rigid conduit repair.

(a) Smooth dents are permitted to the elctrical rigid conduit with these limits as shown in Fig. 841.

1) Dent depth damage is not more than 20 percent of the outer diameter.
2) The conduit is not dented or has a crack that causes it to have kinks, to rub, or to show the ineer wire.
3) The dent is smooth and does not make a sharp wrinkle on the outer surface of the conduit.
4) There are no cracks in the conduit.
5) Dents are not permitted on rigid electrical conduits in the fuel tanks.

(b) Repair or replace electrical rigid conduits if the damage is more than the limits.

(c) If you must form the electrical rigid conduit tube to fit an installation, do not bend more than permitted by the forming limits as shown in Fig. 842.

(4) To repair a damaged tube section, cut out the damaged tube section and replace it with a fitting or with an assembled tube and fitting assembly.

(5) To replace a BACU24AB swage union, cut out the damaged fitting and replace it with a B-nut, BACS13AP sleeve or BACS13BX sleeve or a CRYOLIVE flareless sleeve assembly and an MS21924 bulkhead union, using the procedures in Fig. 807.

(6) If you replace a BACA14BP fitting, you must use another BACA14BP fitting. To install a new BACA14BP or D10203 fitting a the new tube section, refer to "The Installation of Permaswage Fittings". To verify the electrical resistance, where required, refer to Flareless Tubing Assembly - Removal/Installation (AMM 20-10-09/401).

NOTE: Use BACA14BP fittings only for replacement of other BACA14BP fittings unless approved by The Boeing Company on a case-by-case basis. The MS screw-together ends on this fitting are prone to deformation and galling, from repeated assembly and disassembly, and may leak.

(7) To make tube repairs, use tube sections of the same material and use the fittings as shown in Fig. 802. You can make splice a repair of 21-6-9 and Ti-3AL-2.5V tube with 304-1/8th tube of the wall thickness shown in Fig. 821 or 824.

(8) The permitted limits of hydraulic line damage caused by dents, chafes, or the corrosion removal process per the Corrosion Prevention Manual, are shown in Fig. 803.

(9) A repair of a tube section can be in one of three groups. The groups have a relation to the location of the tube damage and the quantity of damage. The three groups are as follows:
  (a) Replace a tube end section that has a flareless end fitting you can move apart, with an assembled tube and fitting assembly (Fig. 806).
  (b) Replace a tube center section that has a short damaged segment with a single union (Fig. 805).
  (c) Replace a tube center section that has very much damage with an assembled tube and fitting assembly (Fig. 809).

(10) If you disconnected more than one hydraulic tube and you think there is a possibility you connected the tubes incorrectly or cross-connected the tubes, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

  (a) Do the post-installation test of one of more components to which the tubes are connected as a check.

(11) If you disconnected electrical wires to get access to the tubes and you think there is a possibility you connected the wires incorrectly or cross-connected the wires, do an operational check:

NOTE: Use your own judgement to determine if a check is necessary.

  (a) Do the post-installation test of one of more components to which the wires are connected as a check.

B. Repair of a Tube (Make a Splice)

S 948-226

(1) Make a decision about the type of repair necessary. Use Fig. 802 to make a decision about which group the repair is in.

S 948-227

(2) Refer to Fig. 805 to find the necessary tube cutout length when you use a single union to replace a damaged tube area.

S 438-228

(3) To use assembled tube ends or a center section to do a repair, find the cutout length and install as follows:
  (a) Make an estimate of the total length (L1) of the repair section necessary to replace the damaged tube (see Fig. 806 & 809).
  (b) Cut and trim the repair tube as follows: (see Fig. 804)
    1) Use the correct size ratchet chipless cutter.
    2) Turn the cutter drive screw counter clockwise to retract the cutter wheel.
    3) Put the cutter over the tube.
    4) Turn the screw clockwise until the cutter touches the tube at the necessary cut location.
    5) Turn the screw 1/8 to 1/4 turn and rotate the cutter until the cutter is easy to rotate. The tube should now be cut.
    6) Remove the tool.

7) To deburr the tube use the correct stem subassembly and deburring tool. To assemble the tool refer to Fig. 804.
8) Push down on the plunger and install the tool into the end of the tube.
9) Release the plunger. Let the plug fill the inside of the tube.
10) Rotate the deburring tool until the inside burr is removed.
11) Remove the tool with the plug expanded. The expanded plug should remove metal particles from the inside of the tube.

NOTE: Make sure you do not drop metal particles in the area of the repair.

(c) Swage the necessary flareless sleeves to the repair tube as told in the applicable section:
- Swage BACS13BX Flareless Sleeves with the Harrison Elastomer Swagers 5175, 5570, and 5720.
- Swage BACS13BX Flareless Sleeves with the 6633K01 Harrison Roller Swaging Kit.
- Preset BACS13AP Flareless Sleeves.
- Remove the CRYOLIVE sleeve/coupling nut protective cap assembly from the liquid nitrogen and slide the assembly on to the tube, allowing it to warm to room temperature.

(d) Assemble and tighten the flareless fittings which are part of the repair section (AMM 20-10-09/401).
(e) Measure all of the tube assembly length (L1) (see Fig. 806 and 809).
(f) To find the necessary cutout length (L2) as shown on Fig. 806 and 809, use the procedure given in Fig. 810.
(g) Remove the pressure from the systems where you will do the repairs.
(h) Cut out the damaged tube (L2). Trim the tube ends as shown in Fig. 804.
(i) When you make the installation, refer to the applicable section as follows:
1) To use the Harrison elastomer swager to install BACS13BX flareless sleeves, refer to "Swage the BACS13BX flareless sleeves with the Harrison elastomer swagers 5175, 5570 and 5720".
2) To use the 6633K01 Harrison roller swaging kit to install BACS13BX flareless sleeves, refer to "Swage the BACS13BX Flareless Sleeves with the 6633K01 Harrison Roller Swaging Kit".
3) To install BACS13AP flareless sleeves, refer to "Preset the BACS13AP Flareless Sleeves".
4) If you use H-couplings (BACC42W) for repair, refer to "Install the BACC42W H-coupling".
5) If you use Cryofit unions (3PO2111) for repair, refer to "Install the 3PO2111 or 3PHS111 Cryofit Coupling.

6) If you use Permaswage unions (D10283) for repair, refer to "Install the Permaswage Fittings".
7) To install Cryolive flareless sleeve assembly, refer to "Install the Cryolive Flareless Sleeve Assemblies".

NOTE: Use only the complete Cryolive flareless sleeve assembly, consisting of a Cryolive sleeve, coupling nut and plastic cap. The Cryolive flareless sleeve assembly, in Sizes 10, 12 and 16, requires use of a longer length coupling nut. The longer length coupling nuts are not interchangeable with standard BACN10- and MS21921 coupling nuts.

8) If you use Rynglok tube to tube unions for repair, refer to "Rynglok Union installation".

(j) Install the repair section and tighten the nuts (AMM 20-11-00/201).
(k) When you use a Cryofit Union or H-Coupling in the repair section, install it after you tighten the flareless fittings in their positions.
(l) When you use a Permaswage union in the repair section, you must make allowance for swage growth. Tighten the repair section in position after installation of the Permaswage union.
(m) When you replace a tube bend section, make sure you keep the minimum straight length specifications for all fittings (Fig. 812).
(n) When you use a CRYOLIVE flareless sleeve/coupling nut in conjunction with a permanent Cryofit, H-Coupling or Permaswage union, tighten the flareless coupling nut hand tight before installing the permanent fitting to minimize axial preload on the CRYOLIVE sleeve.

TASK 20-10-09-308-229

3. Swage the BACS13BX Flareless Sleeves with the Harrison Elastomer Swagers 5175, 5570 and 5720 (Fig. 813)

A. Equipment
(1) Harrison Portable Swagers - 5175 and 5720
Harrison Stationary Swager - 5570
(Sierracin-Harrison - 3020 Empire Ave. - Burbank, California 91504)
(2) "Tiplar" bore gauge or "Mueller" bore gage or equivalent
(3) Regulated air pressure (0 - 100 psi)

B. Consumable Materials
(1) D00324 Lubricant - Extreme Pressure, Anti-Scoring No. 3

C. Procedure

S 948-230

WARNING: POINT THE TUBE AWAY FROM PERSONS AND EQUIPMENT WHEN YOU SWAGE. DRAW-BOLTS CAN BREAK AND COME QUICKLY OUT OF THE TUBE. THE DRAW-BOLTS CAN HIT PERSONS OR EQUIPMENT AND CAUSE INJURY OR DAMAGE.

(1) Get the necessary tools as shown in the instruction manual supplied with the Harrison elastomer swager.

S 648-231

(2) Apply a light layer of antiscoring lubricant to the outer surfaces of the bushings and expanders of the drawbar assemblies. Make sure the tube and sleeve are clean and dry.

NOTE: Do not let the lubricant go into the grooves of the sleeve. Lubricant in the grooves will prevent correct swaging.

S 348-232

(3) Apply the specified swage pressure and hold the pressure for a minimum of two seconds. See Fig. 814 for specified pressure.

S 228-233

(4) Do a check of the groove depth with a Tiplar or Mueller bore gage. See Fig. 816 for groove dimensions.

S 228-234

(5) Do a check on the external dimensions of the swaged fitting. See Fig. 815.

S 228-235

(6) Make sure the tooling die marks on the tube O.D. do not have a height or depth larger than 10% of the tube wall specified thickness. Other permitted defects include marks or scratches on the outer tube which are less than 0.20 inch in length and 0.002 inch in depth.

S 218-236

(7) Make sure the seal areas of the sleeves and unions are not scratched or damaged during fabrication. Make sure each seal area keeps the usual finish specifications.

S 228-237

(8) Make sure the tool and die marks on the external skirt and shoulder areas of the sleeves and unions, are not more than 0.002 inch in height. Also, these marks must not touch the nut.

TASK 20-10-09-308-238

4. Swage the BACS13BX Flareless Sleeves with the 6633K01 Harrison Roller Swaging Kit

A. Equipment

(1) Harrison Roller Swage Tube Repair Kit - 6633K01 (Sierracin Harrison)

B. Procedure

S 948-239

(1) Get the necessary tools as listed in the operating instruction manual supplied with the Harrison Roller Swage Tube Repair Kit.

S 358-240

(2) Apply the specified torque to the expander mandrel (Fig. 817).

S 228-241

(3) After you swage, make sure the BACS13BX sleeve and tube agree with the specifications of Fig. 817.

NOTE: Do not trim the tube after you roller swage. If it is necessary, remove burrs with an approved deburring tool.

S 218-242

(4) Make sure the seal areas of the sleeves are not scratched or damaged during fabrication. Make sure each seal area keeps the 63 RHR (no annular tool marks) finish specifications of its standard.

S 228-243

(5) Make sure the die marks on the external skirt and shoulder areas of the sleeves are not more than 0.002 inch in height. Also, make sure the die marks to not touch the nut.

S 218-244

(6) Make sure the tube inner surfaces at the swage area do not have scratches or marks caused by defective rollers.

TASK 20-10-09-308-245

5. Preset the BACS13AP Flareless Sleeves

A. General

(1) We recommend you pressure preset and do not preset by hand. If you must preset by hand, we recommend you preset some samples first. Then you can preset the section to repair. On samples, cut away the sleeve to make sure the ring cut on the tube makes a circle around the tube circumference and has a depth of 0.002 inch.

B. Equipment
(1) Cherry Lockbolt Gun used with hand presetting tool - Model G87D is the preferred tool and Model G85D is optional (Textron Aerospace Fasteners, Cherry Div., 1224 East Warner Ave, Box 2157, Santa Ana, California 92707)
(2) Presetting tool used with Cherry Lockbolt gun - ST878D
(3) Hand Presetting tool and holding fixture - ST879A and ST879AF

C. Consumable Materials
(1) D00324 Lubricant - Extreme Pressure, Anti-Scoring No. 3

D. Procedure

S 358-246
(1) To do the pressure preset with the Cherry, Lockbolt Gun G85:
(a) Attach the thrust sleeve and die holder to the Cherry Lockbolt Gun.
(b) Install the mandrel and the preset die (see Fig. 818) in the Cherry Lockbolt Gun.
(c) Connect the air pressure line and use the correct pressure (Fig. 818). Do several cycles of the Cherry Lockbolt Gun and make sure the pressure is set correctly.
(d) Assemble the split-clamp die, the clamp nut, and the sleeve. Put the assembly into the die holder.
(e) Put the B-nut on the tube and make the tube end touch the bottom of the die holder.
(f) Start the Cherry Lockbolt Gun. Hold the tube in its position while the die installs the sleeve on the tube. Maintain the pressure while you preset the sleeve on the tube.
(g) Unclamp the nut. Remove the tube and die from the holder. Open the die to show the preset sleeve.

S 358-247
(2) To preset the sleeve by hand do the following:
(a) Use the correct mandrel for the preset tool ST879A (Fig. 819).
(b) Lubricate the threads, sleeve shoulder, and conical seal area of the fitting. Do not lubricate the tube.
(c) Assemble the sleeve on the tube. Insert the tube into the tool ST879A union. Tighten the nut as shown in Fig. 821.
(d) If the ST879A preset tool is not available, you can preset the sleeves with a carbon steel union and nut as shown in procedure A or B of Fig. 821.

S 228-248

(3) After you preset, make sure the BACS13AP sleeve and tube joint have the following properties (Fig. 820):

(a) Corrosion resistant steel tubing (MIL-T-6845):

Make sure the sleeves have a maximum of 0.005 inch longitudinal end play. Make sure the sleeves do not turn freely on the tube under finger pressure (without the use of force).

(b) Annealed corrosion resistant tubing (MIL-T-8504 and MIL-T-8808) and aluminum alloy tubing (MIL-T-7081 or WW-T-700/6):

NOTE: Sleeves can have 0.015 inch maximum longitudinal end play and turn on the tube under finger pressure.

(c) These conditions apply to all tubing materials:

1) Make sure the tube inner diameter does not decrease more than 0.005 inch (Fig. 820).
2) Make sure the sealing surface of the sleeve bow is free of scratches, marks, or other defects.
3) The tube end is permitted to flare if the flare diameter does not prevent entrance of the MS21902 or MS21924 union into the MS flareless fitting end.

TASK 20-10-09-408-249

6. Install the CRYOLIVE Flareless Sleeve Assembly (Fig. 832)

A. General

(1) The Cryolive flareless sleeve, shown in Figure 832 and Figure 802, is installed as part of an assembly consisting of the sleeve, a coupling nut and plastic cap that acts as an assembly tool and a protective cover for the tube end until the tube is installed in the airplane. The assembly is stored in liquid nitrogen until ready for use. During installation, the assenbly is removed from the liquid nitrogen, slipped on to the tube end and allowed to warm to room temperature. The sleeve shrink fits into position at the correct distance from the tube end as it warms to room temperature.

(2) The Cryolive flareless sleeve assembly can be used, as shown in Figure 833 and Figure 802, with 304 1/8 hard CRES, Ti-3Al-2.5V and 21-6-9 CRES tube and 6061-T6 aluminum tube. Titanium coupling nuts (part of Cryolive Assembly 921721T--) or CRES coupling nuts (part of Cryolive Assembly 921721J--) can be used with the Cryolive sleeve on 304 1/8 hard CRES, Ti-3Al-2.5V or 21-6-9 CRES tube. Aluminum coupling nuts (part of Cryolive Assembly 921721W--) and aluminum mating fittings must be used to avoid galvanic corrosion when the Cryolive flareless sleeve assembly is installed on 6061-T6 aluminum tube.

(3) The coupling nut used with the Cryolive flareless sleeve assembly in Sizes 10, 12 and 16 is longer than the standard MS21921/BACN10- coupling nut in the same sizes and is not interchangeable with the MS21921/BACN10- nuts.

B. Equipment
   (1) Cryolive Flareless Sleeve/Coupling Nut/Protective Cap Assemblies (Advanced Metal Components Incorporated, 1374 Willow Road, Menlo Park, California 94025)
   (2) Tongs (any suitable) - Available by P/N AT911067-01 from Advanced Metal Components, Incorporated.
   (3) Insulated Gloves - Available by P/N OE-Glove-Liner, S-M-L, from Advanced Metal Components, Incorporated or by P/N 264E from Damart Corporation, 1811 Woodbury Avenue, Portsmouth, New Hampshire 03805.
   (4) Work Box, Insulated - Available by P/N WB910825-01 from Advanced Metal Components, Incorporated.
   (5) Safety Glasses (commercially available).
   (6) Face Shield (commercially available).

C. Consumable Materials
   (1) G00262 Liquid Nitrogen
   (2) B01000 Solvent - General Cleaning of Metal (Series 80)

D. Procedure

S 868-364

WARNING: DO NOT USE CRYOLIVE FLARELESS SLEEVE ASSEMBLIES ON ANY OXYGEN LINES OR ON FLUID LINES INSIDE THE FIRE ZONES ON ENGINES OR APU'S. DAMAGE TO EQUIPMENT OR INJURY TO PERSONS CAN OCCUR. THE CRYOLIVE FLARELESS SLEEVE ASSEMBLY IS NOT QUALIFIED FOR THESE APPLICATIONS.

(1) Remove pressure from the system where you will do repairs and allow the hydraulic fluid to drain into a suitable container.

S 218-251

(2) Make sure that the tube end where you will install the Cryolive flareless sleeve assembly is round, smooth and free of scratches and burrs.

S 118-252

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

(3) Use solvent, Series 80 (AMM 20-30-80/201) to clean the tube in the area where you will install the Cryolive flareless sleeve.

S 948-253

WARNING: USE EXTREME CAUTION WHEN USING LIQUID NITROGEN. THE TEMPERATURE OF LIQUID NITROGEN IS 320 DEGREES BELOW ZERO. PROVIDE PROPER VENTILATION AS LIQUID NITROGEN VAPORS CAN DISPLACE OXYGEN IN CONFINED AREAS. USE SAFETY GLASSES, A FACE SHIELD, AND INSULATED GLOVES WHEN USING LIQUID NITROGEN. MISSUSE OF LQUID NITROGEN CAN CAUSE INJURY TO PERSONS.

(4) Put on insulated gloves, safety glasses, and face shield.

S 948-254

(5) Put liquid nitrogen BB-N-411, Type II, MIL-P-27401, Type II (-320 °F), into a small, insulated container.

S 948-255

WARNING: SLOWLY AND CAREFULLY SUBMERGE WARM ITEMS IN LIQUID NITROGEN TO PREVENT RAPID BOILING OFF AND SPLASHING. MISUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(6) Remove the Cryolive flareless sleeve/coupling nut/protective cap assembly from the main storage container and put it into the small container of liquid nitrogen. Make sure the assembly is fully covered by the liquid nitrogen.

S 948-256

(7) Move the Cryolive flareless sleeve/coupling nut/protective cap assembly in the liquid nitrogen (-320 °F) to the repair location.

S 948-257

(8) Put the tongs into the liquid nitrogen.

S 038-258

(9) Using cooled tongs, remove the Cryolive flareless sleeve assembly from the liquid nitrogen and allow the excess liquid nitrogen to run off.

S 438-259

WARNING: DO NOT PUT GLOVED HAND IN LIQUID NITROGEN. THE LIQUID NITROGEN CAN "WICK" INTO THE GLOVE MATERIAL AND CAUSE INJURY TO YOUR HAND.

(10) Hold the Cryolive flareless sleeve assembly with the gloved hand and immediately slide it on to the tube end until the assembly bottoms on the tube. Ensure that the tube end is visible in the slotted end of the protective cap.

S 438-260

CAUTION: THE TUBE END MUST BE FULLY BOTTOMED AGAINST THE INSIDE END OF THE CAP SO THAT THE SLEEVE IS CORRECTLY POSITIONED ON THE TUBE END. IF THE TUBE END IS NOT BOTTOMED AGAINST THE INSIDE END OF THE CAP, REMOVE THE PLASTIC CAP AND MEASURE THE TUBE PROTRUSION PER THE "P" DIMENSION REQUIREMENT OF FIGURE 811. IF THE "P" DIMENSION IS INCORRECT, THE INSTALLATION MUST BE REPLACED.

(11) Allow the Cryolive flareless sleeve to warm and shrink on to the tube.

S 438-261

(12) When ready to complete final joining/torquing of the coupling nut/Cryolive flareless sleeve to the mating fitting, remove and discard the plastic cap by unscrewing the coupling nut (Fig. 833).

NOTE: The plastic caps are manufactured from polycarbonate material and may be recycled.

TASK 20-10-09-408-262

7. Install the BACC42W H-Coupling (Fig. 822)

A. General

(1) The BACC42W H-coupling has a union, coupling, slide, and nut. You can use the H-coupling on fuel and hydraulic high pressure (3000 psi) lines of Ti-3AL-2.5V, CRES 21-6-9, and CRES 304 1/8 hard tubing. This repair is also approved for line repair of CRES 304 annealed and 6061-T6 aluminum lines in 3000 psi or lower pressure applications. You can use this repair on tubing that is installed and in use.

(2) You can repair defects that have a maximum width of 3/8 inch. You must make splices on larger defects. The minimum workable splice section with two H-couplings and a length of tube is 4.5 inches (Fig. 809).

B. Equipment

(1) Tube Coupling Assembly - BACC42W( ), (Sierracin/Harrison, 3020 Empire Way, Burbank, California)

NOTE: The number after the W in the part number gives the size of the coupling in sixteenths. For example, BACC42W6 fits 3/8-inch tube size. The BACC42W is superceded by BACC42W-T which is used on Ti-3AL-2.5V and all other hydraulic tubing. You can use BACC42W on all hydraulic tubes except the Ti-3AL-2.5V.

(2) Consumable Materials

(a) G00270 Masking Tape

(b) B01000 Solvent - General Cleaning of Metal (Series 80)

C. Procedure

S 868-365

WARNING: DO NOT USE BACC42W H-COUPLINGS ON ANY OXYGEN LINES OR ON FLUID LINES IN THE FIRE ZONES OF THE ENGINES OR APU'S. DAMAGE TO EQUIPMENT OR INJURY TO PERSONS CAN OCCUR.

CAUTION: DO NOT TIGHTEN THE COUPLING ASSEMBLY BY HAND AFTER YOU REMOVE IT FROM THE SHIPPING CONTAINER OR BEFORE YOU INSTALL IT ON THE TUBE. THE COUPLING ASSEMBLY HAS NO MORE THAN ONE THREAD ENGAGED. YOU CAN COMPRESS THE UNION AND MAKE THE COUPLING ASSEMBLY DIFFICULT TO PUT IN POSITION.

(1) Remove pressure from the systems where you will do repairs.

S 118-264

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY HANDLING DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FORPROPER HANDLING PROCEDURES.

(2) Use solvent, Series 80 (AMM 20-30-80/201) to clean the tube in the area where you will install the H-coupling.

S 358-265

(3) Cut the tube.

S 118-266

(4) Chamfer and remove burrs from the ID and OD edges. Clean the edges with solvent, Series 80 (AMM 20-30-80/201).

S 948-267

(5) Install tape on the nut side of the clearance with a minimum of 0.56 inch from the tube end and a maximum of 0.675 inch from the center of the clearance (Fig. 822).

S 948-268

(6) Use the same measurements to make a mark (index line) on the coupling side of the tube.

S 948-269

(7) Find and make a mark (marking dots) on the nut and coupling side of the tube (Fig. 822).

NOTE: These marks will be used for the last inspection check (dimension "C").

S 428-270
(8) Install the coupling assembly over the coupling side of the tube.

S 218-271
(9) Make sure the large radius and the large diameter end of the sleeve are toward the center of the union.

S 438-272
(10) Install the nut and sleeve over the tape on the nut side of the tube.

S 218-273
(11) Make sure the sleeve large bore is toward the clearence.

S 828-274
(12) Align the tubes and move the union until it touches the tape on the nut side on the tube.

S 218-275
(13) Make sure the union meets or covers the index line on the coupling side of the tube.

S 948-276
(14) Install tape on the coupling side of the tube, with the tape edge even with the end of the union.

S 438-277
(15) Push the sleeve and coupling body on the ends of the union.

NOTE: Make sure the tape does not move and the coupling body does not turn.

S 838-278
(16) Engage the threads of the nut with the coupling body and tighten the nut handtight.

S 438-279
(17) Hold the coupling body with a wrench and tighten the coupling assembly nut to the stop.

S 218-280
(18) Examine the completed repair to make sure you can see the two marking dots (Fig. 822). If you cannot see the two dots, this shows that the sleeve and coupling are not fully seated against the center land of the union.

S 218-281
(19) Make sure dimension "C" did not increase.

S 208-282

(20) Do an inspection as follows:
(a) Remove the nut.
(b) Make sure the slide and coupling are no more than 0.015 inch from the union shoulder.
(c) Make sure the union touches the tape.
(d) If the clearance between the slide or coupling and the union is more than 0.015 inch, install the nut and tighten it until you get the necessary clearance (Fig. 822).
(e) Install the nut again and tighten the nut to the necessary torque value.
(f) If the union does not touch the tape, you must remove the coupling and a sufficient tube length. Install a new repair section.

TASK 20-10-09-408-283

8. Install the 3P02111 or 3PHS111 coupling (Fig./823)

A. General
(1) The Cryofit coupling is a fitting which you can use to repair Ti-3AL-2.5V tubing as shown in Fig. 802. To install the fitting in a straight section, shrink fit it in its position.

B. Equipment
(1) Cryofit repair kit - FRK3P02111-001, Aerofit Products, Inc.
6460 Dale Street
Buena Park, California 90621
(2) Safety Glasses (commercially available)
(3) Face Shield (commercially available)

C. Consumable Materials
(1) G00262 Liquid nitrogen
(2) B01000 Solvent - General Cleaning of Metal (Series 80)
(3) A00558 Loctite 290
(4) G00270 Masking Tape

D. Procedure

S 868-366

WARNING: DO NOT USE CRYOFIT COUPLINGS ON ANY OXYGEN LINES OR ON FLUID LINES INSIDE THE FIRE ZONES OF ENGINES OR APU'S. DAMAGE TO EQUIPMENT OR INJURY TO PERSONS CAN OCCUR. THE CRYOFIT COUPLING IS NOT QUALIFIED FOR THESE APPLICATIONS.

(1) Remove pressure from the systems where you will do repairs.

S 948-369

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

(2) Use solvent, Series 80 (AMM 20-30-80/201) to clean the tube in the area where you will install the Cryofit coupling.

S 438-286

(3) Use tape to make a mark on the tube to make sure you put the Cryofit coupling over the center of the tube repair.

S 328-287

(4) Cut the tube.

S 118-288

(5) Chamfer and remove burrs from the ID and OD edges. Clean the edges with solvent (Series 80) (AMM 20-30-80/201).

S 948-289

WARNING: USE EXTREME CARE WHEN USING LIQUID NITROGEN. THE TEMPERATURE OF LIQUID NITROGEN IS 320 DEGREES BELOW ZERO. PROVIDE PROPER VENTILATION AS LIQUID NITROGEN VAPORS CAN DISPLACE OXYGEN IN CONFINED AREAS. USE SAFETY GLASSES, A FACE SHIELD, AND INSULATED GLOVES WHEN USING LIQUID NITROGEN. MISUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(6) Put on the insulated gloves, the safety glasses, and the face shield.

S 948-290

(7) Put liquid nitrogen (-320°F) into a small, insulated container.

S 948-291

WARNING: SLOWLY AND CAREFULLY SUBMERGE WARM ITEMS IN LIQUID NITROGEN TO PREVENT RAPID BOILING OFF AND SPLASHING. MISSUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS.

(8) Remove the Cryofit coupling from the main storage container and put it into the small container of liquid nitrogen. Make sure the coupling is fully covered by the liquid nitrogen.

S 948-292

(9) Move the Cryofit coupling in the liquid nitrogen (-320°F) to the repair location.

S 948-293
(10) Put the tongs and the tube chiller into the small container of liquid nitrogen.

S 438-294
(11) Slip the test coupling (from the installation kit) over the tube ends to ensure that tubes are round and free of burrs. The test coupling should slide freely.

S 438-296
(12) Remove the test coupling and place the marking gauge over one of the tube ends. Using the marking pen, color in the rectangular slot in the gauge to provide an installation mark on the tube. Follow the same procedure to mark the remaining tube end.

S 438-297
(13) Place an installation stop ("O" ring) or snap on coupling in the middle of the mark on one of the tube ends. Check the location by positioning the test coupling so that it is butted against the stop. Both tube ends should be visible in the window and the test coupling should cover approximately half the installation mark on each tube. Adjust the tubes and installation stop as necessary. Remove the test coupling.

S 438-298
(14) Ensure that the tube ends, within half the coupling length of the end, are free of scratches. If a fitting must be installed over a tube end containing a scratch, apply a thin layer (one to two drops) of Loctite 290 around the tube circumference in the area under the serrations. Be careful not to let the Loctite into the tube. No Loctite application is required for tube ends without scratches.

S 438-300
(15) Place the cooled tube chiller over the tubes to be joined. Remove the chiller after 20 to 30 seconds.

NOTE: This step may be omitted. However, placing the Cryofit coupling in contact with a tube which has not been pre-chilled with liquid nitrogen may initiate premature warming and shrinkage of the coupling.

S 438-301
(16) Install the coupling by following the steps below in rapid sequence:
(a) Remove the tube chiller from the tubes.
(b) Using the cooled tongs, remove the Cryofit installation package from the liquid nitrogen and grasp the package between thumb and forefinger.
(c) Deflect the tube without the installation stop to allow the coupling to be slipped over the tube end.

(d) Slip the coupling on to the tube, realign the tubes and slide the coupling against the installation stop.
(e) Ensure that the Cryofit coupling is against the installation stop and that the fitting is in correct position relative to the installation marks.
(f) Allow the coupling to warm and shrink on to the tube. Remove the Cryofit installation package and the installation stop.
(g) Verify that both ends of the coupling lie within the installation marks on both tubes.

NOTE: If one or both ends of the fitting do not cover a portion of the installation mark, the installation is incorrect and must be replaced.

TASK 20-10-09-408-302

9. Install the Permaswage Fittings

A. General

(1) To do the Permaswage repair procedure, use the DLT series swaging tool and the BACU24BS or D10282 in-line tube unions (sizes 04, 06, 08, 10, 12, and 16). You can use CRES Permaswage fittings, as shown in Fig. 824 and Fig. 802, with 304-1/8 hard CRES tube to repair Ti-3AL-2.5V and 21-6-9 CRES. Repair 6061T6 aluminum tubing with aluminum Permaswage fittings with D suffix in the basic part number.
(2) When you do a repair, remove the part of the tube with the defect. Put in a tube splice and install the splice with two fittings. Fittings and tubing material sizes are shown in Fig. 824.
(3) When you remove tubes, make sure the tubes and port fittings have tags that identify the correct connection locations.
(4) The splice must be shorter than the removed tube section. At a maximum length, make the splice shorter than the tube section by four times the growth value shown in Fig. 827 (four fittings). This permits an increase in length as a result of swaging. As a minimum length, make the splice longer than 0.300 inch less than the cut-out. This permits tube gaps (not more than 0.150 inch) as shown in Fig. 827.

NOTE: Include the length growth caused by swaging when you work with short tube sections with small flexibility. Short tube sections or tube repairs between rigidly installed fittings can buckle.

B. Equipment

(1) DMC Permaswage Lightweight series (DLT Series) - Tool numbers are listed in Fig. 825. You can get tool kits in different size combinations. Contact DMC for tool kit part numbers. Make sure that the DLT Series tooling has been inspected to the following DMC Tooling Control Documents:

NOTE: One pump is required to actuate the power units, as shown in Fig 827. (Designed Metal Connections, P.O. Box 61188, 14800 S. Figueroa St., Los Angeles, CA 90061)

(a) MCP-016 - Inspection Criteria of DMC, DLT Series, Swage Head Assembly - Standard Permaswage, 3,000 psi Application

(b) SOPG-01-05 Instructional Manual for 3,000 PSI Systems

(c) DMC-1320 DLT Tools Prevention Maintenance

C. Consumable Materials

(1) C00064 Alodine - 1200 or 1200S

(2) C00259 Primer - BMS 10-11, Type 1

(3) B00010 Solvent - General Cleaning of Metal (Series 80)

(4) B00138 Abrasive cloth - 240-grit, P-C-451

D. Prepare Tube for Installation

S 948-303

WARNING: DO NOT USE PERMASWAGE FITTINGS ON ANY OXYGEN LINES OR ON FLUID LINES INSIDE THE FIRE ZONES OF ENGINES OR APU'S. DAMAGE TO EQUIPEMENT OR INJURY TO PERSONS CAN OCCUR.

WARNING: DO NOT USE PERMASWAGE FITTINGS FOR REPAIR OF TUBING IN THE FUEL SYSTEM (SUCH AS FUEL PRESSURE SENSING LINES), ON PNEUMATIC DUCTS, FIRE EXTINGUISHER LINES, POTABLE WATER LINES OR WASTE WATER DRAIN LINES, OR FOR REPAIR OF ELECTRICAL CONDUITS. BOEING DOES NOT APPROVE PERMASWAGE FITTINGS FOR THESE APPLICATIONS.

CAUTION: SWAGE FITTINGS ARE NOT PRESENTLY APPROVED FOR REPAIRS ON POTABLE WATER SYSTEM PIPING. CAVITIES EXIST IN SWAGE FITTING CONNECTIONS THAT WILL ENTRAP CONTAMINANTS.

(1) Use the tools shown in Fig. 825.

S 948-304

(2) Cut out the damaged section of the tube:
   (a) Make sure the section you cut out of the tube is a straight section with a minimum straight length as shown in Fig. 826. This will make sure the fitting and swage tool will fit.
   (b) Use one Permaswage fitting for the repair if the damaged section is no more than 0.150 inch long. In this case, the cut can be through the center of the damaged section.
   (c) If the damage is too near to a bend (less than 1/2 "A", Fig. 826) or longer than 0.150 inch, use a tube splice and two fittings to make the repair.

S 948-305

(3) For tube cutouts with a bend, use the cutout tube section as a template to mark and cut the new tube segment.

NOTE: The maximum gap between the tube ends is approximately 0.150 inch for the union installation.

S 118-306

(4) Clean the tube in the swage area:
   (a) Clean the not painted tube sections that you will repair with solvent, Series 80 (AMM 20-30-80/201).
   (b) Make sure the sections are free of dirt, grease, and other unwanted material for a distance equal to the values shown in Fig. 826.
   (c) Remove paint and anodize from the tubes in an area equal to the values shown in Fig. 826. Use the methods shown in Fig. 828.
   (d) Make sure the cleaned surfaces are smooth, uniform, bright, and free of unwanted materials.
   (e) Use a brush to apply a layer of Alodine 1200 to the open surfaces of aluminum tubes.

S 948-307

(5) Remove burrs from the tube ends:

(a) To remove burrs from the inner bore of the tube ends, use DMC plug-type deburring tools or equivalent. Refer to Fig. 804 for the correct deburring procedure.

NOTE: You must remove burrs from the tube inner diameter each time you cut the tube. Make sure the tube shavings do not get into the system.

Do not release the spring pressure of the deburring tool while you pull the tool from the tube.

(b) It is not usually necessary to remove burrs from the tube outer diameter. If it is necessary, use 240-grit abrasive cloth. Use a clean cloth to remove particles.

S 948-308

(6) Use one of these steps to apply witness marks:

(a) Use a felt pen or equivalent to apply witness marks as shown in Fig. 829. Use DMC tools D12580-1, -2, -3 only or equivalent.

(b) Make marks directly on the tube to show the minimum insertion depths as shown in Fig. 829. Swage fittings to the marks.

S 378-309

(7) Apply paint to bare areas. For example, tool marks and areas where you removed paint (fittings and painted tubes).

S 378-310

(8) Apply alodine 1200 to open areas of aluminum and BMS 10-11 primer to all other tubes and fittings.

E. Procedure

S 868-311

(1) Remove pressure from the systems where you will do the repair.

S 948-312

(2) Use a union and a tube as shown in Fig. 824.

NOTE: Keep the Permaswage fittings in their container until you are ready to install them.

S 358-313

(3) Make sure the tube is sufficiently long to do the repair (Fig. 826).

S 118-314
(4) Clean the tube as shown in Fig. 828, then cut the tube.

NOTE: Seal the tube ends with a cap if you do not join the tubing immediately.

S 218-315
(5) Examine the unions for silicone seals (see NOTES, Fig. 824).

S 428-316
(6) Move the union over the tube ends. Center the union on the witness marks or put it in position at the correct insertion depth.

S 358-317

WARNING: MAKE SURE YOU MAKE NO PUMP ADJUSTMENT THAT CAN CAUSE THE SWAGE TOOL HYDRAULIC PRESSURE TO BE MORE THAN MANUFACTURE RECOMMENDED. DLT SERIES TOOLS ARE 1000 PSI +/-250 PSI MAXIMUM. IF PRESSURE IS GREATER THAN ABOVE MAXIMUM/MINIMUM VALUES INJURY OR DAMAGE CAN OCCUR.

(7) Swage the union to the tube as shown in the manufacturer's recommended procedures.

S 358-318
(8) Swage each end three times.

NOTE: After the initial swage, move the swage head between 30 and 45 degrees from the previous swage position before you swage again.

S 648-385
(9) Lubricate the head and lower die blocks regularly.

S 218-320
(10) Examine the end plates for loose retaining screws.

S 768-322
(11) In the fuel tanks and vapor areas, do a check of the electrical resistance specifications across each tube/fitting interface (AMM 20-10-09/801).

S 768-323
(12) Make resistance measurements for all Permaswage repair installations in wing tanks and fuel vapor areas (AMM 20-10-09/801).

S 798-324

(13) For Permaswage fitting repairs in general areas, do a leak test as follows:
(a) Pressurize the system for a minimum of 5 minutes.
(b) Rub the tube and fittings with a clean white cloth to find leakage.

S 218-325

(14) Examine the tube-to-fitting interface for hydraulic leaks you can see.

NOTE: When dimensional or leakage specifications are not met, you can swage again. Then do a leak test. You must replace fittings you cannot seal.

S 378-326

(15) Apply BMS 10-11 primer to the Alodine areas of the finished tube joint where the bare metal is open.

TASK 20-10-09-408-327

10. Rynglok Union Installation (Fig. 834)

A. General

(1) Rynglok tube to tube fittings are not to be used on fluid lines inside airplane fuel tanks, in engine areas, or on lines used in oxygen systems. The rynglok tube to tube fitting is not qualified for these applications.

(2) The Rynglok in-line tube unions (Fig. 834), sizes 04, 06, 08, 10, 12, and 16 are used with 304 1/8 hard CRES to repair Ti-3AL-2.5 and 21-6-9 CRES. The same unionsplus a size 20 are used with 6061-T6 aluminum tube to repair 6061-T6 aluminum tu be, provided the bare areas of the tubing are painted after swaging to limit the possibility of galvanic corrosion ocurring.

(3) When you do a repair, remove the part of the tube with the damage. If the area of the tube damage is less than the value listed in figure 805, use one Rynglok union for repair.

(4) If the tube damage is longer than the value listed in figure 805, put in a tube splice and install the splice with two fittings. The splice must be equal to or slightly shorter than the removed tube section. The minimum length of tubing to be removed is shown in figure 836. Fittings and tubing material sizes are shown in figure 835.

B. Equipment

(1) Swager - Hydraulic Fitting RTSK8-02-006 (Aeroquip Corporation, Jackson Plant, 300 S. East Ave., Jackson, MI 49203-1972)

C. Consumables

(1) B00068 Alcohol, ethyl (denatured) - MIL-E-51454, Type II
(2) C00064 Coating, Surface Treatment (Alodine) - MIL-C-81706, MIL-C-5541, Type II MIL-C-5541, Type II
(3) C00259 Primer, chemical and solvent resistant finish, epoxy resin primer - BMS10-11, Type I

D. Procedure

S 948-328

(1) Remove pressure from the system where you will do the repair.

S 358-329

(2) Use the tools (Fig. 837) contained in swager, RTSK8-02-006.

S 358-375

WARNING: DO NOT USE RYNGLOK FITTINGS ON ANY OXYGEN LINES. DAMAGE TO EQUIPMENT OR INJURY TO PERSONS CAN OCCUR.

WARNING: DO NOT USE RYNGLOK FITTINGS FOR REPAIR OF TUBING IN THE FUEL SYSTEM (SUCH AS FUEL PRESSURE SENSING LINES) OR FUEL TANKS, ON PNEUMATIC DUCTS, FIRE EXTINGUISHER LINES, POTABLE WATER LINES OR WASTE WATER DRAIN LINES OR FOR REPAIR OF ELECTRICAL CONDUITS. BOEING DOES NOT APPROVE RYNGLOK FITTING FOR THESE APPLICATIONS.

(3) Cut out the damaged section of the tube using a chipless tube cutter (Fig. 804) and the following:
(a) Make sure the section you cut out of the tube is a straight section with a minimum straight length as shown in (Fig. 812). This will make sure the fitting and the swage tool will fit.
(b) Use one Rynglok union for the repair if the damaged section is not longer than the dimensions listed in (Fig. 805). If the damage is within the dimensions, the cut can be through the center of the damaged section.

S 158-331

(4) Remove the paint and the anodize from the tubes to the dimensions shown in (Fig. 812).

S 118-332
(5) Clean the non-painted tube sections that you will repair with alcohol, MIL-E-51454, Type II.

S 398-333
(6) Use a brush to apply coating, MIL-C-81706, MIL-C-5541, Type II to the cut ends of the tube.

S 628-334
(7) Seal the tube ends with a cap if you do not join the tubing immediately.

S 948-335
(8) Apply positioning and inspection marks on the tube to be repaired using the appropriate gage from the swager, RTSK8-02-006 and a Sanford Sharpie (or equivalent) felt tip pen with a fine or extra fine point (Fig. 837,838). Bottom the gage on the cut edge of the tube before making the marks.

S 948-336
(9) Move the Rynglok union over the tube ends.

S 948-337
(10) Put the edge of the fitting ring over the center of the positioning mark (nominaltube insertion) as shown in (Fig. 839). The edge of the fitting ring may be anywhere along the length of the positioning mark but the nominal position is recommended.

S 368-338

WARNING: MAKE SURE YOU MAKE NO PUMP ADJUSTMENT THAT CAN CAUSE THE SWAGE TOOL HYDRAULIC PRESSURE TO BE OUTSIDE THE MANUFACTURER'S RECOMMENDATIONS. THE AEROQUIP RECOMMENDATION FOR THE TOOL IS 8000 PSI TO 8500 PSI MAXIMUM. IF PRESSURE IS GREATER THAN THIS VALUE, INJURY AND DAMAGE CAN OCCUR.

(11) Swage the union to the tube as shown in the Aeroquip Installation Guide supplied with the swager, RTSK8-02-006.

NOTE: The fitting must always be fully installed in the tool to maximize tool life.

S 368-339
(12) Examine the finished installation for correct ring advancement using the appropriate size inspection gage from the swager, RTSK8-02-006. The inspection gage should fit over the ring area as shown in (Fig. 841) so that the ring is flush with the center portion of the union.

S 948-340

(13) Pressurize the hydraulic system to operating pressure for the system which was repaired.

S 368-341

(14) Examine the tube-to-union interface for hydraulic leakage. If leakage is found, the union must be cut out and a tube repair by section replacement must be done.

S 378-342

(15) Apply coating, MIL-C-81706, MIL-C-5541, Type II to bare areas of the aluminum tubing where paint was removed, followed by a coat of primer, BMS10-11, Type I.

TASK 20-10-09-358-343

11. Repair Hydraulic Tubing With Flexible Hoses

A. General

(1) The Boeing Company recommends that the operator do these procedures:

(a) Make a record of the flexible hoses that you install as temporary repairs for rigid lines.

(b) Make a schedule for the regular inspection of flexible hose installations. Make sure the installation stays an airworthy repair until the system is put back to its initial configuration.

(c) Make a procedure to make sure the flexible hoses that are installed as temporary repairs are replaced as soon as possible. You must replace the hoses no later than the scheduled time check approved by the assigned principal maintenance inspector.

(2) You can use many different repair techniques. The Boeing Company cannot know about or control these repair techniques. It is your responsibility to decide if this procedure is applicable to your repair techniques.

(3) This procedure is not acceptable for engine hydraulic tube repair or for the replacement of rigid or flexible coiled tubing. Engine hydraulic tubes are those tubes below or forward of the firewall, and within the engine cowls. Consult Boeing when considering a repair to any Engine hydraulic or coiled tube.

B. References

(1) AMM 29-11-00/201, Main Hydraulic Systems - Maintenance Practices

C. Consumable Materials

(1) Hydraulic Tubing Repair Kit - P/N 65-92528-1 or equivalent

D. Install the Flexible Hose

S 228-344

(1) Use a flexible hose that has the specifications that follow:

(a) Make sure the flexible hose is specified for at least the same operating pressure and fluid type as the system in which you will install the flexible hose.

(b) Make sure the new flexible hose has a minimum of the same inner diameter as the damaged tube.

(c) Make sure the new flexible hose is sufficiently long to replace the damaged tube or the damaged section of the tube.

(d) Make sure the new flexible hose has sufficient slack, flex, twisting, bending, clearance, and support specifications as shown below and on Fig. 831.

1) Slack - Do not install the hose assemblies in a way that will cause a mechanical load on the hose. Hoses will change length from +2 to -4 percent when pressurized. Supply sufficient slack or bend to make the allowance for a change in length and length tolerances.

2) Flex - When hose assemblies will have much vibration or flexing, make sure there is sufficient slack between the rigid fittings. Install the hose so flexing does not occur at the end fittings. The hose must stay straight for at least two hose diameters from the end fittings. Do not use clamp locations that will restrict or prevent the hose from flexing.

3) Twisting - Make sure you install the hoses without twists to prevent loose nuts and possible rupture of the hose. You can use swivel connections at one or two ends to release the twist stresses.

4) Bending - To prevent sharp bends in the hose assembly, use elbow fittings, hose with elbow type end fittings, or the applicable bend radii, as shown in Table 1.

TABLE 1

AS 115 HOSE	HOSE INNER DIAMETER (INCH)	MINIMUM HOSE BEND RADIUS MEASURED AT INNER BEND (INCH)
–04	1/4	1.50
–06	3/8	2.50
–08	1/2	2.88
–10	5/8	3.25
–12	3/4	4.00

5) Clearance - Make sure the hose assembly is clear of all other lines, equipment, and adjacent structure under all operating conditions. The hoses must have the minimum clearance specifications shown in Table 2.

TABLE 2

HOSE CLEARANCE TO	MINIMUM CLEARANCE (INCH)
CONTROL CABLES AND LINKAGES	1.0 *[1]
CABLE AT PULLEYS	0.5
CABLE AT MID-SPAN	2.0
ELECTRICAL WIRING	0.5
HYDRAULIC TUBES OR HOSES	0.2

*[1] Measured at a relative position where the hose is closest to the cable or linkage.

6) Support - Make sure the hose assembly has supports that do not cause deflection of rigid lines because of the relative motion that can occur. Use sufficient clamps to follow the contour of the structure to prevent hose abrasive wear, kinking, and entanglement during flexing. At a minimum, put clamps at locations where the tube clamps were.

Make sure the hose is not rigidly supported by tight, rigid clamps around its outer diameter. If a hose between rigid connections must move longitudinally, clamps must be of a type that will not cause wear on the hose casing. Make sure the connections have supports at the tube, not at the hose.

S 868-345

(2) Remove pressure from the hydraulic system where you will do the repair (AMM 29-11-00/201).

S 968-346

(3) If you can replace all of the damaged tube with a flexible hose, do these steps:
(a) Remove the damaged tube.
(b) If necessary, prepare the ends of the tubes to which you will install the flexible hose. Use the applicable fittings as shown in the Tubing Repair paragraph.

S 968-347

(4) If the damaged tube is too long to replace by a flexible hose, do the steps that follow:
   (a) Cut out the damaged tube section to accept the flexible hose.
   (b) Prepare the ends of the cut tube with the applicable fittings as told in the Tubing Repair paragraph.

S 428-348

(5) Install the flexible hose (AMM 20-10-10/401).

S 868-349

(6) Supply the usual operating pressure to the repaired tube.

S 218-350

(7) Examine the hose and connections for leaks.

S 228-351

(8) Make sure the repair agrees with all specifications for slack, flex, twisting, bending, clearance, and support.

TASK 20-10-09-358-371

12. Repair 6061-T4/T6 Aluminum Tubing (Hydraulic or Pitot-Static Tubing)

A. General

WARNING: DO NOT USE THIS PROCEDURE ON OXYGEN TUBING. GREASE, DIRT, OR OTHER FLAMMABLE MATERIALS IN THE OXYGEN TUBING CAN CAUSE A FIRE OR EXPLOSION.

(1) The aluminum tubing in the pitot-static system is 6061-T6 aluminum. The hydraulic system contains both 6061-T4 and T6 aluminum tubes.
(2) This is a repair method that applies to 6061-T4/T6 aluminum tubes in Sizes 16 (1 inch) and 20 (1-1/4 inch). 6061-T6 material may be used as alternate material for repair of 6061-T4 aluminum tubes but 6061-T4 aluminum tube material may NOT be used to repair 6061-T6 aluminum tubes.
(3) Repair is accomplished using only the BACS13BX sleeve, the elastomer swaging process and other applicable methods specified in this MM for flareless tube repairs. No tube-to-tube fitting repairs are approved for 6061-T4/T6 aluminum tube.

(4) Refer to figure 803 for permitted tube damage limits.

B. Repair 6061-T4/T6 Aluminum Tubing

S 308-373

(1) Do the repair:

(a) Decide if a tube splice is necessary or if the damage is small enough to repair by installing a flareless MS21902 union between two BACS13BX sleeves.

(b) Refer to figure 805 to find the necessary tube cutout length when you use a single flareless MS21902 union to replace a damaged tube area.

(c) To use assembled tube ends or a center section to do a repair, find the cutout length and install as follows:

1) Make an estimate of the total length (L1) of the repair section necessary to replace the damaged tube (Figs. 806,809).

2) Cut and trim the repair tube as follows: (Fig. 804)

a) Use the correct size ratchet chipless cutter.

b) Turn the cutter drive screw counter clockwise to retract the cutter wheel.

c) Put the cutter over the tube.

d) Turn the screw clockwise until the cutter touches the tube at the necessary cut location.

e) Turn the cutter screw 1/8 to 1/4 turn and rotate the cutter until the cutter is easy to rotate. The tube should now be cut.

f) Remove the tool.

g) To deburr the tube, use the correct stem subassembly and deburring tool. To assemble the tool refer to (Fig. 804).

h) Push down on the plunger and install the tool into the end of the tube.

i) Release the plunger. Let the plug fill the inside of the tube.

j) Rotate the deburring tool until the inside burr is removed.

k) Remove the tool with the plug expanded. The expanded plug should remove particles from the inside of the tube.

NOTE: Make sure you do not drop metal particles in area of the repair.

3) Swage the necessary flareless BACS13BX sleeves to the repair tube using the applicable section: Swage BACS13BX Flareless Sleeves with the Harrison Elastomer Swagers 5175, 5570, 5720.

4) Assemble and tighten the flareless fittings which are part of the repair section (AMM 20-10-09) Removal/Installation.

5) Measure all of the tube assembly length with BACS13BX sleeves (L1) (Figs. 806, 809).

6) To find the necessary cutout length (L2) as shown in (Figs. 806, 809), use the procedure given in (Fig. 810) for BACS13BX sleeves and Harrison Portable Swagers with MS21902 unions.
7) Remove the pressure from the systems where you will do the repairs.
8) Cut out the damaged tube (L2). Trim the tube ends as show in (Fig. 804).
9) When you make the installation, refer to the section: "Swage the BACS13BX Flareless Sleeves with the Harrison Elastomer Swagers 5175, 5570, 5720".
10) Install the repair section and tighten the nuts (AMM 20-11-00/201).

TASK 20-10-09-208-352

13. Aluminum Fuel Tubes - Temporary Weld Repair Method

A. General
(1) This is a temporary repair method approved for 6061 and 5052 aluminum fuel system tubing, and is applicable only to tubes with wear-through damage, cracks, or punctures.
(2) Repair is accomplished with tubing removed from airplane.

B. Consumable Materials
(1) B01000 Solvent, Series 80
(2) B01008 Solvent, Series 88

C. Aluminum Fuel Tube Temporary Repair

S 018-368

CAUTION: REPLACE THE TEMPORARILY REPAIRED TUBE WITH A NEW SECTION OF TUBE WITHIN A MAXIMUM OF 250 FLIGHT HOURS. IF YOU DO NOT REPLACE THE TUBE, DAMAGE COULD OCCUR.

(1) Remove aluminum fuel tube to be repaired by referring to applicable maintenance manual removal and installation procedure.

S 118-354

CAUTION: FULLY CLEAN THE TUBING. IF YOU DO NOT CLEAN THE TUBING, THE WELD CAN GET CONTAMINATED AND THE WELD QUALITY DECREASES.

(2) Completely clean the inner and outer surfaces of all the tube section with solvent, Series 80 (AMM 20-30-80/201).

S 358-355

(3) If tubing is cracked, drill 3/32-inch stop holes at each end of crack.

S 128-356
(4) Clean tubing use wire brush to descale and remove all protective coatings and oxides from area to be welded.

NOTE: Wire brushes used for descaling must have bristles of austenitic corrosion-resistant steel or nickel-silver.

S 118-357
(5) Rub or rinse the tubing with solvent, Series 88 (AMM 20-30-88/201) to remove all the residue.

S 318-358

CAUTION: MAKE SURE THERE IS NOT TOO MUCH PRESSURE IN THE TUBING DURING THE WELDING. A HIGH PRESSURE CAN CAUSE A BAD WELD BEAD CONFIGURATION.

(6) Fusion weld the damaged area by a gas tungsten arc process per BAC 5975, Class A, using 4043 filler rod.

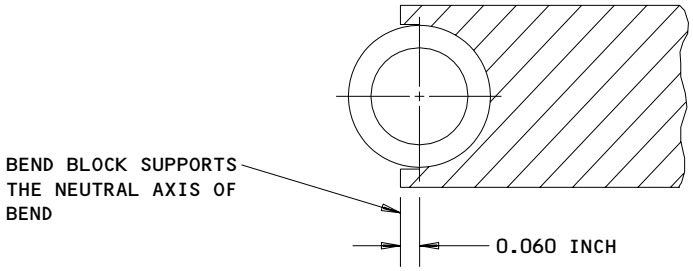
S 238-362
(7) Dye Penetrant Check welded area.

S 118-363
(8) Rinse with solvent, Series 88 (AMM 20-30-88/201).

S 798-359
(9) Hydrostatically test repaired tube to 240 psig per BAC5001-2. There shall be no leakage.

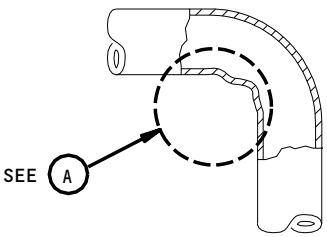
S 378-360
(10) Finish repaired area with appropriate protective coatings as required to meet original tube finish requirements.

S 438-361
(11) Install the repaired fuel tube per applicable maintenance manual procedure.

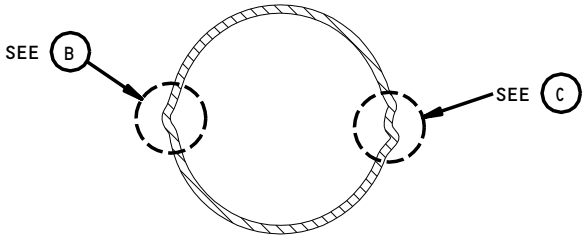


NOTE: IF THE OVALITY OF ANY PART OF THE BEND IS MORE THAN THE MAXIMUM PERMITTED OVALITY, DISCARD THE TUBE.

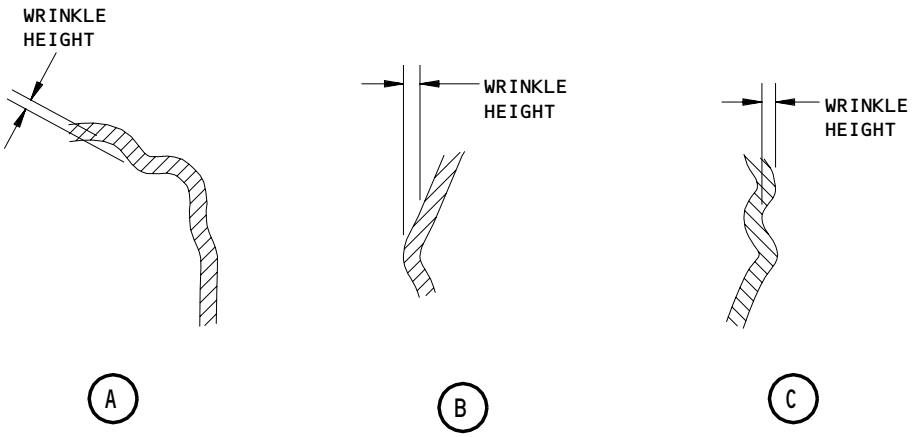
TUBE BEND BLOCK



RADIAL WRINKLE



LONGITUDINAL WRINKLE



WRINKLE MEASUREMENTS

Permitted Ovality and Wrinkle of Hydraulic and Fire Extinguishing Tube Bends
Figure 801 (Sheet 1)

SYSTEM OPERATING PRESSURE	TUBE OD	TUBE MATERIAL	ALLOWABLE WRINKLE HEIGHT (Inches)	ALLOWABLE OVALITY (Percent of Specified OD)* 1
Liquid: 1000 PSI To 3000 PSI (Including Return Lines)	All Sizes	Stainless Steel	0.010	5
		Aluminum	0.010	5
		3AL-2.5V Titanium	None Visible	3
Pneumatic And Oxygen: Pressure Above 1500 PSI or Temperature Above 160F	All Sizes	Stainless Steel	0.010	5
Other Liquid Systems: Pressure Less Than 1000 PSI Pneumatic and Oxygen Systems: Pressure Less Than 1500 PSI or Temperature Less Than 160F	Less Than 1.0	Stainless Steel	0.040	10
		Aluminum Alloy & Copper	0.020	10
	1.0 Or Over, Less Than 2.0	Stainless Steel	0.060	10
		Aluminum Alloy & Copper	0.030	10
	2.0 Or Over, Less Than 3.0	Stainless Steel	0.080	5
		Aluminum Alloy & Copper	0.040	5
	3.0 Or Over	Stainless Steel	0.100	5
		Aluminum Alloy & Copper	0.050	5

* Specified Diameter = Drawing Specified Tube Diameter

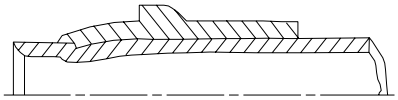
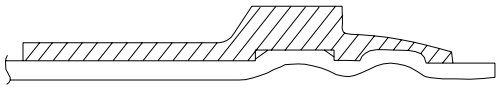
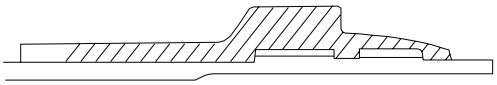
1 PERCENT (OVALITY) = $\frac{\text{OD MAX} - \text{OD MIN}}{\text{OD SPECIFIED*}}$ X 100

(NOTE: OD MEASURED IN SAME PLANE).

NOTE: FOR ADDITIONAL INFORMATION ON TUBE BENDING, SEE SAE AIR 5378 "AIRCRAFT TYBE BENDING METHODS, TECHNIQUES AND TOOLING."

Permitted Ovality and Wrinkle of Hydraulic and Fire Extinguishing Tube Bends
Figure 801 (Sheet 2)

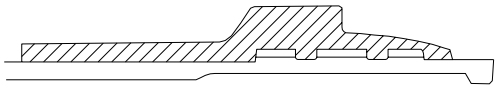
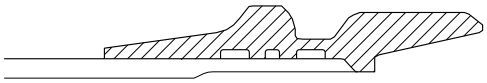
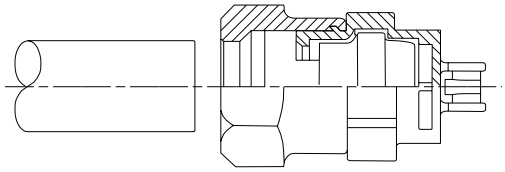
CAUTION: DO NOT USE CADMIUM PARTS ON TITANIUM TUBES. CORROSION WILL OCCUR IF YOU USE CADMIUM PARTS ON TITANIUM TUBES.

TUBE JOINING		TUBE MATERIAL 8	REF TABLE C FOR TOOLS REQUIRED	APPROVED SIZES
ILLUSTRATION	PART NUMBER*			
	BACS13AP (BITE-Type) 1	6061T6	B,C	04, 06, 08, 10, 12
		304 ANN.	B,C	04, 06, 08, 10, 12
		304 1/8 Hard	B,C	04, 06, 08, 10, 12
	BACS13BX (Elastomer Swage) 2 3	6061T6	A	06, 08, 10, 12, 16, 20 4, 24 4
		304 ANN.	A	16, 20
		304 1/8 Hard	A	06, 08, 10, 12, 16, 20 4, 24 4
		21-6-9	A	04, 06, 08, 10, 12, 16
	BACS13BX (Roller Swage)	21-6-9	D	04, 06, 08, 10, 12, 16
		Ti-3Al-2.5V	D	04, 06, 08, 10, 12, 16

REPAIR METHOD - RECONNECTABLE WITH FLARELESS FITTING SLEEVES
TABLE A

Tube Material and Fitting Selection Tables
Figure 802 (Sheet 1)

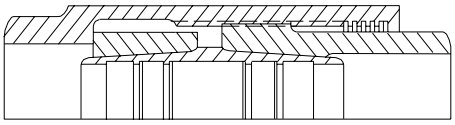
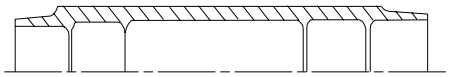
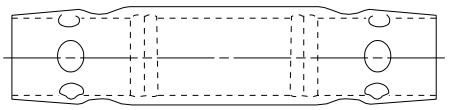
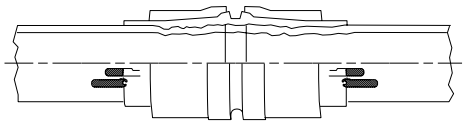
CAUTION: DO NOT USE CADMIUM PARTS ON TITANIUM TUBES. CORROSION WILL OCCUR IF YOU USE CADMIUM PARTS ON TITANIUM TUBES.

TUBE JOINING		TUBE MATERIAL 8	REF TABLE C FOR TOOLS REQUIRED	APPROVED SIZES
ILLUSTRATION	PART NUMBER*			
	35211 SLEEVE (Roller Swage)	Ti-3Al-2.5V	D(1)	04, 06, 08, 10, 12, 16
	35212 UNION (Roller Swage)	Ti-3Al-2.5V	D(1)	04, 06, 08, 10, 12, 16
	CRYOLIVE Assembly 921721	6061T6	G	04, 06, 08, 10, 12, 16
		21-6-9	G	04, 06, 08, 10, 12, 16
		Ti-3Al-2.5V	G	04, 06, 08, 10, 12, 16
		304 1/8 Hard	G	04, 06, 08, 10, 12, 16

* SEE TABLE D FOR ASSOCIATED APPROVED FITTINGS.

REPAIR METHOD - RECONNECTABLE WITH FLARELESS FITTING SLEEVES
TABLE A

Tube Material and Fitting Selection Tables
Figure 802 (Sheet 2)

TUBE JOINING		TUBE MATERIAL (8)	REF TABLE C FOR TOOLS REQUIRED	APPROVED SIZES
ILLUSTRATION	PART NUMBER			
	BACC42W Repair H-Coupling BACC42W-T	6061T6	G	04, 06, 08, 10
		304 ANN.	G	04, 06, 08, 10, 12, 16
		304 1/8 Hard	G	04, 06, 08, 10, 12, 16
		21-6-9	G	04, 06, 08, 10, 12, 16
		Ti-3Al-2.5V	G	04, 06, 08, 10
	3PO2111 or 3PHS111 Cryofit	Ti-3Al-2.5V	F	04, 06, 08, 10, 12, 16
	Permaswage D10282-D (Al)	6061T6	E	04, 06, 08, 10, 12, 16
	Permaswage D10282 - (Cres)	Ti-3Al-2.5V	E	04, 06, 08, 10, 12, 16
		304 1/8 Hard	E	04, 06, 08, 10, 12, 16
		21-6-9	E	04, 06, 08, 10, 12, 16
	Rynglok 80101T - (TITANIUM)	6061T6	H	04, 06, 08, 10, 12, 16
		Ti-3Al-2.5V	H	04, 06, 08, 10, 12, 16
		304 1/8 Hard	H	04, 06, 08, 10, 12, 16
		21-6-9	H	04, 06, 08, 10, 12, 16

REPAIR METHOD - PERMANENT UNIONS, TUBE-TO-TUBE
TABLE B

Tube Material and Fitting Selection Tables
Figure 802 (Sheet 3)

REF LETTER FOR TABLES A AND B	TOOL REQUIRED
A	Harrison Portable Swagers No. 5175 and 5720 or equivalent stationary Swager No. 5570
B	Pressure Presetting Tools ST878D
C	Hand Presetting Tools ST879A
D	Harrison Roller Swage Tool Kit 6633K01
D (1)	Harrison Roller Swaging Machine 6777
E	DMC Permaswage Kits: • DLT Series - Refer to Fig. 825 for individual tool numbers - Consult DMC for tool kit numbers - One pump unit, DLT02MAPP1000 (pneumatic, 10,000 psi) or - DLT05MAPM1000 (manual, 10,000 psi) is necessary for swaging with the tool kits shown.
F	AMCI: • FRK3P02111-001
G	None necessary - hand tools only.
H	Aeroquip Rynglok Kit RTS8-02-006 for sizes 04, 06, 08, 10, 12, 16, 20.

TOOL REQUIRED FOR REPAIR METHOD
TABLE C

Tube Material and Fitting Selection Tables
Figure 802 (Sheet 4)

PART NUMBER	ASSOCIATED APPROVED FITTINGS	
	FITTING NUTS 5 7	UNIONS 6
BACS13AP (BITE-Type) BACS13BX (Elastomer Swage) BACS13BX (Roller Swage)	For Aluminum tubes less than size 20, use: • BACN10YL-Alum • MS21921-Alum or Steel • BACN10CS-Alum or Steel For size 20 and 24 Aluminum tubes used with short flareless fittings, use: • AS4660-Alum	For Aluminum tubes less than size 20, use: • MS21902-Alum or Steel • M21924-Alum or Steel For size 20 and 24 Aluminum tubes used with short flareless fittings, use: • AS4663-Alum
	For Cres tubes, use: • BACN10YE-Cres • MS21921-Cres, Steel or Ti • BACN10CS-Cres, Steel • BACN10YA-Ti	For Cres tubes, use: • MS21902-Cres, Steel or Ti • MS21924-Cres, Steel or Ti
	For Ti tubes, use: • BACN10YA-Ti • BACN10YE-Cres • MS21921-Ti, Cres • AS4660-Ti (sizes 20 and 24 only)	For Ti tubes, use: • MS21902-Cres or Ti • MS21924-Cres or Ti • AS4660-Ti (sizes 20 and 24 only) • 35212 swaged union
35211 Sleeve (Roller Swage)	For Ti tubes, use: • BACN10YA-Ti • BACN10YE-Cres • MS21921-Ti, Cres • AS4660-Ti (sizes 20 and 24 only)	For Ti tubes, use: • MS21902-Cres or Ti • MS21924-Cres or Ti • AS4660-Ti (sizes 20 and 24 only) • 35212 swaged union
35212 Union (Roller Swage)	N/A	N/A
CRYOLIVE Assembly 921721	For Aluminum tubes, use: • 921721W- (sizes 04 thru 12 only For Cres tubes, use: • 921721J- For Ti tubes, use: • 921721T-	For Ti tubes, use: • MS21902-Cres or Ti • MS21924-Cres or Ti

ASSOCIATED APPROVED FITTINGS
TABLE D

Tube Material and Fitting Selection Tables
Figure 802 (Sheet 5)

MATERIAL	TUBE SIZES								
	04	05	06	08	10	12	16	20	24
	0.250	0.312	0.375	0.500	0.625	0.750	1.000	1.250	1.500
21-6-9	0.016	0.020	0.020	0.026	0.033	0.039	0.052		
3A1-2.5V	0.016		0.019	0.026	0.032	0.039	0.052	0.070	
6061-T6	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.049	0.049
304 1/8 H	0.020	0.020	0.028	0.035	0.049	0.058	0.065*	0.035*	0.049*

* NOT QUALIFIED FOR 3000 PSI SYSTEMS, LOWER PRESSURES ONLY.

NOTE: ALTERNATIVE WALL THICKNESSES FOR TUBE REPAIRS OF 3000 PSI AND LOWER SYSTEM PRESSURE APPLICATIONS PER FLAGNOTE 8.

CRES 321 TUBING PER MIL-T-8808 MAY BE USED AS A SUBSTITUTE FOR 304 TUBING PER MIL-T-8504, 6061-T6 ALUMINUM TUBING PER MIL-T-7081 OR AMS 4083. 6061-T6 ALUMINUM PER MIL-T-7081 OR AMS 4083 MAY BE USED AS A SUBSTITUTE FOR 6061-T6 ALUMINUM TUBING PER 22-T-700/6. CONTACT THE BOEING COMPANY WHEN CONSIDERING USE OF TUBE MATERIALS OTHER THAN THOSE SPECIFIED.

TABLE E

Tube Material and Fitting Selection Tables
Figure 802 (Sheet 6)

TUBING MATERIAL	LOCATION ON AIRPLANE	TUBING SURFACE	FINISH RECOMMENDATION AND OPTIONS	FINISH CODE FOR COMMERCIAL AIRPLANES
Titanium	All	Inside	None	F-25.01
		Outside	None	F-25.01
CRES	All	Inside	None	F-25.01
		Outside	None Optional: Passivate + Primer (Green) Passivate + Primer + Paint (White)	F-25.01 F-17.09 + F-20.02 F-17.09 + F-20.02 + F-21.03
Aluminum	Fuel Tanks	Inside	None	F-25.01
		Outside	Alodine (Transparent Gold)	F-17.08
	All Other	Inside	None	F-25.01
		Outside	Anodize plus Primer (Green) Optional: Anodize + Primer + Paint (White)	F-17.19 and F-20.02 F-17.19 + F-20.02 + F-21.03

TYPICAL FINISHES FOR HYDRAULIC TUBING
TABLE F

Tube Material and Fitting Selection Tables
Figure 802 (Sheet 7)

NOTE: REFER TO FIG. 824 TO MAKE AN ORDER FOR PARTS.

1 STANDARD CADMIUM-PLATED SLEEVE BACS13AP (SIZE)

2 STANDARD CADMIUM-PLATED SLEEVE:
- BACS13BX (SIZE) HP

3 BACS13BD2OH.HP AND BACS13BD24H.HP HAVE BEEN SUPERSEDED BY BAC13BX2OH.HP AND BAC13BX24H.HP.

4 THE BACSBBX SLEEVE CAN BE USED TO REPAIR SIZE 2O AND 24 ALUMINUM TUBES WITH SHORT FLARELESS FITTINGS. IT CAN ALSO BE USED TO REPAIR SIZE 2O ALUMINUM TUBES AND SIZE 2O AND 24 CRES TUBES WITH STANDARD FLARELESS FITTINGS. MAKE SURE YOU DETERMINE THE APPLICATION BEFORE SWAGGING. SHORT FLARELESS FITTINGS REQUIRE A SHORTER "Z_1" DIMENSION (FIG. 811).

5 DO NOT USE ALUMINUM NUTS OR UNIONS ON TUBE MATERIALS OTHER THAN ALUMINUM.

6 ASSOCIATED APPROVED FITTINGS FOR OTHER UNIONS, REDUCERS, ELBOWS, AND TEES WITH MS33514 OR MS33515 FITTING ENDS; AND FOR SHORT FLARELESS FITTING APPLICATIONS, OTHER UNIONS, REDUCERS, ELBOWS AND TEES WITH AS4658 OR AS4659 FITTING ENDS.

7 USE ONLY THE CRYOLIVE FLARELESS SLEEVE ASSEMBLY, CONSISTING OF THE CRYOLIVE SLEEVE, COUPLING NUT AND PLASTIC CAP. THE CRYOLIVE FLARELESS SLEEVE ASSEMBLY, IN SIZES 1O, 12 AND 16, REQUIRES USE OF A LONGER LENGTH AMCI P/N 9211699 (MATERIAL CODE)(SIZE) N COUPLING NUT. THE LONGER LENGTH COUPLING NUTS ARE NOT INTERCHANGEABLE WITH STANDARD BACN1O- AND MS21921 COUPLING NUTS.

8 WHEN PERFORMING A HYDRAULIC TUBE REPAIR WITH THE SAME TUBE MATERIAL, THE ALTERNATE TUBE WALL THICKNESSES LISTED IN FIG. 8O2 (SHEET 6) MAY BE USED IN PLACE OF WALL THICKNESSES DELIVERED WITH THE AIRPLANE WHEN PERFORMING A REPAIR ON TUBES IN SYSTEMS WITH 3OOO PSI OR LESS OPERATING PRESSURE.

Tube Material and Fitting Selection Tables
Figure 8O2 (Sheet 8)

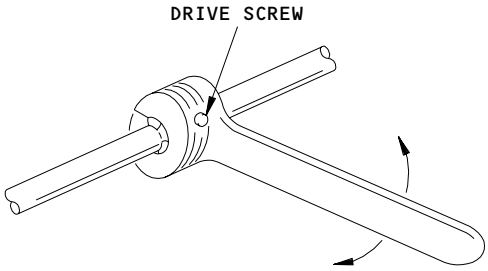
TUBE MATERIAL (PRESSURE)	PROBLEM TYPE	TUBE OUTER DIAMETER						
		1/4	3/8	1/2	5/8	3/4	1	1-1/4
Ti-3Al-2.5V 21-6-9 (3000 psi)	chafed	0.006	0.007	0.008	0.010	0.011	0.012	0.030 (Ti)
	dent	0.005	0.007	0.010	0.015	0.018	0.020	0.030 (Ti)
304 1/8 Hard (3000 psi)	chafed	0.006	0.007	0.008	0.010	0.011	0.012	N/A
	dent	0.005	0.010	0.020	0.030	0.040	0.040	N/A
6061T6 (1500 psi except*)	chafed	0.015	0.015	0.010	0.005	0.004 0.015*	0.003 0.015*	0.003 0.015*
	dent	0.015	0.015	0.010	0.005	0.005	0.005	0.005

*Suction Line, 150 psi

ALL DIMENSIONS ARE IN INCHES.

NOTE: THE ABOVE LIMITS WERE VERIFIED BY HYDRAULIC IMPULSE FATIGUE AND BURST TESTING (FOR ADDITIONAL INFORMATION SEE SAE-AIR 1388).

Permitted Tube Problem Depth -
Hydraulic Pressure (3000 PSI), Return Lines (1500 PSI),
Fire Extinguishing Pressure (1000 PSI) and Pitot-Static Tubing
Figure 803

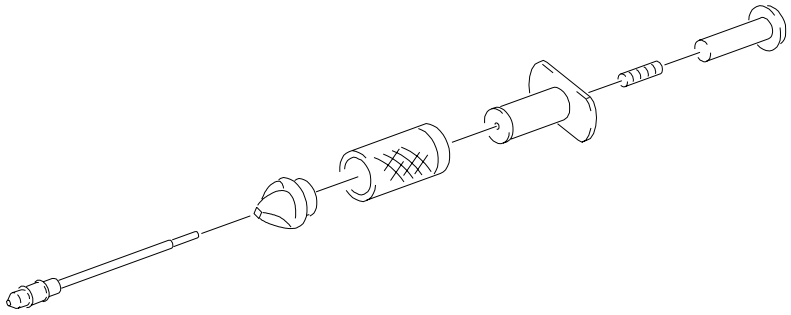


CUTTER TOOL

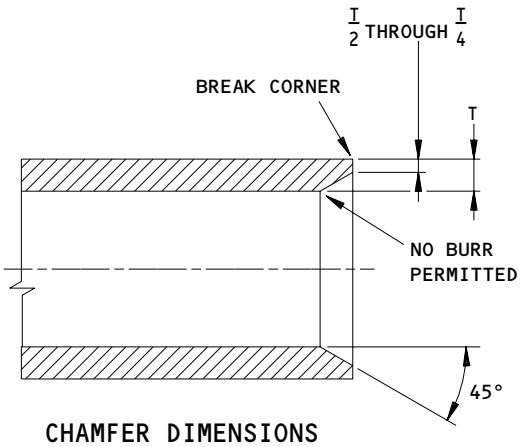
TUBE SIZE	CHIPLESS CUTTER PART NUMBER	CUTTER WHEEL PART NUMBER
04	D12530-001	D12530-109
06	D12530-001	D12530-109
08	D12531-001	D12531-109
10	D12531-001	D12531-109
12	D12531-001	D12531-109

DMC CHIPLESS CUTTERS AND CUTTER WHEELS
TABLE A

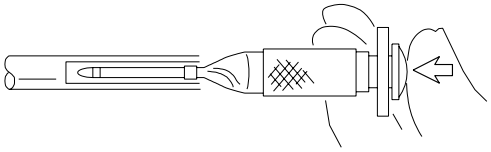
DMC Tools
Figure 804 (Sheet 1)



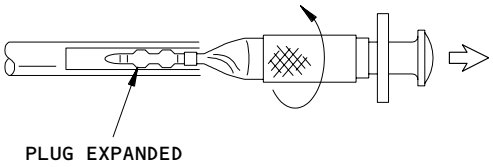
DEBURRING TOOL ASSEMBLY



CHAMFER DIMENSIONS



DEBURRING TOOL INSERTION

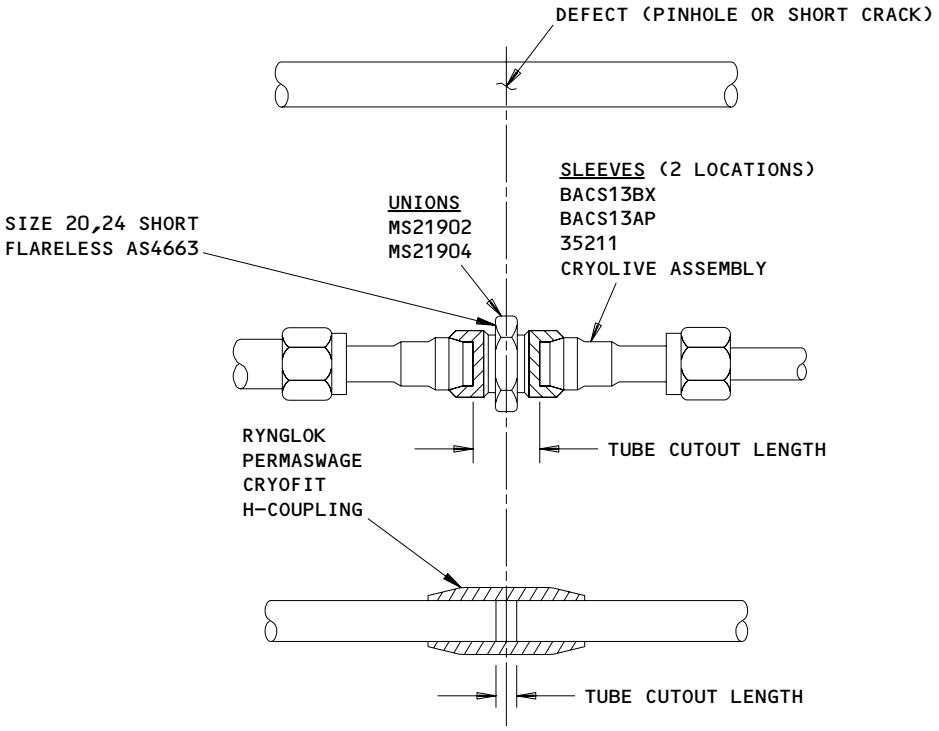


DEBURRING TOOL EXTRACTION

TUBE SIZE	TUBE WALL THICKESS (INCHES)	STEM SUBASSEMBLY PART NUMBER	DEBURRING TOOL PART NUMBER
04	0.016-0.028	D9851-13-04	D9851
04	0.028-0.050	D9851-13-03	D9851
06	0.016-0.035	D9851-13-06	D9851
06	0.035-0.058	D9851-13-07	D9851
08	0.016-0.042	D9850-13-08	D9850
10	0.016-0.058	D9850-13-10	D9850
12	0.016-0.058	D9850-13-12	D9850
16	0.016-0.058	D9849-13-16	D9849
20	0.016-0.058	D9849-13-20	D9849

DMC STEM SUBASSEMBLIES, DEBURRING TOOLS, AND
REQUIRED CHAMFER DIMENSIONS
TABLE B

DMC Tools
Figure 804 (Sheet 2)



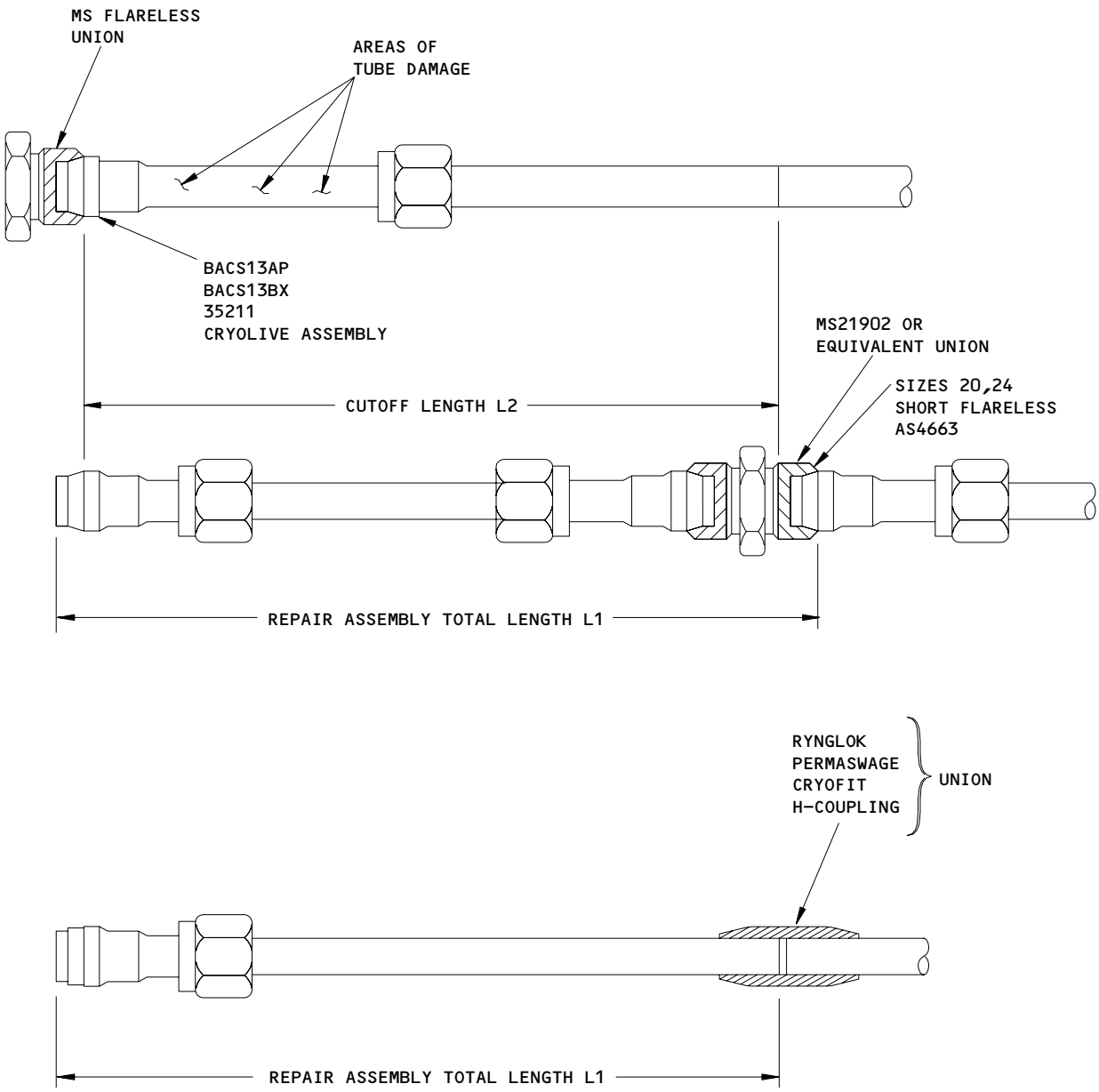
NOTE: FITTING NUTS NOT SHOWN.

Tubing Repair with Unions - Short Damage
Figure 805 (Sheet 1)

UNION PART NO.	SLEEVE PART NO.	TUBE SIZE								
		04	05	06	08	10	12	16	20	24
MS21902	BACS13AP	0.59	0.56	0.68	0.76	0.86	1.05	N/A	N/A	N/A
	BACS13BX (Harrison Elastomer Swager) CRYOLIVE Assembly	0.63	0.60	0.72	0.80	0.90	1.09	0.96	0.96	0.96
	BACS13BX (Harrison Roller Swager) 35211 (Harrison Roller Swager 6777)	0.82	N/A	0.95	1.03	1.21	1.40	1.40	N/A	N/A
MS21924	BACS13AP	1.18	1.18	1.29	1.42	1.55	1.78	N/A	N/A	N/A
	BACS13BX (Harrison Elastomer Swager) CRYOLIVE Assembly	1.22	1.22	1.33	1.46	1.59	1.82	1.68	1.67	1.67
	BACS13BX (Harrison Roller Swager) 35211 (Harrison Roller Swager 6777)	1.41	N/A	1.56	1.69	1.90	2.13	2.13	N/A	N/A
Rynglok	None Necessary	0.300	N/A	0.300	0.350	0.350	0.350	0.400	0.400	N/A
Permaswage Cryofit H-Coupling		← 0.150 INCH MAXIMUM →								

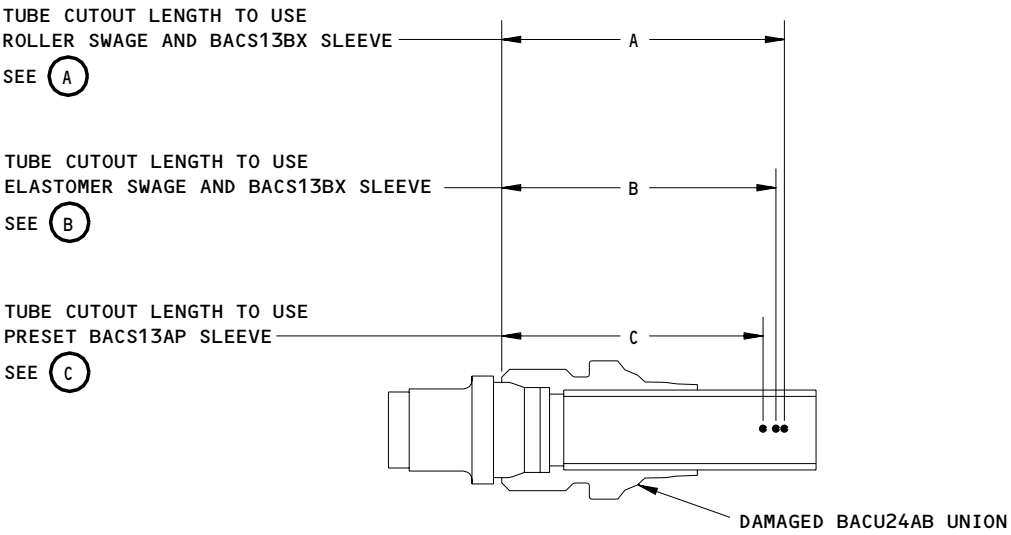
TUBE CUTOUT LENGTHS IN INCHES

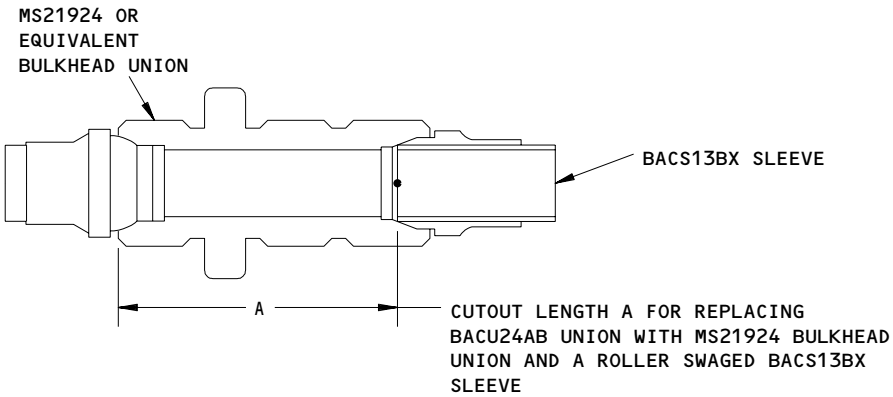
Tubing Repair with Unions – Short Damage
Figure 805 (Sheet 2)



NOTE: REFER TO FIG. 810 (SHEET 1) FOR THE LENGTHS L1 AND L2.

Tubing Repair by End Replacement
Figure 806



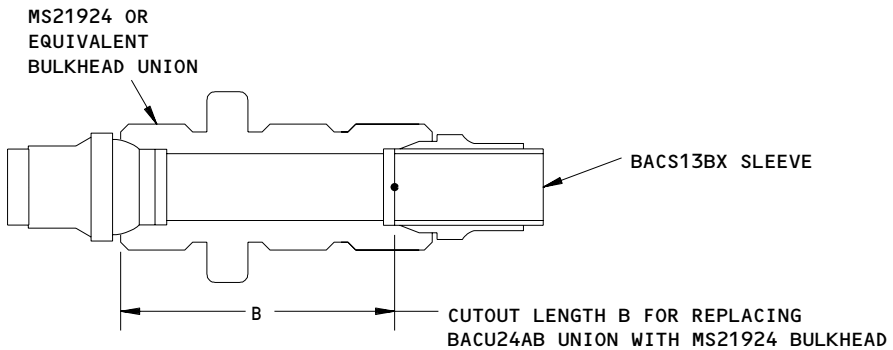


A

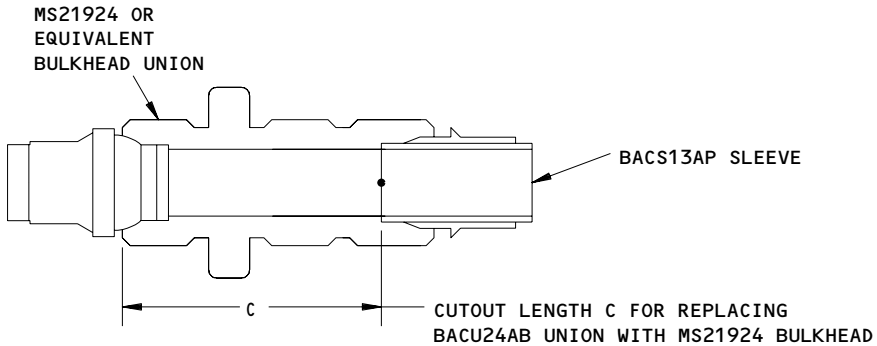
NOTE: REFER TO FIG. 808 FOR THE LENGTHS A,B AND C.
COUPLING NUTS NOT SHOWN.

Tube Cutout Lengths for
Replacement of Damaged BACU24AB Swage Unions
Figure 807 (Sheet 1)

L21661



B



C

Tube Cutout Lengths for
Replacement of Damaged BACU24AB Swage Unions
Figure 807 (Sheet 2)

FITTINGS REPLACING BACU24AB UNIONS				TUBE CUTOUT LENGTHS REQUIRED							
SLEEVE PART NO.	SWAGE METHOD	UNION PART NO.	DIM.	04	06	08	10	12	16	20	24
BACS13BX	HARRISON ROLLER SWGE KIT 6633K01	MS21924	A (Fig. 807)	1.562	1.705	1.886	2.100	2.334	2.319	N/A	N/A
35211	HARRISON ROLLER SWAGE MACHINE 6777										
BACS13BX	HARRISON PORTABLE SWAGERS 5175, 5720 OR EQUIV. STATNRY. 5570	MS21924	B (Fig. 807)	1.487	1.612	1.791	1.965	2.199	2.122	2.119	2.049
BACS13AP	HAND OR MACHINE PRESET	MS21924	C (Fig. 807)	1.422	1.547	1.726	1.900	2.134	N/A	N/A	N/A
CRYOLIVE Assembly	N/A	MS21924	B (Fig. 807)	1.487	1.612	1.791	1.965	2.199	2.122	N/A	N/A

REPAIR METHOD: YOU NEED TO REPLACE A DAMQGED BACU24AB SWAGE UNION. YOU WILL CUT OUT THE FITTING AND REPLACE IT WITH A BACS13BX OR BACS13AP SLEEVE, A COUPLING NUT AND MS21924 FLARELESS BULKHEAD UNION OF THE SAME OR EQUIVALENT MATERIAL AS THE UNION YOU ARE REPLACING. CHECK FIG. 802 FOR SLEEVE/TUBE MATERIAL LIMITATIONS.

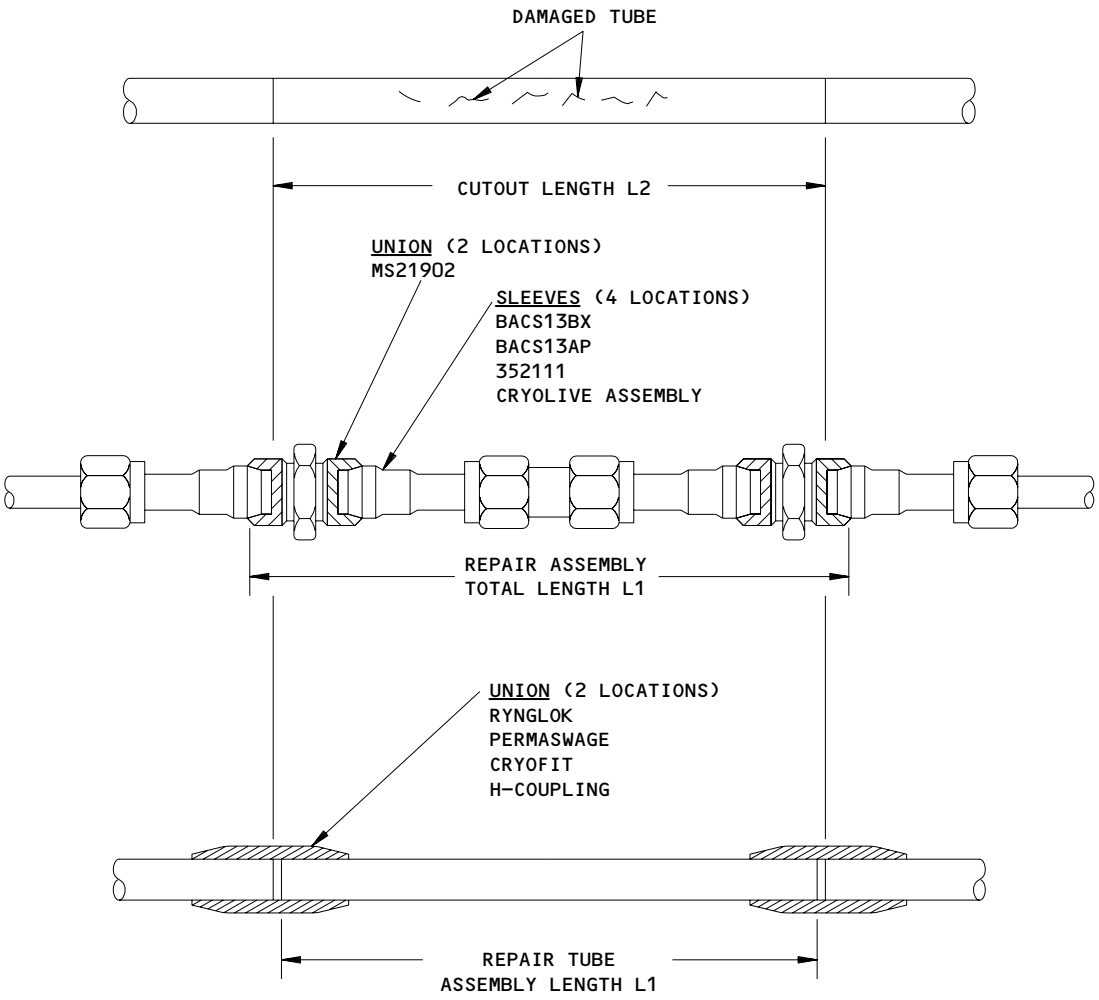
TO MAKE THE REPAIR (REFER TO FIG. 807):

STEP 1. CUT THE TUBE ADJACENT TO THE DAMAGED UNION – TO DIMENSION A, B, OR C DEPENDING ON THE SLEEVE AND SLEEVE INSTALLATION METHOD YOU PLANE TO USE.

STEP 2. SLIDE A FLARELESS COUPLING NUT ON THE TUBE. FOLLOW THE PROCEDURES FOR PRESETTING A BACS13AP SLEEVE OR SWAGING A BSCS13BX SLEEVE TO THE TUBE END.

STEP 3. INSTALL THE MS21924 FLARELESS BULKHEAD UNION BETWEEN THE TWO TUBE ENDS AND TIGHTEN THE NUTS.

Procedure to Replace BACU24AB Union
Figure 808



NOTE: REFER TO FIG. 810 FOR THE LENGTHS L1 AND L2.

Tubing Repair by Section Replacement
Straight or Bend - Extensive Damage
Figure 809

FITTINGS USED FOR REPAIR TUBE ASSEMBLY			L2 CUTOUT LENGTH FORMULA 1	
FLARELESS SLEEVE		UNION PART NO.	FOR TUBE END SECTION	FOR TUBE CENTER SECTION
PART NO.	SWAGE METHOD			
BACS13BX	Harrison Portable Swagers 5175 and 5720 or Equivalent Stationary Swager 5570	MS21902 or Equivalent	L1 Minus 2P	L1 Minus 2P
BACS13BX	Harrison Roller Swage Kit 6633K01		L1 Minus $2Z_1$	L1 Minus $2Z_1$
BACS13AP	Hand or Machine Preset		L1 Minus 2H	L1 Minus 2H
CRYOLIVE Assembly 921721	N/A		L1 Minus 2P	L1 Minus 2P
35211	Harrison Roller Swage Machine 6777		L1 Minus $2Z_2$	L1 Minus $2Z_2$
BACS13BX	Harrison Portable Swagers 5175 and 5720 or Equivalent Stationary Swager 5570	Permaswage Cryofit H-Fitting	L1 Minus (P+0.10)	N/A
BACS13BX	Harrison Roller Swage Kit 6633K01		L1 Minus (Z_1+0.10)	
BACS13AP	Hand or Machine Preset		L1 Minus (H+0.10)	
CRYOLIVE Assembly 921721	N/A		L1 Minus (P+0.10)	
35211	Harrison Roller Swage Machine 6777		L1 Minus $2Z_2$	L1 Minus $2Z_2$
N/A	N/A	Rynglok Permaswage Cryofit H-Coupling		L1 Minus 0.20

Procedure to Find the Tube Cutout Length L2
Figure 810 (Sheet 1)

L21666

Example: You have made a decision that to repair tube damage: You will remove a tube end section and replace it with a prefabricated tube assembly as shown on Fig. 806.

To make the repair tube end section, you roller swaged BACS13BX flareless sleeves to the tube ends and tightened then to one end of a MS21902 flareless union.

Step 1: Measure the repair tube assembly total length L1 (Fig. 806).

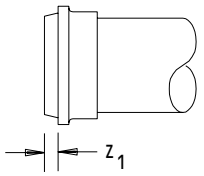
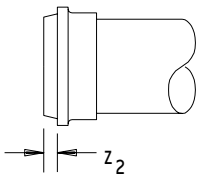
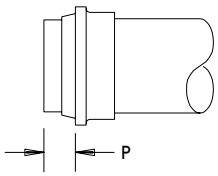
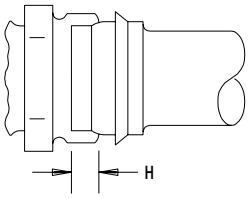
Step 2: Observe the cutout length L2 formula (L1 minus $2Z_1$) in above table.

Step 3: find the Z_1 value for tube size in Fig. 811.

Step 4: Subtract (Z_1 times 2) from the measured L1 for cutout length L2.

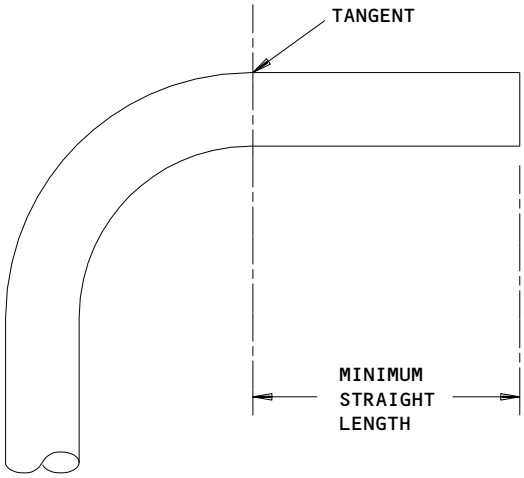
1 REFER TO FIG. 811 FOR VALUES FOR H, P, Z_1 AND Z_2.

Procedure to Find the Tube Cutout Length L2
Figure 810 (Sheet 2)

FLARELESS SLEEVE JOINT TYPE	TUBE SIZES								
	04	05	06	08	10	12	16	20	24
BACS13BX (Roller Swaged) 	0.140	N/A	0.137	0.190	0.195	0.195	0.195	N/A	N/A
35211 (Harrison Roller Swaged) 	0.210	N/A	0.207	0.250	0.255	0.255	0.255	N/A	N/A
BACS13BX (Elastomer Swaged) 	0.214	0.230	0.230	0.285	0.330	0.330	0.392	0.395 (1) 0.355 (2)	0.465 (1) 0.350 (2)
BACS13AP (Preset) 	0.234	0.250	0.250	0.305	0.350	0.350	N/A	N/A	N/A

(1) ALL EXCEPT SHORT FLARELESS
(2) SHORT FLARELESS

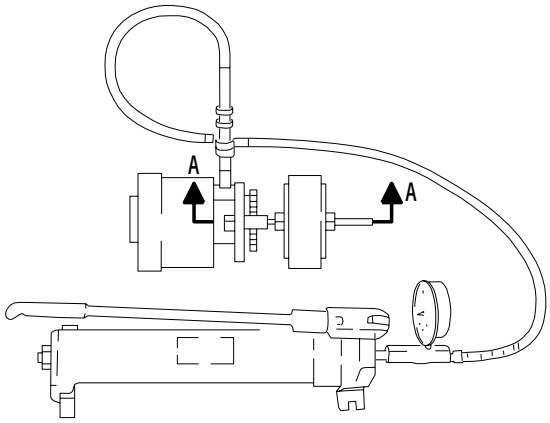
Flareless Sleeve Tube End Values
Figure 811



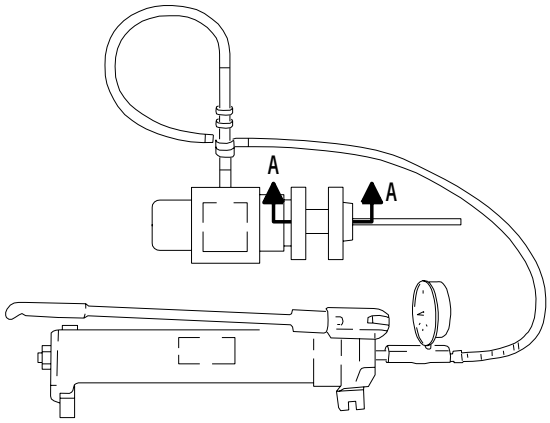
FITTING TYPE	TUBE END MINIMUM STRAIGHT LENGTH – INCHES								
	04	05	06	08	10	12	16	20	24
BACS13BX (Harrison Elastomer Swager) and CRYOLIVE Flareless Sleeve Assembly	1.23	1.25	1.28	1.39	1.48	1.51	1.47	1.46	1.46
BACS13BX (Harrison Roller Swager)	2.25	2.25	2.25	2.25	2.25	2.25	2.25	N/A	N/A
BACS13AP (BITE Type)	0.80	0.90	1.00	1.10	1.15	1.15	N/A	N/A	N/A
D10282 * (Permaswage)	1.07	N/A	1.15	1.65	1.70	1.80	1.90	2.15	N/A
BACC42W * (H-Coupling)	2.80	2.80	2.80	2.80	2.80	2.80	2.80	N/A	N/A
3p02111 * (Cryofit)	0.71	0.81	0.90	0.98	1.17	1.35	1.76	N/A	N/A
35211 Sleeve (Harrison Roller Swager)	1.30	N/A	1.30	1.38	1.42	1.40	1.40	N/A	N/A
35212 Union (Harrison Roller Swager)	1.22	N/A	1.30	1.48	1.46	1.50	1.50	N/A	N/A
80101T (Rynglok)	1.236	N/A	1.362	1.480	1.628	1.777	2.109	2.143	N/A

* Based on 1/2 fitting length

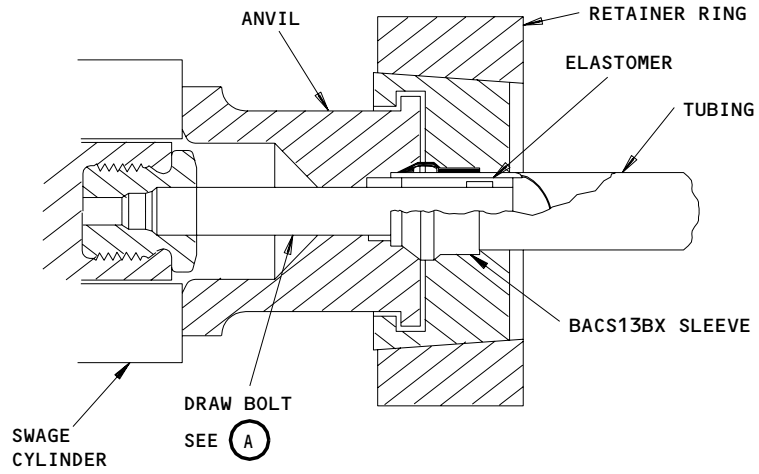
Minimum Straight Length Specifications for Repair Fitting Installations Adjacent to Tube Bends
Figure 812



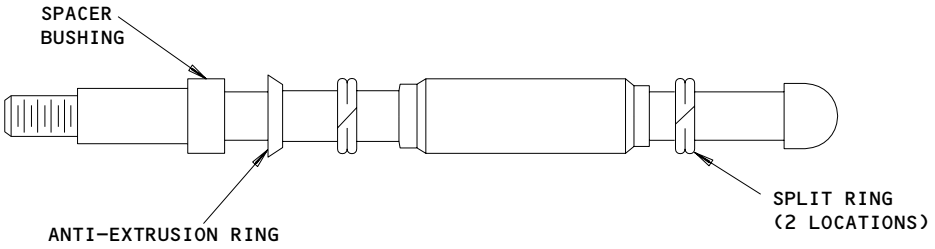
HARRISON MODEL 5720



HARRISON MODEL 5175



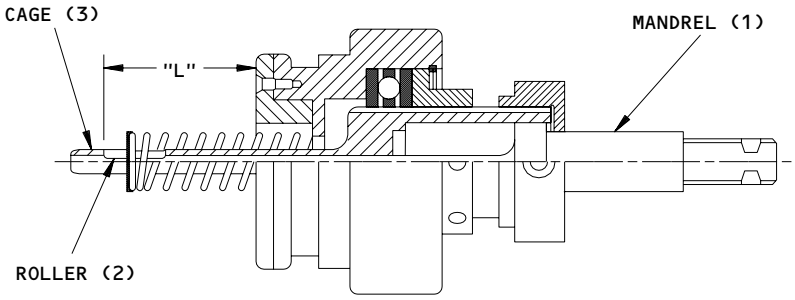
A-A



DRAW BOLT ASSEMBLY
(SHOWN EXTENDED)

A

Harrison Portable Swagers for BACS13BX Sleeves
Figure 813 (Sheet 1)



SIZE	EXPANDER ASSEMBLY	MANDREL (1)	ROLLERS (2)	CAGE (3)
-04	7320-04016	7321-04016	7322-04016	7323-04016
-06	7320-06019	7321-06019	7322-06019	7323-06019
-08	7320-08026	7321-08026	7322-08026	7323-08026
-10	7320-10032	7321-10032	7322-10032	7323-10032
-12	7320-12039	7321-12039	7322-12039	7323-12039
-16	7320-16051	7321-16051	7322-16051	7323-16051

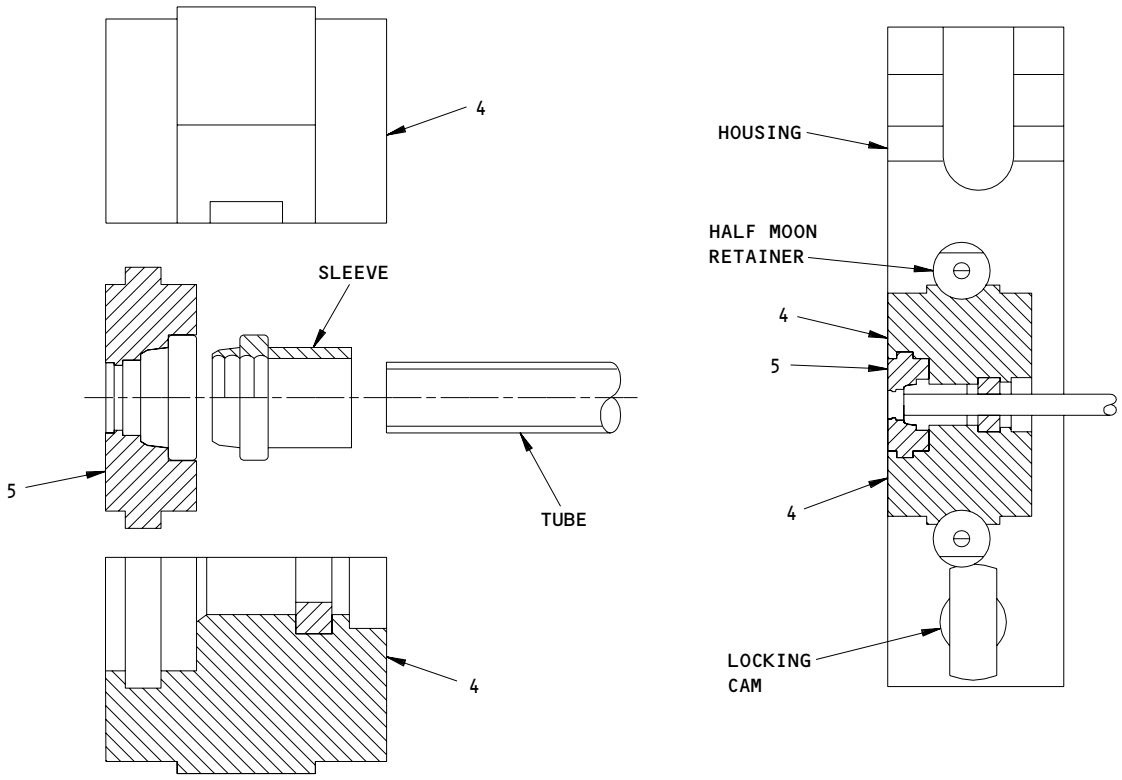
EXPANDERS P/N AND SPARE PARTS P/N REQUIRED
TO ROLLER SWAGE 35211 AND 35212 TO 3AI-2.5V TITANIUM TUBING

TUBE O.D.	SET LENGTH "L" (INCHES) ±0.005
-04	1.010
-06	1.205
-08	1.310
-10	1.382
-12	1.474
-16	1.600

TOOL ADJUSTMENT

HARRISON 6777 MACHINE

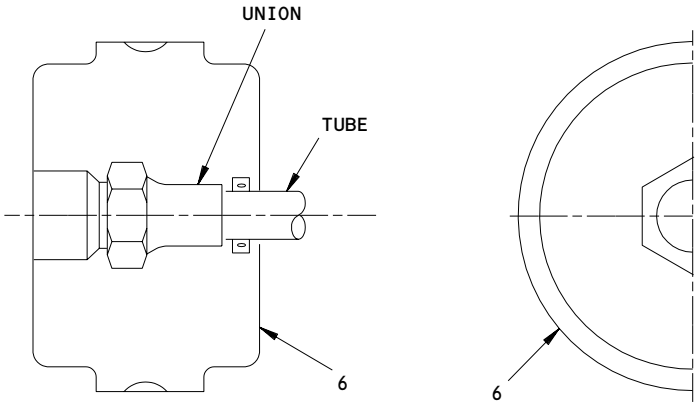
Harrison Portable Swagers for BACS13BX Sleeves
Figure 813 (Sheet 2)



TUBE AND SLEEVE DIA. INCHES	TWO HALF JAWS (4)	RETAINER (5)
1/4	6884-04	6885-104
3/8	6884-06	6885-106
1/2	6884-08	6885-108
5/8	6884-10	6885-110
3/4	6884-12	6885-112
1	6884-16	6885-116

HARRISON 6777 MACHINE

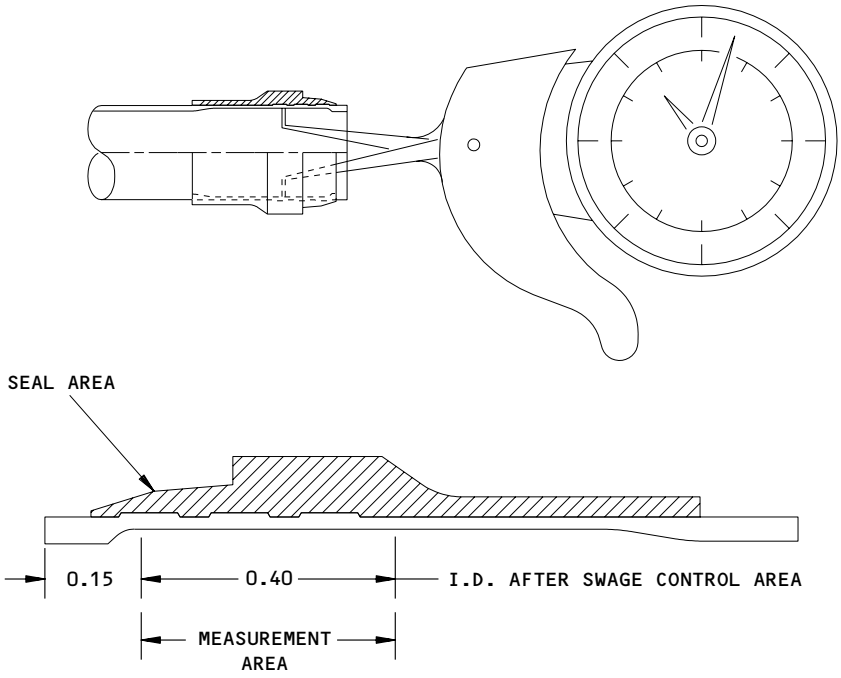
Harrison Portable Swagers for BACS13BX Sleeves
Figure 813 (Sheet 3)



TUBE AND UNION DIA. INCHES	TWO HALF JAWS (6)
1/4	6886-04
3/8	6886-06
1/2	6886-08
5/8	6886-10
3/4	6886-12
1	6886-16

EXTERNAL ROLLER SWAGE TOOLS FOR UNIONS

Harrison Portable Swagers for BACS13BX Sleeves
Figure 813 (Sheet 4)



NOTE: I.D. AFTER SWAGE REQUIREMENTS-MEASURING METHOD
FOR 35211 SLEEVE AND 35212 UNION.

TUBE O.D./DASH NO.	TUBE WALL	TORQUE	I.D. AFTER SWAGE
TUBE MATERIAL: 3AI-2.5V TITANIUM PER AMS4945			
0.250/-04	0.016	6-7	0.225-0.232
0.375/-06	0.019	11-12	0.347-0.354
0.500/-08	0.026	20-22	0.458-0.465
0.625/-10	0.032	40-43	0.575-0.587
0.750/-12	0.039	40-43	0.684-0.695
1.000/-16	0.051	65-68	0.913-0.919

SWAGING TORQUE AND I.D. AFTER SWAGE REQUIREMENTS
FOR 35211 SLEEVE AND 35212 UNIONS

Harrison Portable Swagers for BACS13BX Sleeves
Figure 813 (Sheet 5)

Swage Pressures for Elastomer Swaging Flareless Sleeves
Figure 814 (Sheet 1)

TUBE SIZE	SWAGER MODEL NO.	21-6-9 CRES AS SHOWN IN BMS 7-185		6061-T6 AL PER WW-T-700/6 OR MIL-T-7081 OR AMS 4083		6061-T4AL PER MIL-T-7081 OR AMS 4083		304, 321, AND 347 CRES	
		WALL (IN.)	SWAGE PRESSURE (PSI) ▷3◁ BACS13BX	WALL (IN.)	SWAGE PRESSURE (PSI) ±5% BACS13BX	WALL (IN.)	SWAGE PRESSURE (PSI) ±5% BACS13BX	WALL (IN.)	SWAGE PRESSURE (PSI) ▷3◁ BACS13BX
04	5175	0.016	475	N/A	N/A	N/A	N/A	0.020	475* ▷2◁
05		0.020	1000	0.035	450	N/A	N/A	N/A	N/A
06		0.020	1150	0.028 0.035	500	N/A	N/A	0.035 0.035 ▷2◁	940 ▷1◁ 1150* ▷2◁
08		0.026	2000	0.035	950	N/A	N/A	0.035 ▷2◁	2000* ▷2◁

* SWAGE PRESSURES NECESSARY TO INSTALL BACS13BX FLARELESS SLEEVES ON TUBE MATERIALS WITH THE HARRISON PORTABLE AND STATIONARY SWAGERS

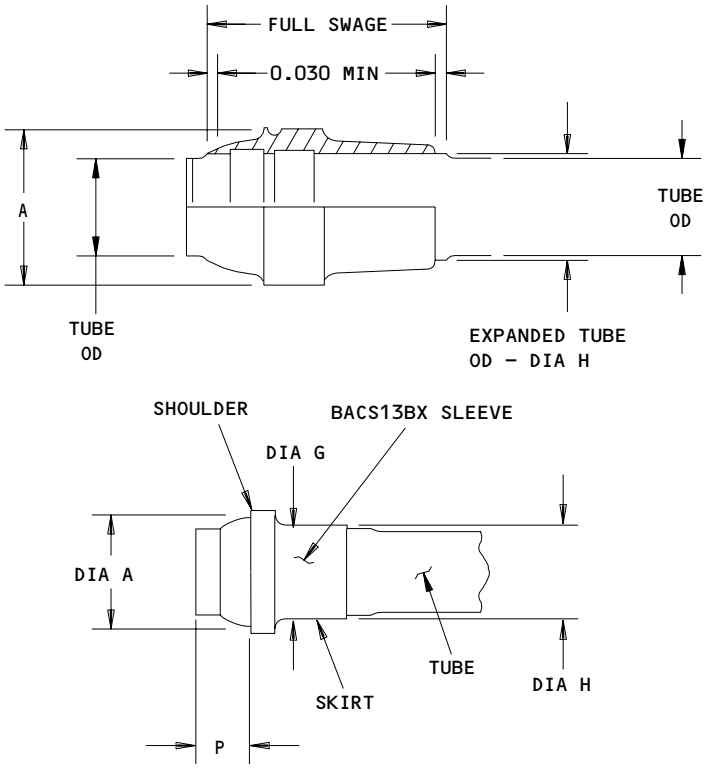
▷1◁ 304 CRES (MIL-T-8504), 321 AND 347 CRES (MIL-T-8808)

▷2◁ 304 1/8 HARD CRES (MIL-T-6845)

▷3◁ MINIMUM SWAGE PRESSURE - IF YOU MUST SWAGE AGAIN, INCREASE IN 5% INCREMENTS.

TUBE SIZE	SWAGER MODEL NO.	21-6-9 CRES AS SHOWN IN BMS 7-185		6061-T6 AL PER WW-T-700/6 OR MIL-T-7081 OR AMS 4083		6061-T4AL PER MIL-T-7081 OR AMS 4083		304, 321, AND 347 CRES	
		WALL (IN.)	SWAGE PRESSURE (PSI) △3	WALL (IN.)	SWAGE PRESSURE (PSI) ±5%	WALL (IN.)	SWAGE PRESSURE (PSI) ±5%	WALL (IN.)	SWAGE PRESSURE (PSI) △3
			BACS13BX		BACS13BX		BACS13BX		BACS13BX
10	5570 5720	0.033	850	0.020	250	N/A	N/A	0.035	450
				0.028	325			0.049	850*
				0.035	375				
12		0.039	1600	0.035	600	N/A	N/A	0.035 △2 0.049 △2 0.058 △2	1300 △2 1350 △2 1600* △2
16		0.052	3050	0.035	950	0.035	750	0.065 △2 0.035 △2	3050* △2 1650 △2
20		N/A	N/A	0.035	N/A	0.035	750	0.035	N/A
24	▼	N/A	N/A	N/A	N/A	N/A	N/A	0.035	N/A

Swage Pressures for Elastomer Swaging Flareless Sleeves
Figure 814 (Sheet 2)



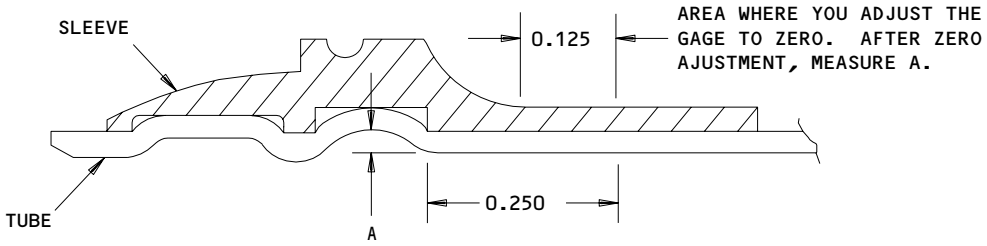
DIMENSION	SIZE								
	04	05	06	08	10	12	16	20	24
P ±0.010	0.214	0.230	0.230	0.285	0.330	0.330	0.392	0.395 (1) 0.355 (2)	0.465 (1) 0.350 (2)
A max	0.374	0.437	0.493	0.673	0.789	0.964	1.214	1.474	1.723
G max	0.298	0.364	0.423	0.550	0.686	0.822	1.070	1.323	1.573
H max	0.260	0.322	0.385	0.511	0.636	0.761	1.011	1.262	1.517

NOTE: ALL DIMENSIONS ARE IN INCHES.

DIMENSIONS OF FLARELESS TUBE ENDS AND
BACS13BX SLEEVES AFTER ELASTOMERIC SWAGING

(1) ALL EXCEPT SHORT FLARELESS
(2) SHORT FLARELESS

BACS13BX Flareless Sleeve Dimensions After Elastomeric Swaging
Figure 815



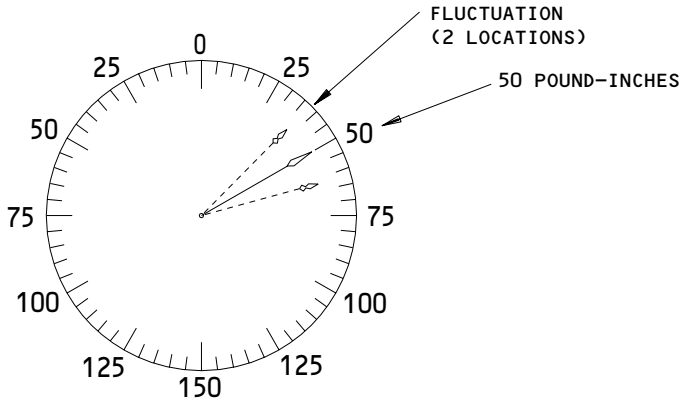
BACS13BX (TWO GROOVES)

TUBE SIZE	DEPTH 2A – INCHES	
	MINIMUM	MAXIMUM
04	0.020	0.032
05	0.020	0.032
06	0.020	0.032
08	0.020	0.032
10	0.022	0.034
12	0.026	0.038
16	0.028	0.040
20	0.026	0.042
24	0.026	0.042

BACS13BX SWAGE
GROOVE DEPTH LIMITS

NOTE: ALL DIMENSIONS ARE IN INCHES.

Groove Depth Measurement for BACS13BX Sleeves
Figure 816



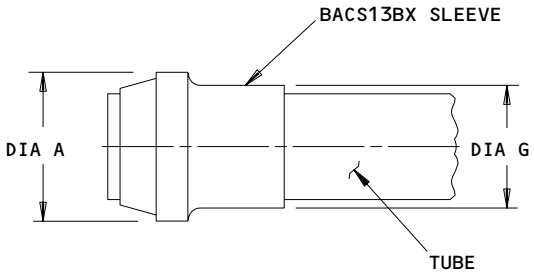
TORQUE WRENCH DIAL - PROCEDURE TO READ TORQUE

TUBE SIZE	MATERIAL WALL THICKNESS - INCHES		SWAGE TORQUE (POUNDS-INCH)	
	3AL-2.5V TITANIUM 1	21Cr-6Ni-9Mn CRES 2	MIN	MAX
04	0.016	0.016	4	5
06	0.019	0.020	12	15
08	0.026	0.026	20	25
10	0.032	0.033	40	45
12	0.039	0.039	40	45
16	0.051	0.052	80	85

SWAGER TORQUES NECESSARY TO ROLLER SWAGE BACS13BX SLEEVES
TO Ti-3AL-2.5V CWSR OR 21-6-9 CRES TUBE USING HARRISON 6633K01
ROLLER SWAGING KIT

1 AS SPECIFIED IN SPECIFICATION AMS 4945/BMS 7-234
2 AS SPECIFIED IN SPECIFICATION BMS 7-185

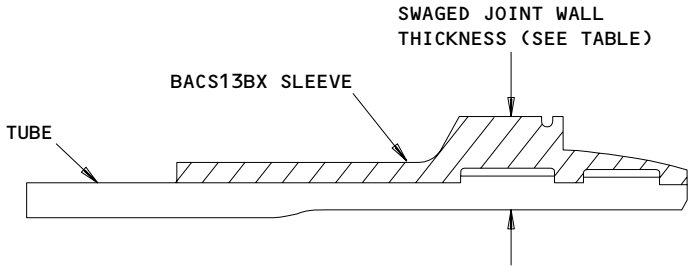
Swage Torques, Sleeve Dimensions, and Wall Thicknesses for Roller Swaging
Figure 817 (Sheet 1)



DIAMETER	TUBE SIZE					
	04	06	08	10	12	16
A MAX	0.374	0.493	0.673	0.789	0.964	1.214
G MAX	0.298	0.423	0.550	0.686	0.822	1.070

MAXIMUM PERMITTED SHOULDER AND SKIRT DIAMETERS (INCH)

Swage Torques, Sleeve Dimensions, and Wall Thicknesses for Roller Swaging
Figure 817 (Sheet 2)



SECTION OF ROLLER SWAGED JOINT

TUBE SIZE	TUBE DIMENSIONS "NOMINAL" WALL THICKNESS - INCHES 4		SWAGED JOINT WALL THICKNESS FOR "NOMINAL" TUBE WALLS - INCHES 3	
	Ti-3AL-2.5V	21-6-9 CRES		
04	0.016	0.016	0.068	TOLERANCE +0.002 -0.003
06	0.019	0.020	0.066	
08	0.026	0.026	0.100	
10	0.032	0.033	0.101	
12	0.039	0.039	0.132	
16	0.051	0.052	0.143	

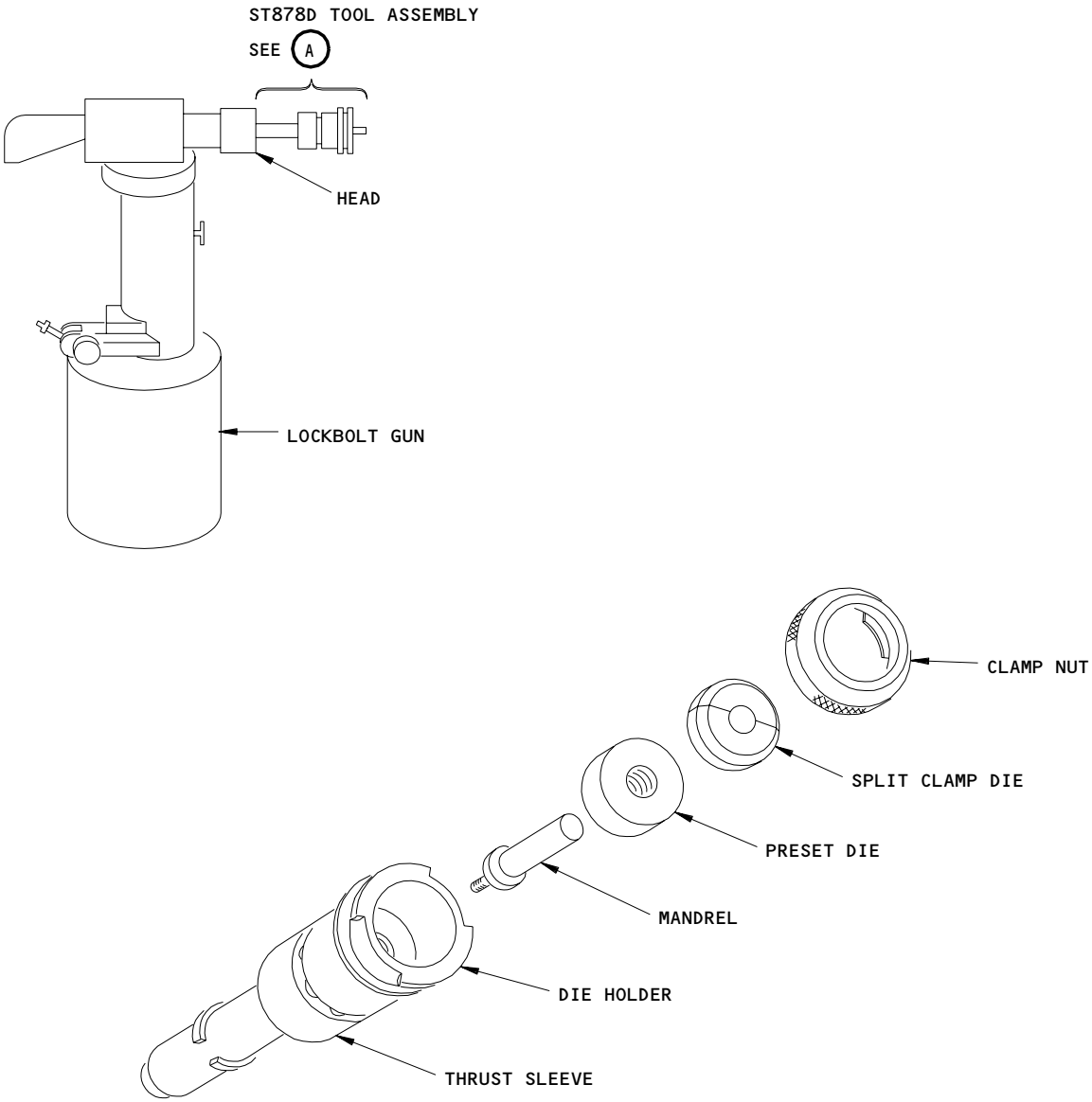
SWAGED JOINT WALL THICKNESS SPECIFICATION 3 4

3 "NOMINAL" WALL THICKNESS DEFINITION: TUBE WALL THICKNESS WITHOUT TOLERANCES AS SPECIFIED BY TUBE SPECIFICATION: AMS 4945 FOR Ti-3AL-2.5V AND BMS 7-185 FOR 21-6-9 CRES.

4 IF THE THICKNESS OF A MEASURED TUBE WALL IS DIFFERENT THAN THE "NOMINAL", ADD OR SUBTRACT THE DIFFERENCE FROM THE NECESSARY SWAGED JOINT WALL THICKNESS FOR "NOMINAL" TUBE WALLS.

EXAMPLE: 1. MEASURED 10 SIZE TITANIUM 3AL-2.5V TUBE WALL = 0.035 INCH
2. WALL DIFFERENCE IS 0.035 INCH, MINUS 0.032 INCH = 0.003 INCH
3. ADD 0.003 INCH TO 0.101 INCH = 0.104 INCH

Swage Torques, Sleeve Dimensions, and Wall Thicknesses for Roller Swaging
Figure 817 (Sheet 3)



ST878D TOOL ASSEMBLY

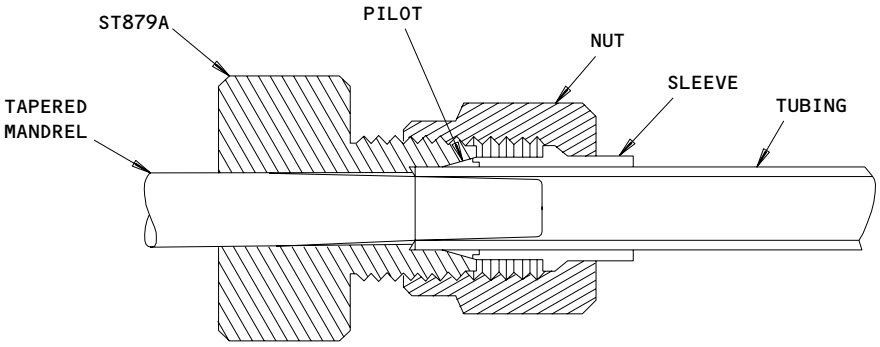
A

Preset Pressures (PSI) for the Cherry G-85 Lockbolt Gun
with ST878D Presetting Tool Assembly (BACS13AP Sleeves)
Figure 818 (Sheet 1)

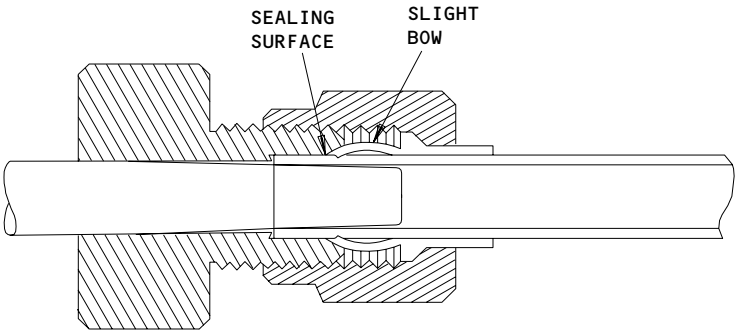
TUBE SIZE	WALL THICKNESS	TOOL NO.	RECOMMENDED AIR PRESSURE (PSI)	
			ALUMINUM	STEEL
			6061-T6	AISI 304-1/8 HARD
3/16	0.020-0.035	ST878D-3-020 ST878D-3-035	22.5	30.0
1/4	0.020-0.035	ST878D-4-020 ST878D-4-035	27.5	40.0
5/16	0.020-0.035	ST878D-5-020 ST878D-5-035	30.0	40.0
3/8	0.020-0.035	ST878D-6-020 ST878D-6-035	30.0	52.5
1/2	0.028-0.035	ST878D-8-028 ST878D-8-035	42.5	75.0
5/8	0.028-0.083	ST878D-10-028 ST878D-10-083	50.0	80.0
3/4	0.020-0.049	ST878D-12-020 ST878D-12-049	52.5	85.0

NOTE: ALL DIMENSIONS ARE IN INCHES.

Preset Pressures (PSI) for the Cherry G-85 Lockbolt Gun
with ST878D Presetting Tool Assembly (BACS13AP Sleeves)
Figure 818 (Sheet 2)

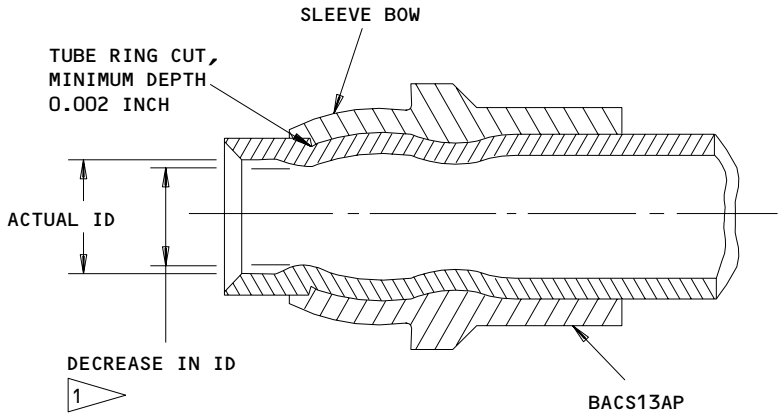


BEFORE PRESET BY HAND

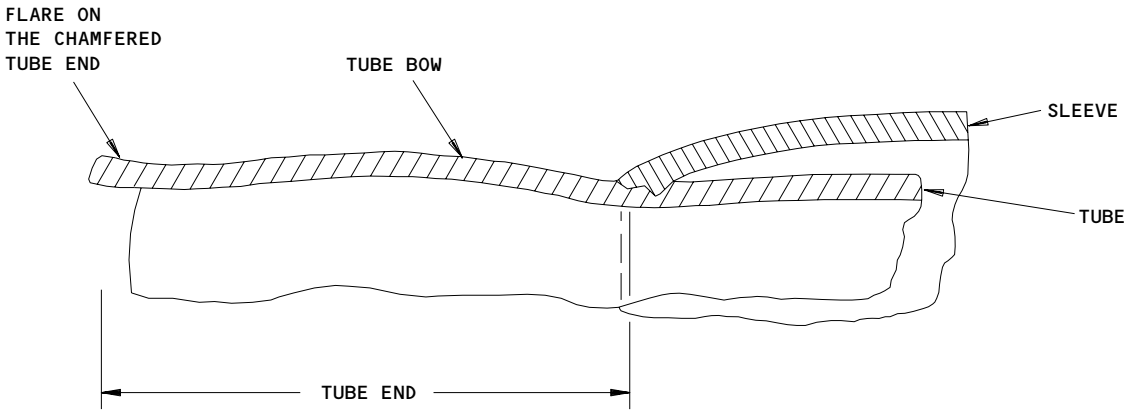


AFTER PRESET BY HAND

Preset by Hand with Preset Tool ST879A
Figure 819



ASSEMBLED AND PRESET SLEEVE



TUBE END DEFORMATION

1 MAKE SURE THE ID DOES NOT DECREASE MORE THAN 0.005 INCH AFTER PRESET OR 0.015 INCH AFTER YOU TIGHTEN MANY TIMES.

Properties of Preset BACS13AP Flareless Sleeve/Tube End
Figure 820

TUBE OD		1/4	5/16	3/8	1/2	5/8	3/4	1	1-1/4
Wall Thickness	304	0.020	0.020	0.028	0.035	0.049	0.058	N/A	N/A
	21-6-9	0.016	0.020	0.020	0.026	0.033	0.039	N/A	N/A
Procedure A 2 (Displacement, Turns)		1-1/6	1-1/6	1-1/6	1-1/6	1-1/6	1-1/6	N/A	N/A
Procedure B (Torque) Pound-Inches 3	304	145	200	290	545	780	900	N/A	N/A
	21-6-9	145	200	290	545	780	1200	N/A	N/A

NOTE: ALL DIMENSIONS ARE IN INCHES.

HAND PRESETTING FLARELESS FITTINGS - NO MANDREL 1
(STEEL TUBING)
TABLE A

TUBE OD		1/4	5/16	3/8	1/2	5/8	3/4	1	1-1/4
Wall Thickness	6061-T6	0.035	0.035	0.035	0.035	0.035	0.035	N/A	N/A
Procedure A 2 (Displacement, Turns)		1-1/6	1-1/6	1-1/6	1	1	1	N/A	N/A
Procedure B (Torque) Pound-Inches 3	6061-T6	110	140	170	280	360	450	N/A	N/A

NOTE: ALL DIMENSIONS ARE IN INCHES.

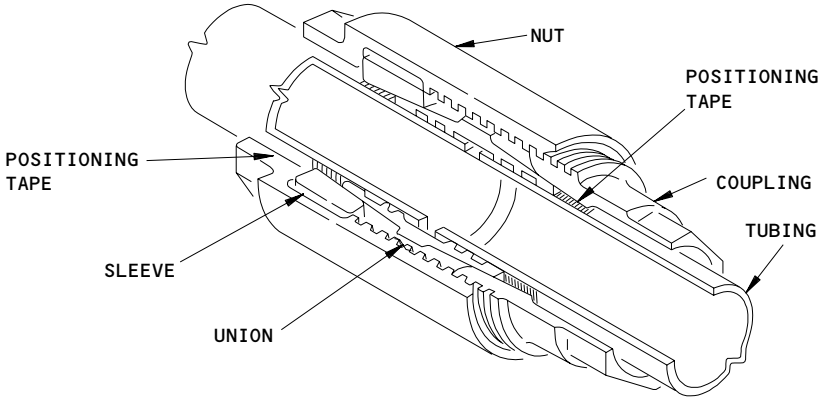
HAND PRESETTING FLARELESS FITTINGS - NO MANDREL 1
(ALUMINUM TUBING)
TABLE B

1 USE AN INTERNAL MANDREL PRESET TOOL ON TUBES WITH THINNER WALLS (REFER TO ST879A). WHEN IN DOUBT, MAKE A TEST PRESET TO MAKE SURE THE RING CUT MINIMUM DEPTH IS 0.002 INCH.

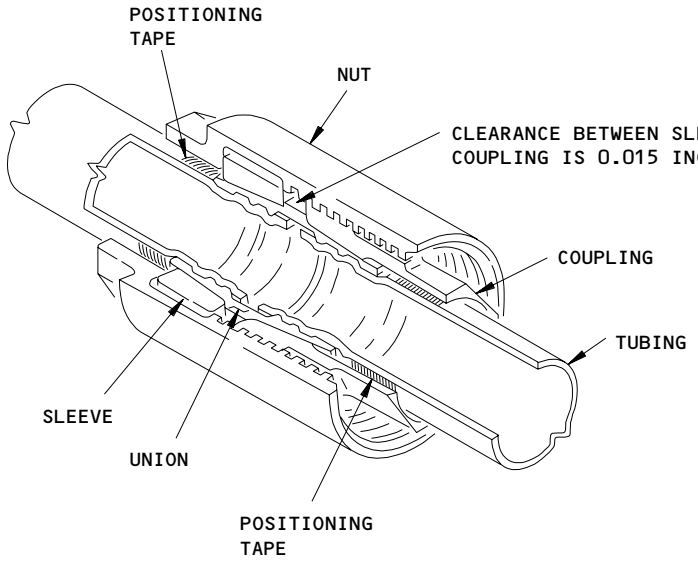
2 MEASURE DISPLACEMENT FROM THE POINT WHERE THE FITTING, SLEEVE, AND NUT ARE FIRMLY HAND-TIGHTENED, AND A WRENCH IS NECESSARY TO FURTHER TIGHTEN.

3 APPLY TORQUE, LOOSEN, AND APPLY INDICATED TORQUE THREE TIMES.

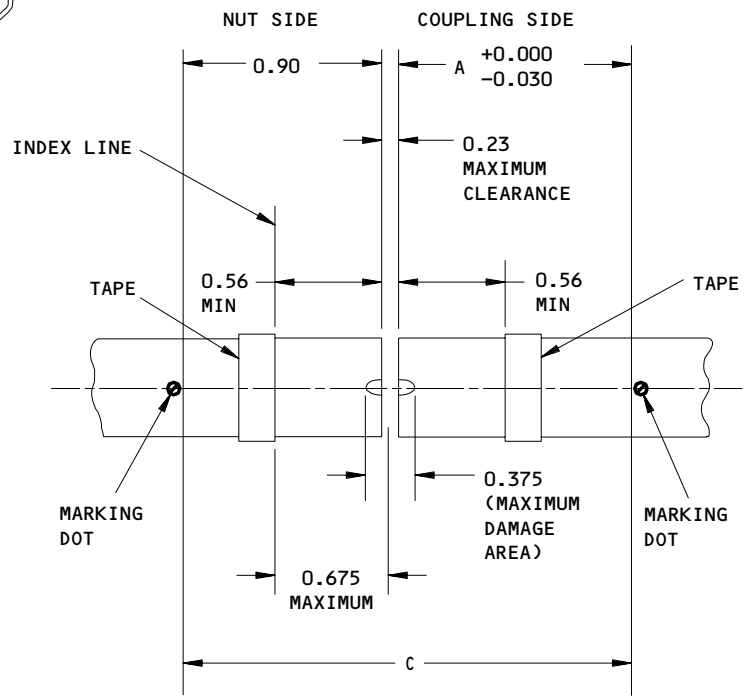
Displacement Turns and Torque Values for Hand Preset of Flareless Sleeves
Figure 821



H-COUPLING
(BEFORE INSTALLATION)



H-COUPLING
(INSTALLED, TIGHTENED)

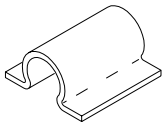


TUBE SIZE	DIMENSION A
04 THRU 10	1.440
12 THRU 16	1.740

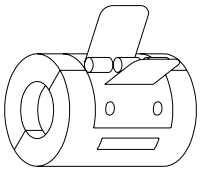
NOTE: USE THESE DIMENSIONS TO FIND DIMENSION C.

ALL DIMENSIONS ARE IN INCHES.

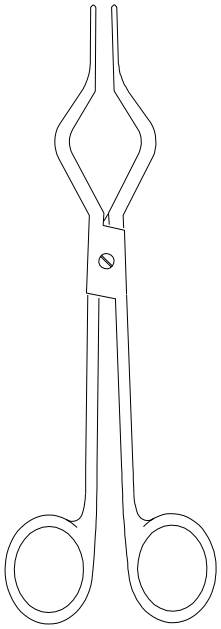
H-Coupling Installation
Figure 822



SNAP–ON
INTALLATION STOP

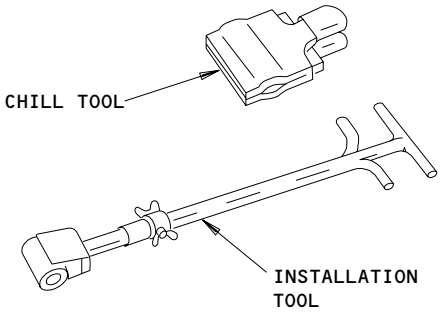


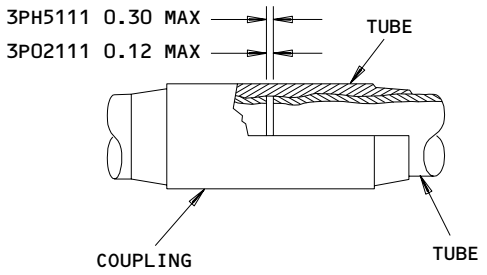
EXTENDED TIME TOOL



TONGS

O–RINGS INSTALLATION STOP

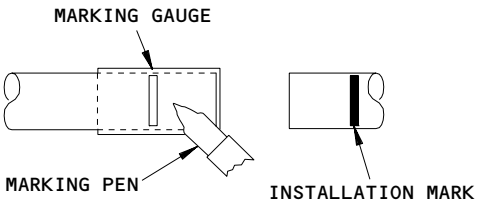




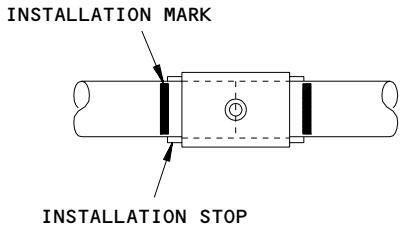
CRYOFIT COUPLING INSTALLATION

NOTE: CRYOFIT KITS INCLUDE ADDITIONAL ITEMS.

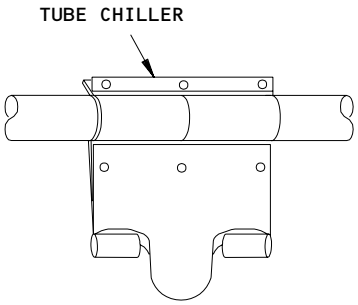
Cryofit Coupling 3PO2111 and 3PH5111 Repair
Figure 823 (Sheet 1)



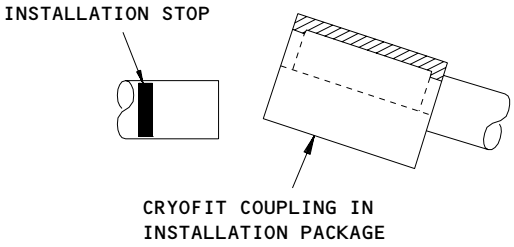
APPLICATION OF INSTALLATION MARK



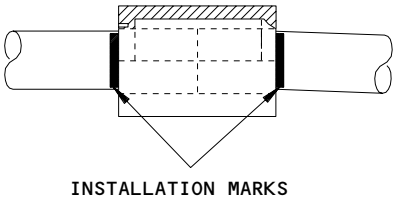
INSTALLATION STOP



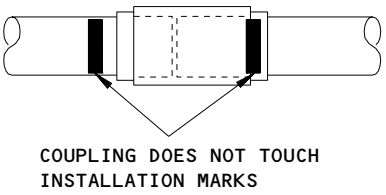
TUBE CHILLER APPLICATION



CORRECT POSITIONING OF
CROFIT FITTING ON TUBE



ACCEPTABLE



UNACCEPTABLE

POSITION OF INSTALLED FITTING ON TUBE

NOTE: CRYOFIT KITS INCLUDE ADDITIONAL ITEMS.

Cryofit Coupling 3PO2111 and 3PH5111 Repair
Figure 823 (Sheet 2)

DMC PART NO.	FITTING MATERIAL	FOR USE WITH TUBE MATERIAL	APPROVED TUBE SIZES OD/WALL						
			04	06	08	10	12	16	20
D10282-() 1	21-6-9 Cres	21-6-9 Cres	0.016	0.020	0.026	0.033	0.039	0.052	--
		3AL-2.5V Ti	0.016	0.019	0.026	0.032	0.039	0.051	0.074
		304-1/8 Hard Cres (MIL-T-6845)	0.020	0.028	0.035	0.049	0.058	0.065	--
D10282D() 1	6061T6 Al	6061T6 Al (MIL-T-7081)	0.035	0.035	0.035	0.035	0.035	0.035	0.049

TABLE A

BOEING PART NO.	FITTING MATERIAL	FOR USE WITH TUBE MATERIAL	APPROVED TUBE SIZES OD/WALL						
			04	06	08	10	12	16	20
BACU24BS (SIZE) (SIZE) J 1	21-6-9 Cres	21-6-9 Cres	0.016	0.020	0.026	0.033	0.039	0.052	--
		3AL-2.5V Ti	0.016	0.019	0.026	0.032	0.039	0.051	0.074
		304-1/8 Hard Cres (MIL-T-6845)	0.020	0.028	0.035	0.049	0.058	0.065	--
BACU24BS (SIZE) (SIZE) D 1	6061T6 Al	6061T6 Al (MIL-T-7081)	0.035	0.035	0.035	0.035	0.035	0.035	0.049

TABLE B

Approved Fitting/Tube Material Combinations for Repair with Permaswage Unions
Figure 824 (Sheet 1)

NOTE: Material code (J) with the Boeing part number or no material code (–) with the DMC part number indicates 21–6–9 cres fitting with two internal grooves on each end, one each filled with silicone. Material code D on either the Boeing or DMC part number indicates 6061T6 aluminum fitting with two internal groves on each end, all filled with silicone.

Aluminum unions without all grooves filled with the silicone sealant are not approved for Boeing airplanes.

1 A BOEING STANDARD FOR AN EXTERNALLY SWAGED UNION – BACU24BS (SIZE)(SIZE) MATERIAL) – BASED ON THE DMC PERMASWAGE D10282 UNION HAS BEEN DEVELOPED BY BOEING FOR USE ON THE 777 AIRPLANE. THE BACU24BS (SIZE)(SIZE) J UNION (BOTH SIZES THE SAME) AND THE D10282–(SIZE) UNION ARE INTERCHANGEABLE. IN ADDITION, THE BACU24BS (SIZE)(SIZE) D UNION (BOTH SIZES THE SAME) AND D10282D (SIZE) D UNION ARE INTERCHANGEABLE.

THE CORROSION RESISTANT STEEL D10282–(SIZE) AND ALUMINUM D10282D(SIZE) PER–MASWAGE UNIONS ARE IMPROVED REPLACEMENTS FOR THE STANDARD CORROSION RESISTANT STEEL D10036D (SIZE) AND ALUMINUM D10036D (SIZE) UNIONS, RESPECTIVELY. THE D10036 UNIONS ARE FUNCTIONALLY INTERCHANGEABLE WITH THE D10282 UNIONS.

BACU24BS (SIZE)(SIZE) J – (BOTH SIZES THE SAME), BACU24BS (SIZE)(SIZE) D – (BOTH SIZES THE SAME), D10282–(SIZE) AND D10282D (SIZE) UNIONS ARE NOT SHOWN IN DMC CATALOGS, BUT YOU CAN MAKE AN ORDER DIRECTLY TO DESIGNED METAL CONNECTIONS, 14800 SOUTH FIGUEROA ST., LOS ANGELES, CA 90248.

Approved Fitting/Tube Material Combinations for Repair with Permaswage Unions
Figure 824 (Sheet 2)

TUBE SIZE	SWAGE TOOL ASSEMBLY	SWAGE HEAD ASSEMBLY	POWER UNIT	INSPECTION GAGE
04	DLT05PSKT3000	DLT05PSHA3004	DLT05MAPW0000	D12-9892-04
06	DLT10PSKT3000	DLT10PSHA3006	DLT10MAPW0000	D12-9892-06
08	DLT20PSKT3000	DLT20PSHA3008	DLT20MAPW0000	D12-9892-08
10		DLT20PSHA3010		D12-9892-10
12	DLT30PSKT3000	DLT30PSHA3012	DLT30MAPW0000	D12-9892-12
16	DLT40PSKT3302	DLT40PSHA4016	DLT40MAPW0000	DNR9892-016
20	DLT40PSKT3003	DLT40PSHA3020	DLT40MAPW0000	D12-9892-20

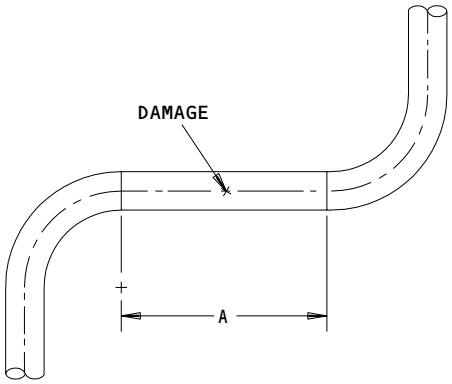
NOTE: One of the following pumps is necessary to actuate the power units:

- DTL02MAPP1000 pneumatic pump 10,000 psi
- DLT05MAPM1000 manual pump 10,000 psi

DMC LIGHTWEIGHT TOOLS

Swage and Inspection Tool Part Numbers
Figure 825

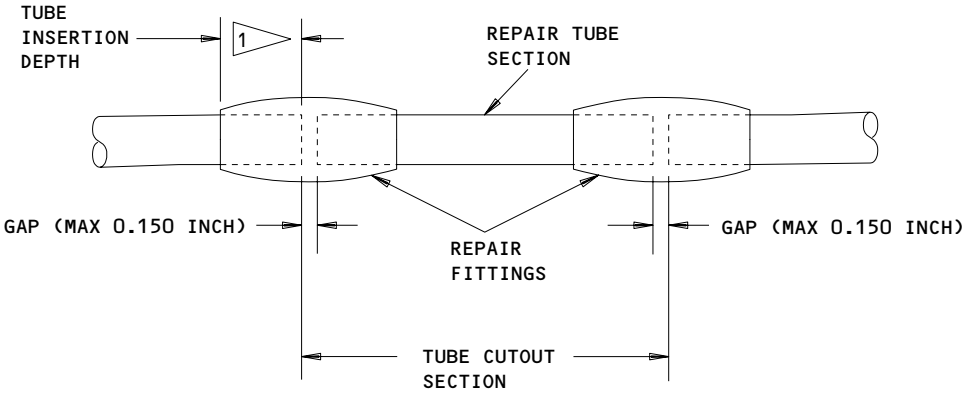
L21727



SIZE	TUBE SIZE						
	04	06	08	10	12	16	20
Fitting length	1.540/ 1.530	1.690/ 1.680	2.700/ 2.686	2.780/ 2.766	2.920/ 3.906	3.209/ 3.195	3.664/ 3.650
A tube length (min)	2.15	2.30	3.30	3.40	3.55	3.80	4.30

NOTE: ALL DIMENSIONS ARE IN INCHES.

Minimum Straight Length for Permaswage Fitting Installation
Figure 826



MATERIAL	TUBE SIZE						
	04	06	08	10	12	16	20
Cres/Ti	0.02	0.02	0.03	0.04	0.057	0.049	0.05
Al	None	0.04	0.06	0.06	0.061	0.048	0.06

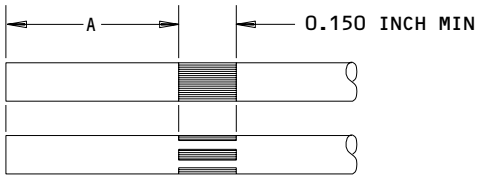
SWAGE GROWTH VALUES (INCH)

1 THE A DIMENSION IS SHOWN IN FIG. 829.

Tube Splice Repair
Figure 827

MATERIAL SURFACE	PROCEDURE TO CLEAN TUBE
Bare or alodine	Solvent clean
Anodize	Hand apply abrasive material, 180-grit or finer: • Fed Spec P-P-121 • Fed Spec P-C-451 • Abrasive Scotch Brite, Type A
Primer/paint	1. Hand apply abrasive material, 240-grit or finer 2. Lacquer thinner (refer to TT-T-266) (flammable) MEK (refer to TT-T-261) (flammable) for primed surfaces (MIL-P-6889) and lacquer base paint/enamel

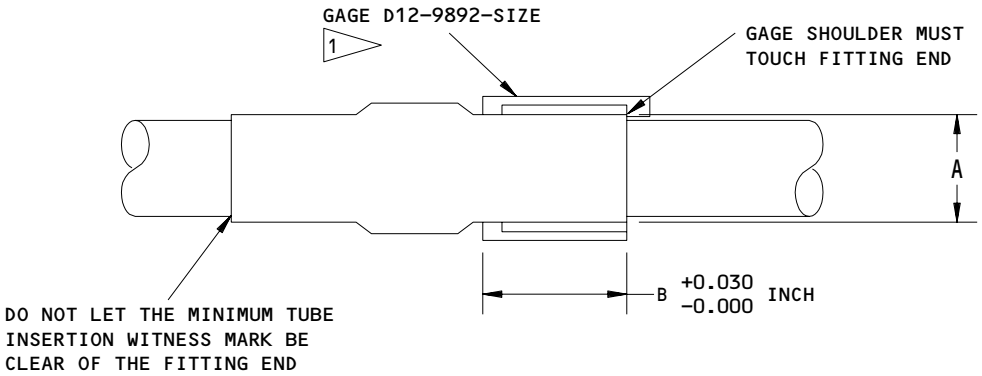
Cleaning and Paint Removal Procedures for Aluminum Tubes
FIgure 828



DIMENSION (FIG. 827)	TUBE SIZE AND INSERTION DEPTH – INCHES					
	04	06	08	10	12	16
A	0.69	0.77	1.27	1.31	1.38	1.52

MARK FOR THE MINIMUM TUBE INSERTION DEPTHS

Witness Mark Location and Usual Marking Procedures
Figure 829

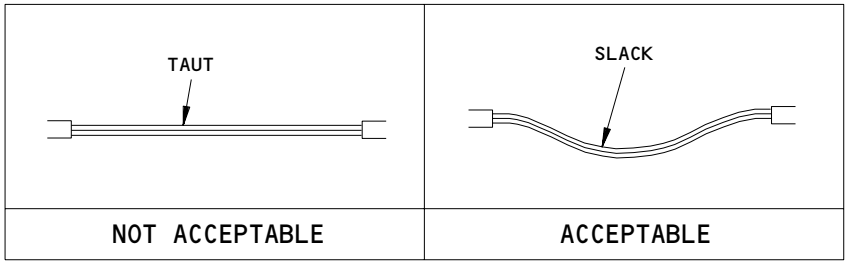


TUBE DIAMETER (INCHES)	SWAGED DIAMETER MAX A DIMENSIONS (INCHES)	SWAGED LENGTH MIN B DIMENSIONS (INCHES)
1/4 (04)	0.315	0.46
3/8 (06)	0.447	0.53
1/2 (08)	0.606	1.02
5/8 (10)	0.735	1.02
3/4 (12)	0.863	1.02
1 (16)	1.181	1.406
1-1/4 (20)	1.390	1.406

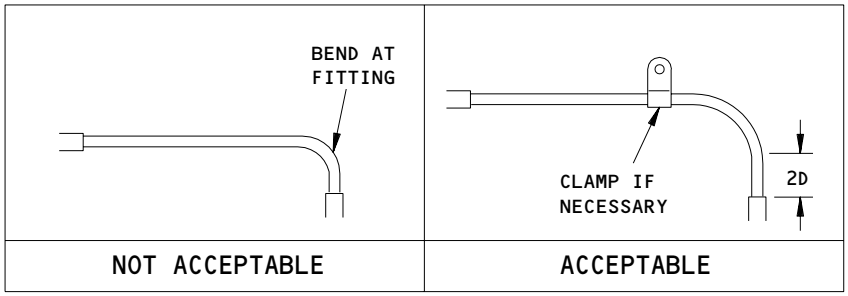
AFTER SWAGE DIMENSIONS (INCH)

1 USE DNR9892-016 FOR SIZE 16.

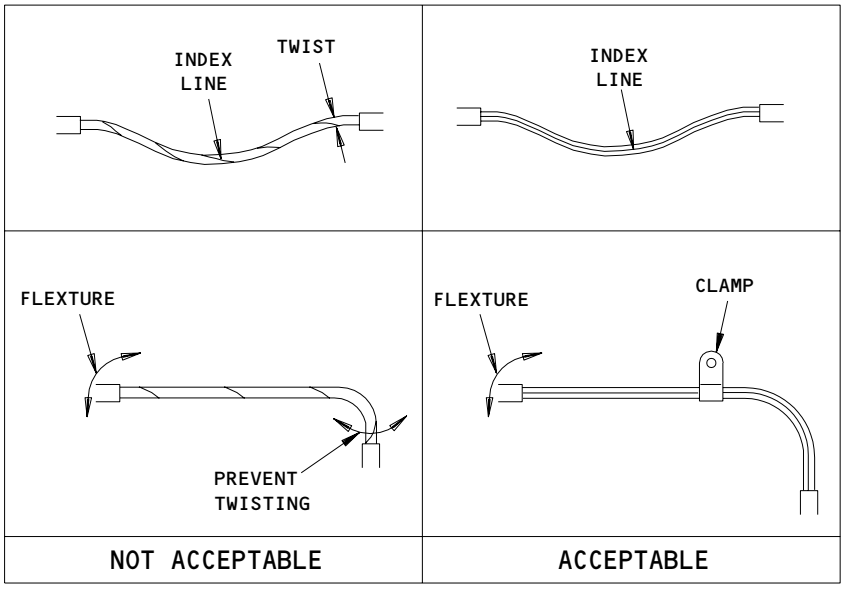
Final Swage Dimensions
Figure 830



SLACK

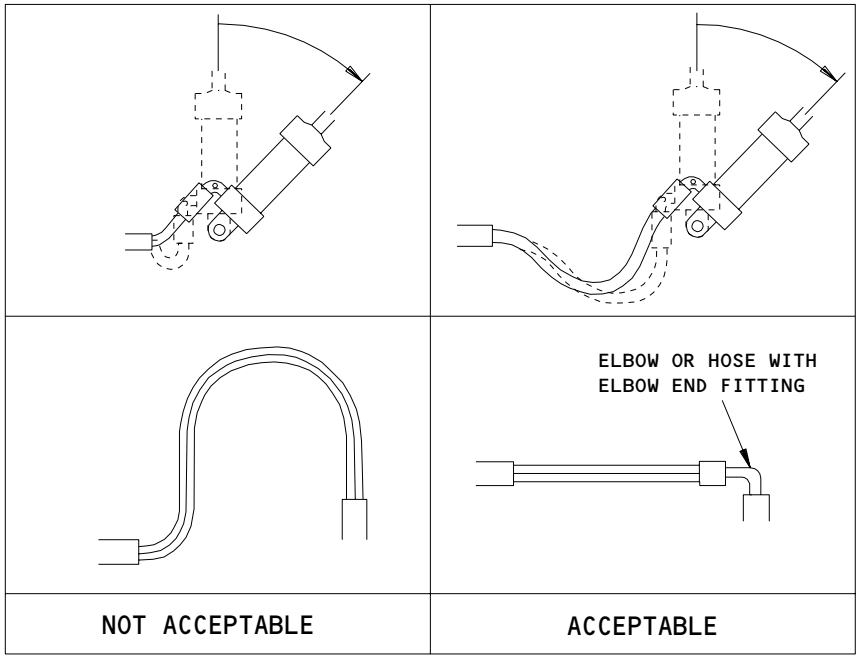


FLEX

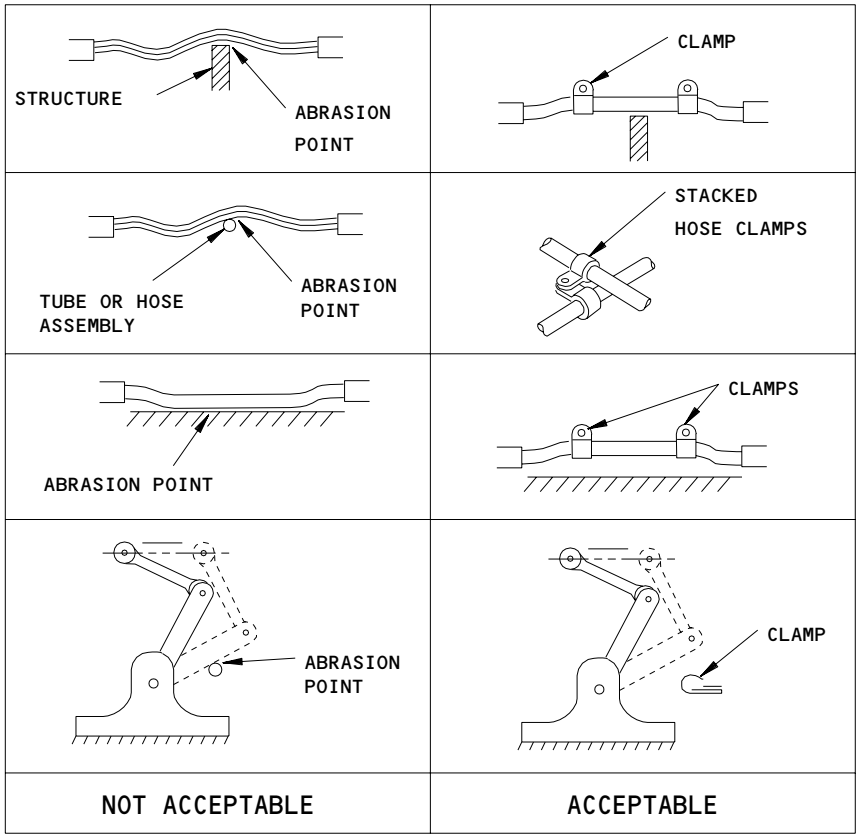


TWISTING

Hydraulic Tubing Repair with Flexible Hose
Figure 831 (Sheet 1)

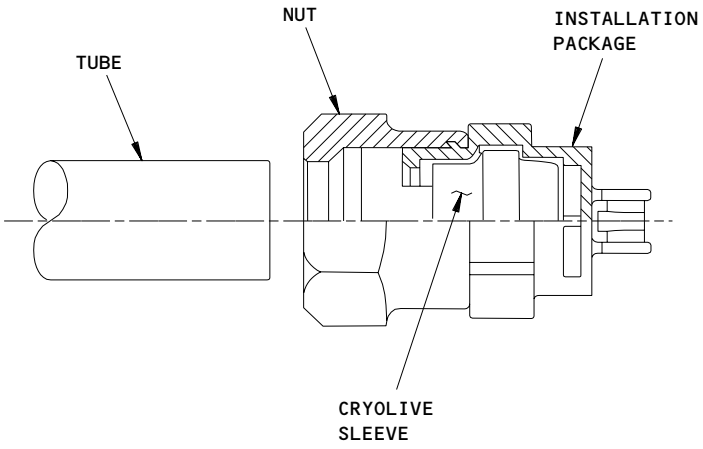


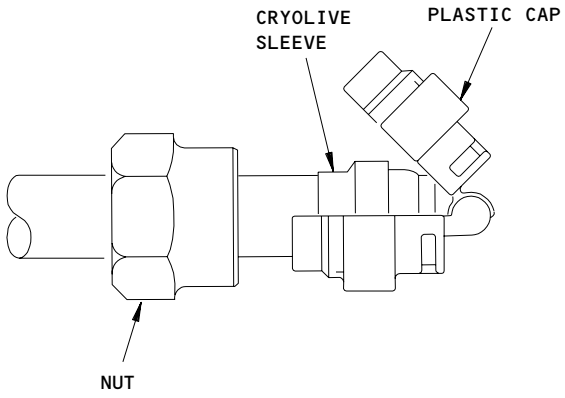
BENDING



CLEARANCE

Hydraulic Tubing Repair with Flexible Hose
Figure 831 (Sheet 2)





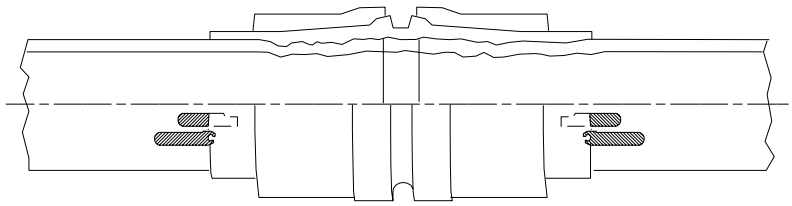
NOTE: REMOVAL OF PLASTIC CAP AFTER INSTALLATION.

CRYOLIVE Flareless Sleeve Assembly
Figure 832

TUBE SIZE	COUPLING NUT MATERIAL	COMBINATION - SLEEVE/COUPLING NUT/PLASTIC CAP PART NO. *
04	304 Cres 7075-T73 Al 6Al-4V Ti	921721J04 921721W04 921721T04
06	304 Cres 7075-T73 Al 6Al-4V Ti	921721J06 921721W06 921721T06
08	304 Cres 7075-T73 Al 6Al-4V Ti	921721J08 921721W08 921721T08
10	304 Cres 7075-T73 Al 6Al-4V Ti	921721J10 921721W10 921721T10
12	304 Cres 7075-T73 Al 6Al-4V Ti	921721J12 921721W12 921721T12
16	304 Cres 7075-T73 Al 6Al-4V Ti	921721J16 (Combination Not Approved) 921721T16

* DO NOT REPLACE COUPLING NUTS INCLUDED WITH THE CRYOLIVE FLARELESS SLEEVE/COUPLING NUT/PLASTIC CAP COMBINATIONS. USE ONLY THE COUPLING NUT PROVIDED WITH THE ASSEMBLY.

Approved CRYOLIVE Flareless Sleeve/Coupling Nut/Plastic Cap Combinations
Figure 833



Rynglok Tube to Tube Union
Figure 834

L21744

AEROQUIP PART NUMBER	FOR USE WITH TUBE MATERIALS	APPROVED TUBE SIZES OD/WALL						
		04	06	08	10	12	16	20
R80101T(-) (TITANIUM MATERIAL)	21-6-9 CRES	0.016	0.020	0.026	0.033	0.039	0.052	N/A
	304 1/8 HARD CRESS (MIL-T-6845)	0.020	0.028	0.035	0.049	0.058	0.065	N/A
	6061-T6 AL (MIL-T-7081) or AMS 4083	0.035	0.035	0.035	0.035	0.035	0.035	0.035
	3AL-2.5V TITANIUM	0.016	0.019	0.026	0.032	0.039	0.051	N/A

Approved Fitting/Tube Material Combinations for Repair with Rynglok Unions
Figure 835

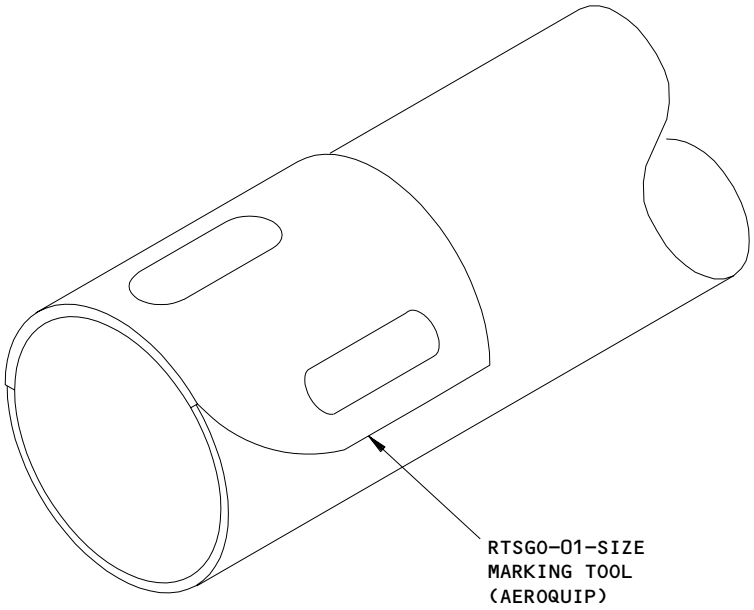
TUBE DASH NUMBER	TUBE OUTER DIAMETER (IN)	MINIMUM REMOVED TUBE SECTION (IN)
04	0.250	2.38
06	0.375	2.64
08	0.500	2.92
10	0.625	3.18
12	0.750	3.56
16	1.000	4.15
20	1.250	4.81

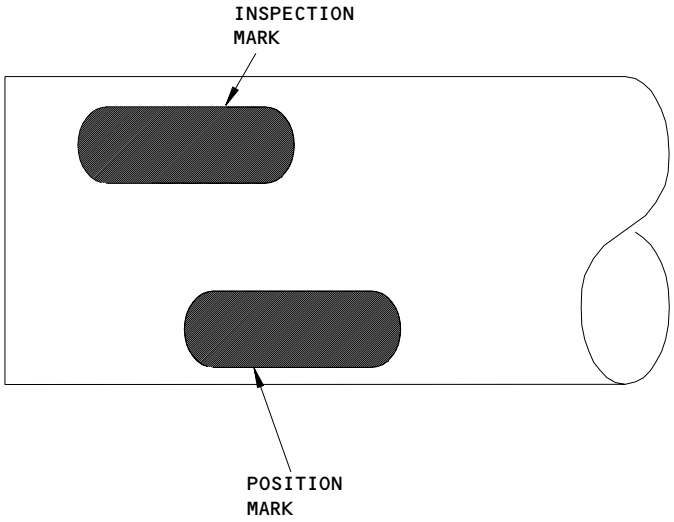
Splice Repair with More Than One Rynglok Tube to Tube Union–
Minimum Removed Tube Section
Figure 836

TUBE SIZE	TOOL NUMBER FOR EACH TUBE SIZE	INSP. GAGE P/N
04	RTST8-02-04	RTSG-051-04
06	RTST8-02-06	RTSG-051-06
08	RTST8-02-08	RTSG-051-08
10	RTST8-02-10	RTSG-051-10
12	RTST8-02-12	RTSG-051-12
16	RTST8-02-16	RTSG-051-16
20	RTST8-02-20	RTSG-051-20

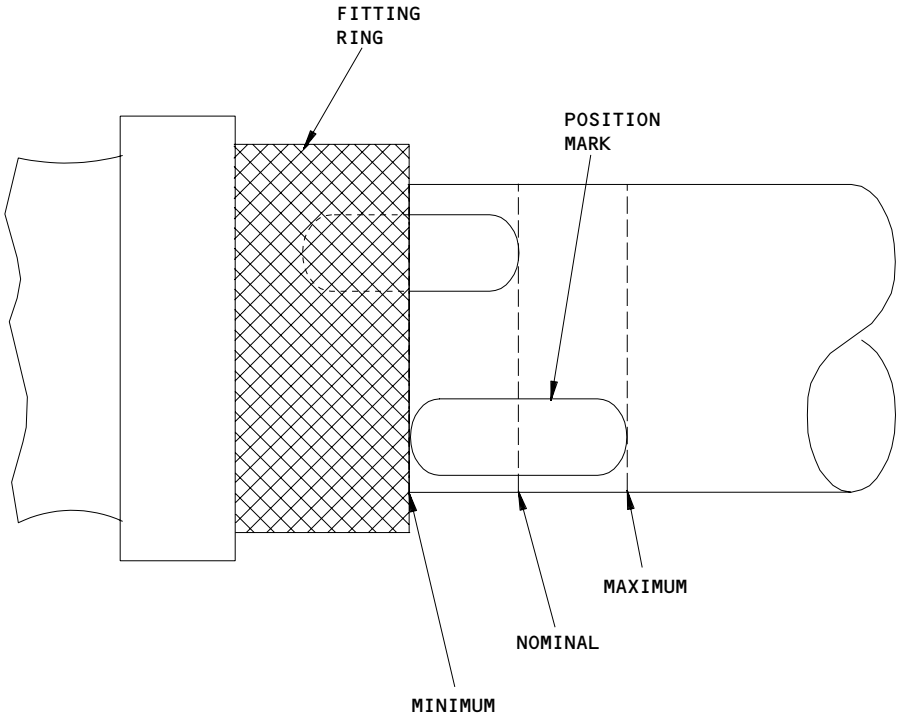
AEROQUIP TOOL KIT NUMBER
RTSK8-02-006 (COVERS TUBE SIZES 04 THROUGH 20)

Rynglok Repair Fittings Swage and Inspection Tool Part Numbers
Figure 837

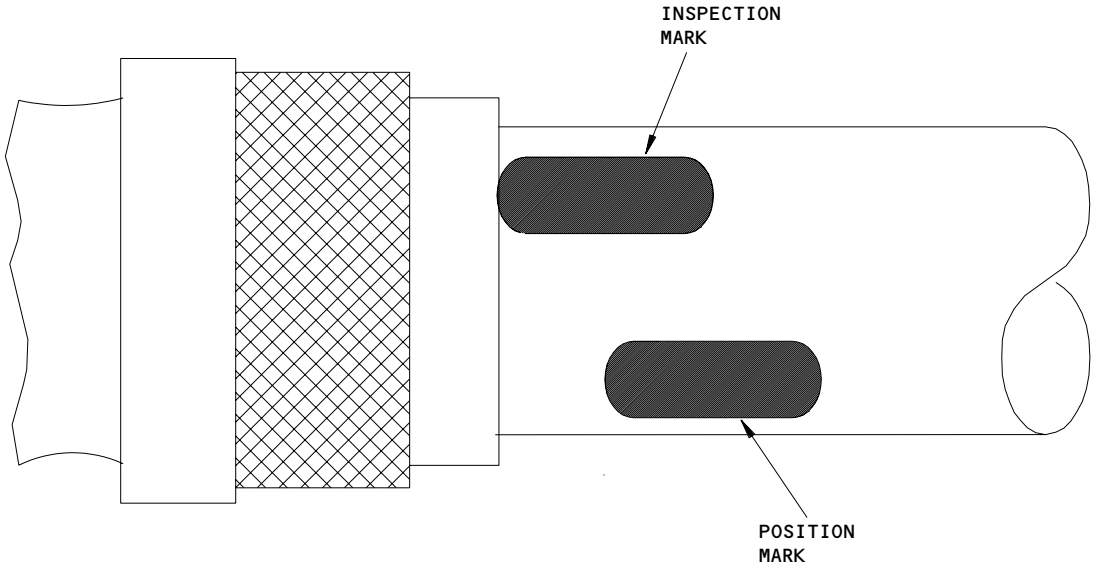




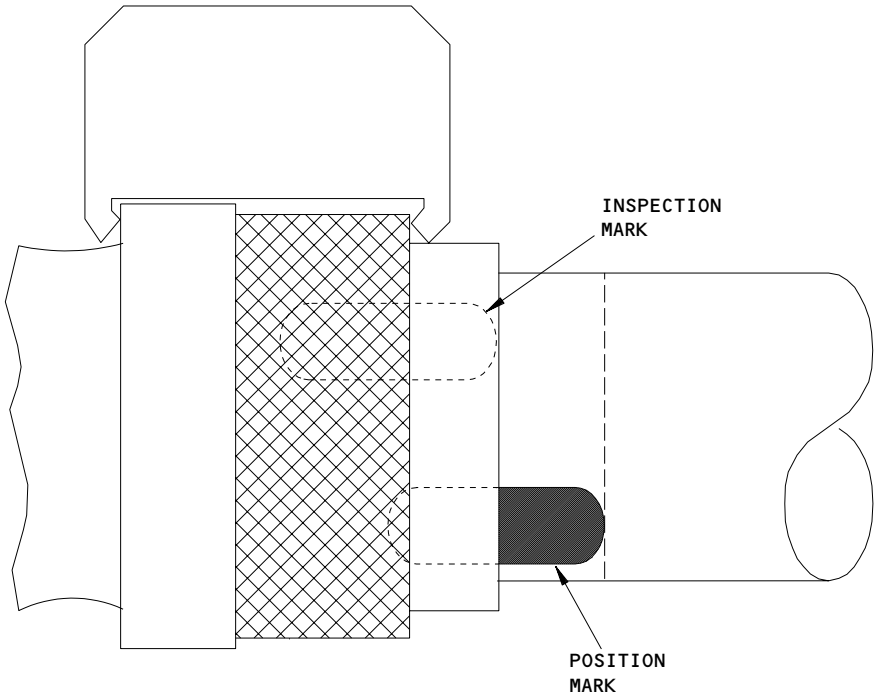
Mark Location During Rynglok Fitting Installation
Figure 838



Fitting Position for Tube Insertion
Figure 839



MINIMUM INSPECTION MARK AFTER SWAGING

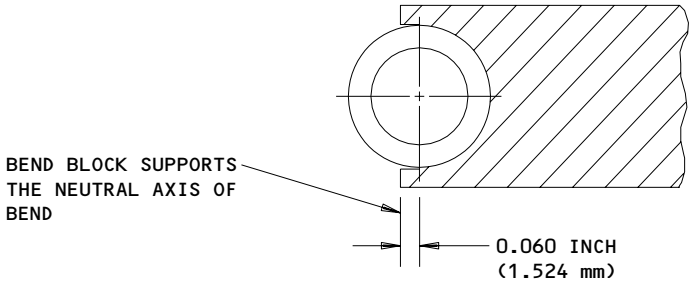


MAXIMUM INSPECTION MARK AFTER SWAGING

Use of Inspection Gage After Swage of Rynglok Fittings
Figure 840

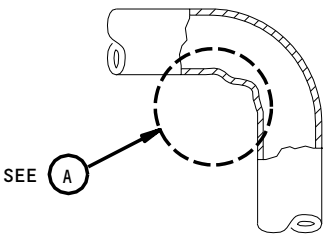
CONDUIT SIZE (OD) INCH (mm)	MAXIMUM DENT DEPTH INCH (mm)
0.25 (6.35)	0.050 (1.27)
0.31 (7.87)	0.063 (1.60)
0.38 (9.65)	0.075 (1.90)
0.50 (12.70)	0.100 (2.54)
0.63 (16.00)	0.125 (3.17)
0.75 (19.05)	0.150 (3.81)
0.88 (22.85)	0.175 (4.45)
1.00 (25.40)	0.200 (5.08)
1.25 (31.75)	0.250 (6.35)
1.50 (38.10)	0.300 (7.62)
1.75 (44.45)	0.350 (8.89)
2.00 (50.80)	0.400 (10.16)

Smooth Dent Damage Limits for Electrical Rigid Conduits
Figure 841

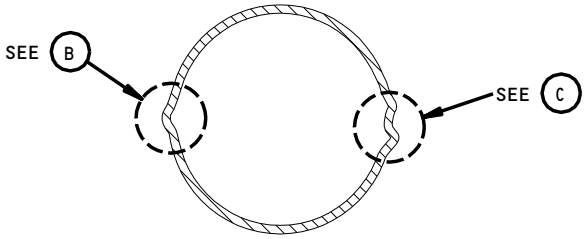


NOTE: IF THE OVALITY OF ANY PART OF THE BEND IS MORE THAN THE MAXIMUM PERMITTED OVALITY, DISCARD THE TUBE.

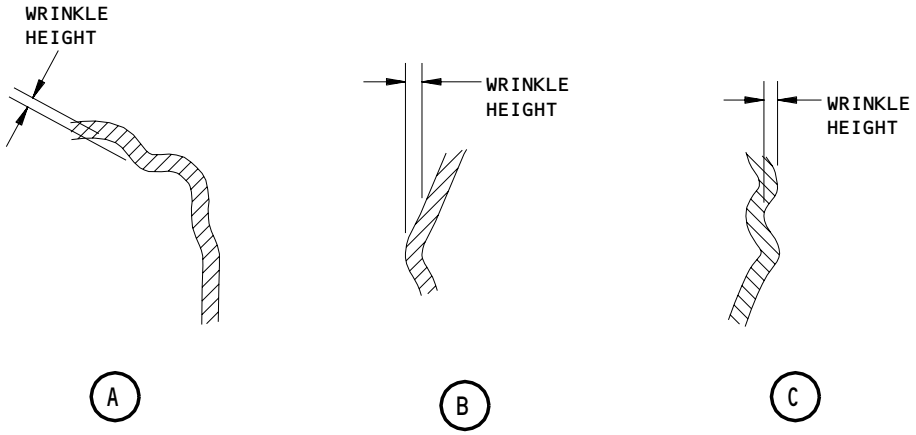
TUBE BEND BLOCK



RADIAL WRINKLE



LONGITUDINAL WRINKLE



WRINKLE MEASUREMENTS

Permitted Forming Limits for Electrical Rigid Conduits
Figure 842 (Sheet 1)

CONDUIT SIZE (OD)	CONDUIT MATERIAL	ALLOWABLE WRINKLE HEIGHT INCH (mm)	ALLOWABLE OVALITY (PERCENT OF SPECIFIED OD)
1.0 OR LESS	STAINLESS STEEL	0.040 (1.016)	10
	ALUMINUM ALLOY	0.020 (0.508)	10
OVER 1.0	STAINLESS STEEL	0.060 (1.524)	10
	ALUMINUM ALLOY	0.030 (0.762)	10

Permitted Forming Limits for Electrical Rigid Conduits
Figure 842 (Sheet 2)

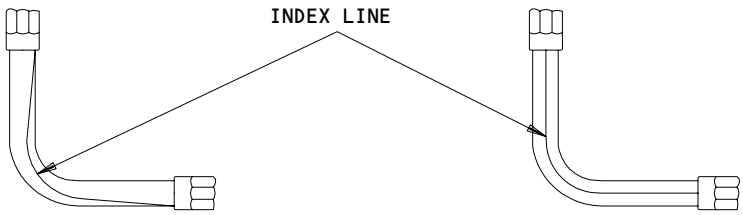
L99161

FLEXIBLE HOSE - INSTALLATION

TASK 20-10-10-404-001

1. Install the Flexible Hose (Fig. 401)
   A. General
      (1) This procedure contains one task. The task is the installation of flexible hoses.
      (2) This procedure gives general instructions for the installation of flexible hoses. If there are special instructions for a system, use the special instructions. For example, AMM 71-00-02/401, Power Plant - Removal/Installation includes special instructions for the installation of flexible hoses.
      (3) Flexible hoses do not have a specified life limit. Inspect flexible hoses to the applicable operators standard.
      (4) Before you do maintenance on oxygen system flexible hoses, read the oxygen system safety precautions and general maintenance instructions, (AMM 35-11-00) Crew Oxygen System, or (AMM 35-21-00) Passenger Oxygen System.
      (5) Make sure hose assemblies and mating connections have caps to keep out moisture, dirt, or other contaminants until the hose is connected to the airplane system.
   B. Consumable Materials
      (1) Thread Compound - Use one from Table 401.

Flexible Hose Assembly Thread Compounds Table 401	
TYPE OF SYSTEM	APPROVED THREAD COMPOUNDS (STRAIGHT THREAD FITTINGS)
Compressed Gas	Antiseize Compound BMS 3-28
Deicing or (Anti-icing)	
Instrument Air	Antiseize Compound BMS 3-28
Pneumatic	Antiseize Compound BMS 3-28, D00062 Pneumatic Grease MIL-G-4343
Air Conditioning	



Flexible Hose Installation
Figure 401

Flexible Hose Assembly Thread Compounds Table 401	
TYPE OF SYSTEM	APPROVED THREAD COMPOUNDS (STRAIGHT THREAD FITTINGS)
Fire Protection	Antiseize Compound BMS 3-28 or D00053 Grease MIL-G-6032
Coolant	
Water Injection	Antiseize Compound BMS 3-28
Fuel	D00070 Hydraulic Fluid MIL-H-5606
Lubrication	
Hydraulic MIL-H-5606	D00070 Hydraulic Fluid MIL-H-5606
Hydraulic BMS 3-11	D00054 Skydrol Assy Lube MCS 352B BMS 3-11
Hydraulic Tubing MIL-H-6083	D00070 Hydraulic Fluid MIL-H-5606 or D00106 Hydraulic Fluid MIL-H-6083
Misc Tubing	Antiseize Compound BMS 3-28 or D00053 Grease MIL-G-6032

C. Procedure

S 214-009

(1) Prior to hose installation do a visual check of the hose assembly to determine its condition.
   (a) Look at the hose, fittings, sealing surfaces and outer covering for damage.
   (b) Do the following if you find broken wires in the outer covering:
      1) Put a tag on the hoses that have isolated or random broken wires.

         NOTE: This is to identify the hose for future inspections.

2) Do not use the hose if two or more wires in one plait are broken, or if several wires are broken in a concentrated area.

S 214-002

(2) Make sure all fittings are clean and free of defects.

S 644-003

(3) Lubricate the external threads if necessary.

S 424-004

(4) Put the hose in position and tighten fittings hand tight.

S 214-005

(5) Make sure the installation is correctly aligned and is the correct length.

S 434-006

CAUTION: USE THE INDEX LINE ON THE SIDE OF THE HOSE TO FIND IF THE HOSE IS TWISTED. IF THE HOSE IS TWISTED, HOSE FAILURE OR HOSE COUPLING LEAKAGE COULD OCCUR BEFORE THE USUAL TIME.

(6) Tighten the pipe fitting ends. Refer to AMM 20-11-00/201 for the correct torque values.

S 434-007

(7) Tighten the coupling type ends (AMM 20-11-00/201). Use two wrenches to prevent twists in the hose.

S 424-008

CAUTION: MAKE SURE THERE IS SUFFICIENT CLEARANCE BETWEEN THE FLEXIBLE HOSE AND THE ADJACENT STRUCTURE AFTER YOU TIGHTEN THE CLAMPS. IF CLEARANCE IS NOT SUFFICIENT, THE HOSE COULD TOUCH THE ADJACENT STRUCTURE. THIS CAN CAUSE HOSE WEAR OR HOSE FAILURE BEFORE THE USUAL TIME.

(8) Clamp the hose as necessary.

FLUID LINE TUBING CLAMPS - REMOVAL/INSTALLATION

1. General
   A. This procedure contains one task. The task is the replacement of block clamps.
   B. Block clamps are used to hold fluid lines at a specified location.
   C. Loop-type cushioned tube clamps are used in the fluid line installations to prevent vibration and wear of lines.
      (1) Before you install a nylon loop clamp, make it larger to approximately 1-1/2 times the tube diameter. Do this three or four times to do a test for flexibility. If the clamp feels flexible and does not crack, you can install it.
   D. For removal/installation procedures of vee-band clamps, refer to (AMM 70-12-02/201).

TASK 20-10-11-964-001

2. Replacement of Block Clamps
   A. Consumable Materials
      (1) G00145 Tape - Permacel P421
   B. Remove the Block Clamp

      S 034-002
      (1) Remove the nuts, bolts and washers that hold the block clamp assemblies together.

      S 024-003
      (2) Remove the block clamp assemblies.
   C. Install the Block Clamp

      S 034-010
      (1) Remove and discard the used tape from the tube.

      NOTE: The condition of used tape on the tube does not always occur.

      S 214-004
      (2) At the location of the block clamps and tube overlap, apply three layers of P421 tape to the tube.

S 434-011
(3) Apply the tape ±.25 inch from each edge of the block.

S 434-005
(4) Put the tubes in the applicable notches in one-half of the block assembly.

S 424-006
(5) Put the other half of the block assembly in position.

S 434-007
(6) Put the channel on the half of the block assembly that the bolt head will touch.

S 434-008
(7) Put the washers on the bolts and put the bolts through the holes in the block clamp assembly.

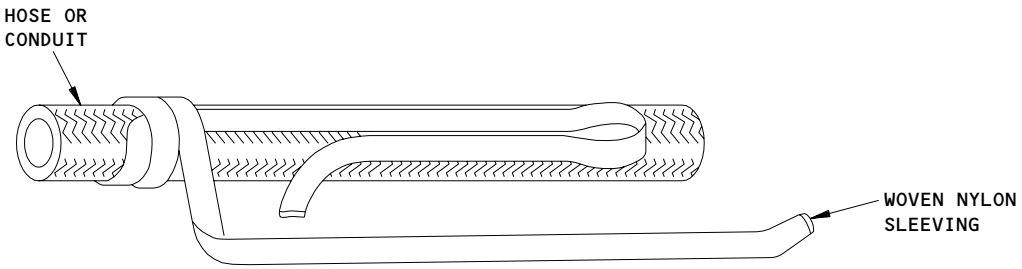
S 434-009
(8) Put the washer and nut on the threaded end of the bolt and tighten the nut.

NOTE: Make sure the washers are under the bolt head and the nut to prevent wear caused by the bolt head to the block clamp channel.

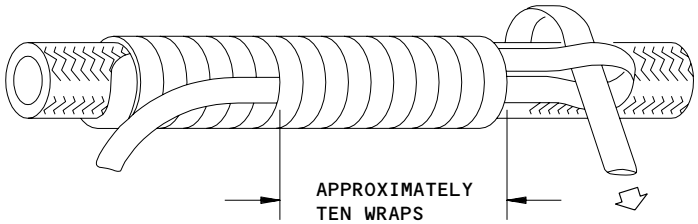
TASK 20-10-11-404-013

3. Protective Lacing - Installation
   A. Consumables
      (1) A00564 Adhesive - RTV 108 (used on nose landing gear only)
      (2) G00057 Tape - Scotch, 3M #63, (used on nose landing gear only)
      (3) G02503 Lace - Black Nylon Untreated Sleaving (1/8 inch)
   B. Procedure - Install the Protective Lacing

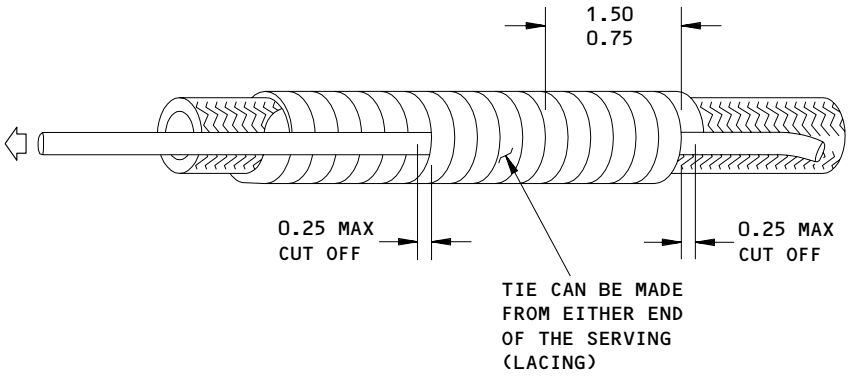
S 404-014
(1) Install the lacing per Figure 401, steps 1 through 3, except nose landing gear.



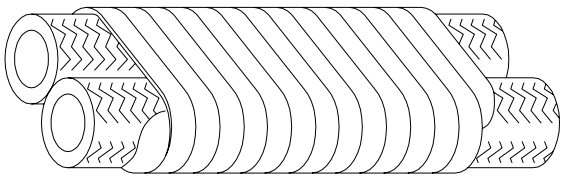
STEP 1



STEP 2



STEP 3



FOR TWO OR MORE HOSES

NOTE: ALL DIMENSIONS ARE IN INCHES.

Protective Lacing Installation
Figure 401

S 404-015

(2) Install the protective lacing on the nose landing gear per Figure 401, steps 1 through 3.
   (a) Prior to pulling the lock lace through, (before step 3), apply adhesive to laces.
   (b) Pull the laces into place, (step 3), this will bond the laces in place.
   (c) Apply two layers of tape over the lacing.
      1) Spirally wrap each layer with a 50% overlap and reverse the direction of the spiral with each layer.
      2) Extend the tape 1.0 inch to 1.5 inch beyond each end of the lacing.

PRESSURE-SENSITIVE DECALS - REMOVAL/INSTALLATION

1. General
   A. This procedure has these two tasks:
      (1) Pressure-Sensitive Decal Removal.
      (2) Pressure-Sensitive Decal Installation.
   B. Apply the external decal sections in a sequence that puts the end with the overlap downstream from the line of flight.
   C. All exterior decals require edge sealing using paint or an edge sealer unless specified differently.
   D. Clean the plastic film decals with naphtha.
   E. Remove air bubbles during the 8 hours after you apply the decal. Make a hole in the decal film with a sharp pointed instrument, at the edge of bubble, and push air out through the hole.
   F. You can also install interior decals with the same procedure that you use to install pressure-sensitive placards (AMM 20-10-13/401).

TASK 20-10-12-004-001

2. Pressure-Sensitive Decal Removal
   A. Equipment
      (1) Plastic scraper (See AMM 51-31-01/201 for approved scrapers)
      (2) Source of heat - 120°F: for example, hot air blast or light bulb
   B. Consumable Materials
      (1) B00130 Ethyl Alcohol, Denatured
      (2) B00148 Methyl Ethyl Ketone (MEK)
      (3) B00666 Methyl Propyl Ketone (MPK)
      (4) G00033 Cheesecloth - BMS 15-5
   C. References
      (1) AMM 20-30-89/201, Solvent - Series 89
      (2) AMM 51-21-01/701, Paint Stripping
      (3) AMM 51-31-01/201, Seals and Sealing
   D. Remove External Decals

      S 024-002

      (1) Use the Paint Stripping procedure to remove external decals (AMM 51-21-01/701).

E. Remove Internal Decals

NOTE: You can remove internal decals with heat or with a solvent.

S 024-003

(1) To remove decals with heat, do these steps:

NOTE: If heat causes a decal to melt, you must remove the decal with solvent.

CAUTION: THE TEMPERATURE OF THE SURFACE TO WHICH THE DECAL IS APPLIED MUST NOT BE MORE THAN 130°F.

(a) Heat the decal to approximately 120°F until the adhesive becomes soft.

CAUTION: MAKE SURE THAT YOU 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 ABRASIVE PADS (SCOTCH-BRITE) OR ABRASIVE PAPER ON THE ALUMINUM SURFACE UNLESS THE SCRIBE LINE INSPECTIONS WERE MADE. ABRASIVE PADS CAN SMOOTH THE ALUMINUM SURFACE AND HIDE SCRIBE LINE MARKS. IF YOU USE ABRASIVE PADS TO REMOVE PAINT OR PRIMER BEFORE YOU DO THE SCRIBE LINE INSPECTIONS, YOU CAN BE REQUIRED TO DO REPEAT INSPECTIONS BASED ON THE SCRIBE LINE INSPECTION SERVICE BULLETIN 737-53A0092.

(b) Lift the corner of the decal with an approved scraper and remove the decal from the surface.

(c) If necessary, clean the surface with a cheesecloth pad that is moist with a solution made of half cleaner and half water.

S 024-004

(2) To remove decals with solvent, do these steps:

(a) Use a brush or cloth to apply solvent to the decal (AMM 20-30-89/201).

(b) After decal is wrinkled (approximately 2 minutes after you apply solvent), apply solvent again.

(c) After approximately 2 minutes, move the soft decal off of the surface or remove with a spatula.

(d) If necessary, clean the surface with a cheesecloth pad that is moist with solvent (AMM 20-30-89/201).

TASK 20-10-12-404-005

3. Pressure-Sensitive Decal Installation

A. Equipment

(1) Scotchcal Cutter - ST732

(2) Plastic scraper (See AMM 51-31-01/201 for approved scrapers)

(3) Pin, air release tool 391X; 3M ID 75-3455-7437-2
(4) Pin, air release tool 71604; 3M ID 75-3467-077
(5) Power Grip Multi-Pin Air Release Tool MPP-1; 3M ID: 75-3469-5897-0

B. Consumable Materials
(1) B00083 Aliphatic Naphtha - TT-N-95
(2) B00068 Ethyl Alcohol, Denatured
(3) B00130 Isopropyl Alcohol - TT-I-735
(4) B00666 Methyl Propyl Ketone (MPK)
(5) C50020 Edge Seal - Desothane (CA8000/B900B)
Desothane HS Activator (CA8000B)
(6) C00260 Enamel, BMS 10-11, Type II
(7) A00247 BMS 5-95, Class F, Type 1 - PR1432GP
(8) C00843 Coating - BAC5710 Type 41
683-3-2 Base
X-310 Catalyst
(9) G00270 Masking Tape
(10) G00033 Cheesecloth - BMS 15-5
(11) B00137 Abrasive Paper - 150 Grit or Finer

C. References
(1) AMM 12-25-01/301, Airplane Servicing (Exterior Cleaning)
(2) AMM 51-21-03/701, Corrosion Removal and Control
(3) AMM 51-24-01/701, Hydraulic Fluid Resistant Finish
(4) AMM 51-31-01/201, Seals and Sealing

D. Prepare for Installation

S 114-034

WARNING: DO NOT APPLY PAINT, OR MATERIALS THAT ARE NOT TRANSPARENT TO THE ACRYLIC WINDOWS. DO NOT APPLY OTHER MATERIALS UNLESS THEY ARE APPROVED FOR ACRYLIC WINDOWS. THESE MATERIALS CAN CAUSE DAMAGE TO THE STRUCTURE OF ACRYLIC WINDOWS. THIS CAN MAKE FLIGHT DANGEROUS.

(1) Clean the surfaces where you will apply decals, as specified:

NOTE: Clean an area sufficient to include the decal with an edge seal area.

(a) Clean corroded aluminum surfaces (AMM 51-21-03/701).
(b) Clean wax-coated aluminum surfaces until the area shows a water-break-free surface (AMM 12-25-01/301).
(c) Clean the not painted phenolic plastic or polyester plastic with aliphatic naphtha or alcohol cleaner and a clean cloth.
1) Rub dry with a clean cloth. Do not let air dry.
(d) Lightly sand cork surfaces with 150-grit abrasive paper until you have a clean cork surface. Remove dust with a clean dry cloth.

NOTE: The sanded surface must be 0.38 inch wider than the decal area.

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

(e) Clean all other surfaces with naphtha and clean cloth, except in preparation for application of the Refuel Panel Placard (BAC27NFS223) which requires the use of solvent, Series 89 (AMM 20-30-89/201) and a clean dry cloth in place of naphtha.

NOTE: Verify that no grease is present on the surface prior to the application of the Refuel Panel Placard.

1) Lightly sand surface with 180-grit or finer abrasive paper.
2) Clean surface with aliphatic naphtha and clean dry cloth.
3) Do not let the cleaner air dry, but rub dry with a clean cloth.

S 014-007

(2) On decals with an area less than one square foot, remove the backing and put the decal face down on a smooth surface.

S 014-008

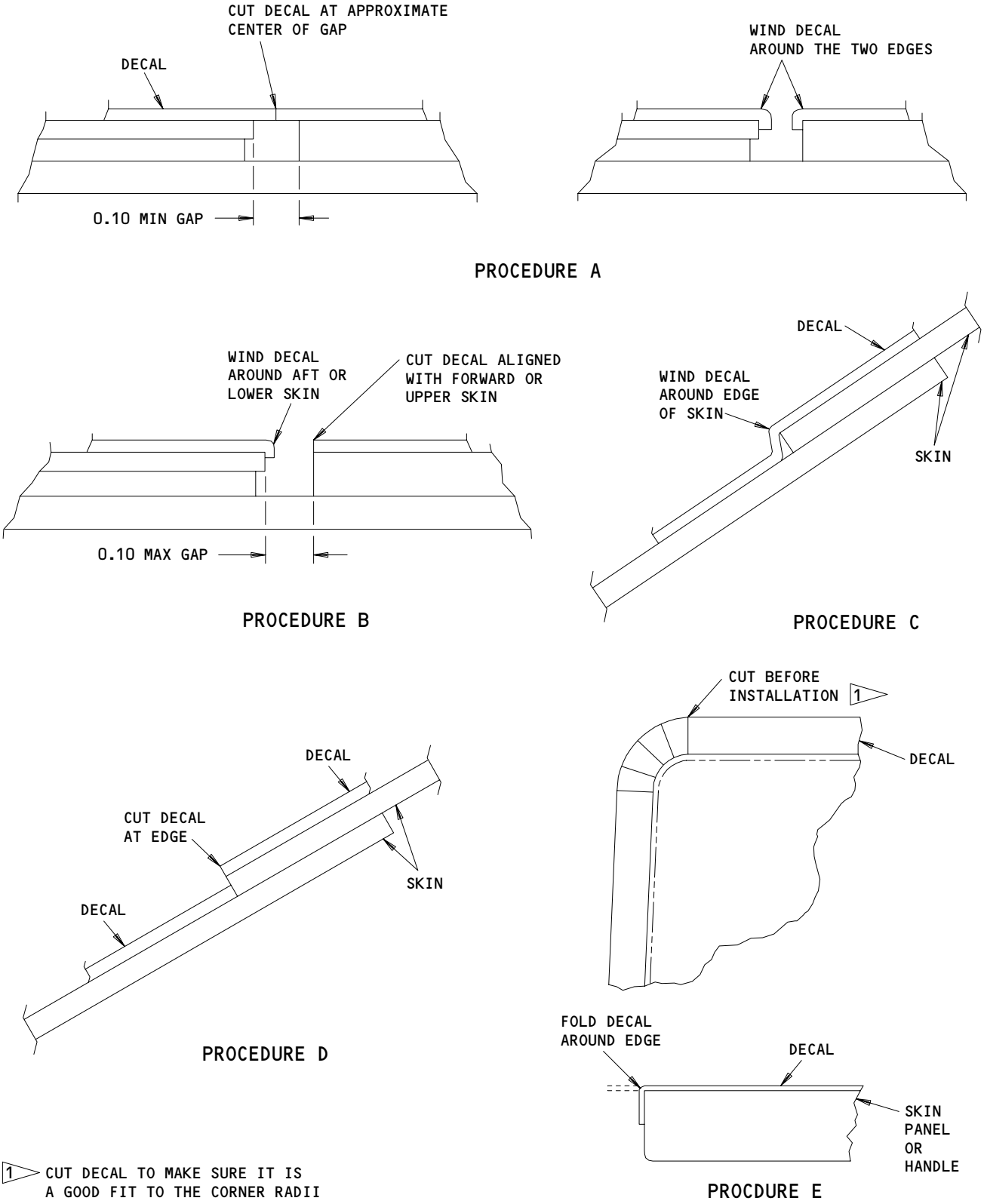
(3) On decals with an area more than one square foot, use masking tape to put the decal in position on the surface:
(a) Cut a sheet of carrier tape approximately four inches longer than the decal and approximately the same width. When you use decals with premasks, the premask can be the carrier.
(b) Put the carrier over the decal, with the edge you will hang on the surface 2 to 3 inches beyond the decal edge.
(c) Hang the carrier on the surface with masking tape.

CAUTION: MAKE SURE THAT YOU ONLY USE APPROVED SCRAPERS ON THE AIRPLANE SKIN. SCRAPERS THAT ARE NOT APPROVED CAN MAKE SCRATCHES ON THE SKIN AND CAUSE FATIGUE CRACKS.

(d) Rub the carrier on with an approved plastic scraper. Use short movements and work from the middle of the hinge to the edges to remove all wrinkles and air bubbles.
(e) Fold the carrier and decal back at the hinge, along the surface with the backing up. Use masking tape to hold in this position.
(f) Remove the decal backing.

S 014-009

(4) On strip decals, remove approximately one foot of backing and put the decal face down on a smooth surface.



Decal Application Over Irregular Surfaces
Figure 401

78441

E. Install Decals on Smooth Surface

S 434-011

(1) Put decals with areas less than one square foot in position and bond one edge to the surface. Hold remaining decal tight and a little away from the surface with a piece of backing on the adhesive side.

S 434-012

(2) On the decals with an area of more than one square foot, move the carrier into position. Hold the free end tight and a little away from the surface with a piece of backing on the adhesive.

CAUTION: MAKE SURE THAT YOU ONLY USE APPROVED SCRAPERS ON THE AIRPLANE SKIN. SCRAPERS THAT ARE NOT APPROVED CAN MAKE SCRATCHES ON THE SKIN AND CAUSE FATIGUE CRACKS.

(a) Rub decal onto the surface using an approved plastic scraper with short fan-like strokes.

NOTE: Do not allow the decal to touch the receiving surface until the plastic scraper rubs it down.

S 434-013

(3) Align and bond approximately three inches of the strip decals to the surface.
   (a) Use the applied section as a hinge and remove up to three feet of the backing.
   (b) Align the stripping and hold it tight and a little away from the surface.

S 434-014

(4) Start at the hinge and use the approved plastic scraper with short fan-like movement to rub the decal on the surface. Do not let the adhesive touch the surface until the plastic scraper rubs the decal down.

S 434-015

(5) Continue to apply strip decals until you install all of the decal.

S 434-016

(6) If a splice occurs when you apply a strip decal around a corner, make an overlap of a minimum of 0.5 inches and a maximum of 2 inches.

S 354-032

(7) When application is made over pressurized areas, to prevent air bubbles underneath the decal carefully puncture the unperforated film at each pressurized area (e.g., over a rivet) using a fine needle, pin or similar pointed object (Section 5.4x, 5.4y, 5.4z). Do not use a knife or razor.

S 354-033

(8) Bubbles may be eliminated at any time within 8 hours after application using the following procedure
   (a) Carefully puncture the decal at one edge of bubble using a fine needle, pin or similar pointed object (Section 5.4x, 5.4y, 5.4z). Do not use a knife or razor blade.
   (b) Softly press out the entrapped air with a squeegee or thumb moving toward the puncture.

F. Install Decals on Surfaces that are not Smooth

S 424-029

CAUTION: DO NOT DAMAGE THE AIRPLANE SKIN WHEN YOU CUT THE DECAL. DAMAGE TO THE SKIN SUCH AS NICKS, CUTS, SCRATCHES, OR SCRIBE LINES WILL REDUCE THE FATIGUE STRENGTH AND DURABILITY OF THE STRUCTURE.

(1) Use these steps to install over a joint between two surfaces which move with respect to each other:
   (a) For gaps of 0.100 inch and more, cut the decal at the approximate center of the gap and wind the decal around the two edges (Procedure A, Fig. 401).
      1) If you damage the skin or sealant, obey all the specified steps, cautions and references to inspect and repair the sealant and skin in AMM 51-31-01/201 and the applicable structural repair manual.
   (b) For gaps of less than 0.100 inch, cut the decal aligned with the forward or upper skin edge. Wind decal around the aft or lower skin edge (Procedure B).
      1) If you damage the skin or sealant, obey all the specified steps, cautions and references to inspect and repair the sealant and skin in AMM 51-31-01/201 and the applicable structural repair manual.

S 424-030

CAUTION: DO NOT DAMAGE THE AIRPLANE SKIN WHEN YOU CUT THE DECAL. DAMAGE TO THE SKIN SUCH AS NICKS, CUTS, SCRATCHES, OR SCRIBE LINES WILL REDUCE THE FATIGUE STRENGTH AND DURABILITY OF THE STRUCTURE.

(2) Use one of these steps to install decals across lap joints:
  (a) Wind the decal smoothly and continuously around the edge of the lap joint (Procedure C [recommended procedure]).
  (b) You can use an alternative procedure where the decal extends along the lap joint for a long distance. Cut the decal aligned with the overlap edge and touch the remaining decal to the overlap edge (Procedure D).
    1) If you damage the skin or sealant, obey all the specified steps, cautions and references to inspect and repair the sealant and skin in AMM 51-31-01/201 and the applicable structural repair manual.

S 434-019

(3) Use these steps to install decals on external emergency exit handles (Procedure E):
  (a) Before you remove the backing paper, put the decal on the handle and slit the decal overlap around each rounded corner.
  (b) Remove the backing paper and apply the decal. Push the overlap around the edges of the handle.

S 424-031

CAUTION: DO NOT DAMAGE THE AIRPLANE SKIN WHEN YOU CUT THE DECAL. DAMAGE TO THE SKIN SUCH AS NICKS, CUTS, SCRATCHES, OR SCRIBE LINES WILL REDUCE THE FATIGUE STRENGTH AND DURABILITY OF THE STRUCTURE.

(4) Use tool ST732 to cut decals, except pressure-sensitive polyester decals, around the heads of the fasteners on the panels that you can remove.
  (a) Push the decal into the recessed slot.
  (b) If you damage the skin or sealant, obey all the specified steps, cautions and references to inspect and repair the sealant and skin in AMM 51-31-01/201 and the applicable structural repair manual.

S 434-021

(5) Use these steps for pressure-sensitive polyester decals:
  (a) Use a Scotchcal cutter to cut and remove an area of film the approximate size of a rivet or fastener that is not aligned.
  (b) Push the decal film firmly in position around the rivet or fastener.
  (c) Let the adhesive dry for 1/2 hour before you seal the edges.

S 424-022
(6) Make a hole in the decal film, with a sharp pointed instrument, at each rivet on decals applied over pressurized areas.

S 024-023
(7) To remove the carrier, or the premask and masking tape, pull it back parallel to the decal surface.

NOTE: If you will paint in the adjacent area, let the premask stay in position.

G. Decal Edge Sealing

S 394-024
(1) Seal the edges of the decals:
(a) If you applied paint up to the edges of the decals, seal the edges of the decal completely with paint.

NOTE: If the decal edges are not sealed with paint, then apply edge sealer to decal.

(b) Use a brush to apply BAC 5710, Type 41 or Desothane Edge Seal to a dry film thickness of 0.0010 to 0.0020 inch on the edges of these decals:

NOTE: To make sure there is sufficiant edge seal thickness, two applications of edge sealer will be necessary.

(c) Extend the edge seal to a minimum of 0.2 inches around the marker and 0.2 inches on the marker.
(d) Dry the edge sealer for a minimum of 30 minutes.
(e) For pressure-sensitive polyester decals, let the adhesive dry for a minimum of 30 minutes then seal the edges.
1) Use a brush to apply the applicable color of BMS 10-11, Type II enamel on all exposed rivet or fastener heads on pressure-sensitive polyester decals. Make a dry film thickness of 0.0015 to 0.0020 inches. Make a 0.25 inch minimum overlap on the edge of the decal.
(f) It is permitted to seal the edges of external decals that are open to erosion, disbonding, or skydrol with BMS 5-95, Type I, Class F sealer.
1) Coat decal entire surface with BAC 5710, Type 41 seal coating to a dry thickness of 0.0015 to 0.0020 inches.

PRESSURE-SENSITIVE DECALS - APPROVED REPAIRS

1. General
   A. This procedure contains one task. The task is the repair of external decals.
   B. You can repair damaged external decals with patches of decals that are almost the same. You must replace damaged internal decals.

TASK 20-10-12-358-001

2. Repair the External Decals
   A. References
      (1) AMM 20-10-12/401, Pressure-Sensitive Decals
      (2) AMM 51-31-01/201, Seals and Sealing
   B. Procedure

S 028-007

CAUTION: DO NOT DAMAGE THE AIRPLANE SKIN WHEN YOU CUT THE DECAL. DAMAGE TO THE SKIN SUCH AS NICKS, CUTS, SCRATCHES, OR SCRIBE LINES WILL REDUCE THE FATIGUE STRENGTH AND DURABILITY OF THE STRUCTURE.

(1) Cut and remove all loose decal film but be careful not to cut the airplane skin.
   (a) If you damage the skin or sealant, obey all the specified steps, cautions and references to inspect and repair the sealant and skin in AMM 51-31-01/201 and the applicable structural repair manual.

S 808-003

(2) Cut a patch of decal film of the same type and color as the initial decal. Make the patch of sufficient size to make a 1/4-inch overlap on the part of the decal that is not damaged.

S 438-004

(3) To apply the patch (AMM 20-10-12/401).

S 398-005

(4) Seal the edges all around the repair. Use the edge sealer specified in AMM 20-10-12/401.

PRESSURE-SENSITIVE PLACARDS - REMOVAL/INSTALLATION

1. General
   A. This procedure contains one task. The task is the replacement of interior vinyl placards.
   B. Vinyl placards do not easily make a good fit on the contour of a rough or textured surface. The placards will touch only the high spots and have an unsatisfactory bond. You will use an adhesive to get a smooth surface that will give the placard a firm bond.

   TASK 20-10-13-964-001

2. Replace the Placard
   A. Consumable Materials
      (1) B00048 Detergent Cleaner - Spraywhite E
      (2) B00036 Freon TF
      (3) B00083 Aliphatic Naphtha - TT-N-95
      (4) A00119 Adhesive - BMS 5-55
      (5) A00016 Adhesive Film - BMS 5-91
      (6) B00137 Sandpaper, medium grit
      (7) G00270 Masking tape
   B. Remove the Placard

      NOTE: If the used placard is attached firmly and the new placard is the same size, you can install the new placard on the used placard.

      S 034-002
      (1) Put a sharp knife or equivalent object under the edge of the placard and remove the placard from the adhesive area.

      S 114-003
      (2) Use naphtha or Freon TE, Isopropyl alcohol, or Ethyl alcohol to remove adhesive from the surface.
   C. Prepare the Placard for Installation

      S 804-004
      (1) If the placard has a mark that shows BMS 5-91 adhesive is used, no special placard preparation is necessary. Do the installation.

      S 804-005
      (2) If the placard has no backing adhesive, prepare the placard as follows:
         (a) Use sandpaper to make the rear surface of the placard rough.
         (b) Clean the placard with naphtha cleaner.
         (c) Remove the release paper from one side of the BMS 5-91 adhesive film and apply to the rear of the placard. Remove unwanted film.

(d) Bond the adhesive film to the placard with one of these steps:

NOTE: This step loosens the bond between the adhesive and the release paper. Be careful not to let the release paper move.

1) Roll the placard on a hot roll laminator heated to 140°F.
2) Heat the placard to not more than 140°F with a dry air blast or some other applicable heat source. Rub the release paper side with a cheesecloth.

S 804-006

(3) If the placard has an adhesive backing other than BMS 5-91, prepare the placard as follows:

NOTE: This step is not necessary but it does make sure the adhesive film is firmly bonded to the placard.

(a) Remove the release paper from the rear of the placard.
(b) Remove the release paper from one side of BMS 5-91 adhesive film and apply adhesive film to the rear of the placard. Remove unwanted film.
(c) Bond the adhesive film to the placard with one of these steps:
1) Roll the placard on a hot roller laminator heated to 140°F.
2) Heat the placard to not more than 140°F with a dry air blast or some other applicable heat source. Rub the release paper side with a cheesecloth.

D. Install the Placard

NOTE: If you install the new placard over a used placard or on the cured adhesive from a used placard, steps 2 thru 4 and 8 are not necessary.

S 114-007

(1) Clean the surface with Freon, Naphtha, Isopropyl alcohol, or Ethyl alcohol. Dry thoroughly.

S 954-008

CAUTION: MAKE SURE THE MASKED AREA IS IN THE CORRECT LOCATION. YOU CAN REMOVE DRY ADHESIVE WITH NAPHTHA CLEANER. BUT IF YOU REMOVE CURED ADHESIVE, YOU WILL DAMAGE THE SURFACE.

(2) Use masking tape to apply a mask to an area approximately 1/16 inch smaller than the placard. Or use a mask of the necessary size in the correct position.

S 354-009

(3) Use a brush to apply one layer of adhesive to the area where the placard touches the surface.

S 844-015
(4) Let the adhesive dry thoroughly (approximately 15 minutes).

S 034-010
(5) Remove the masking tape or mask.

S 034-011
(6) Remove the release paper from the placard.

S 424-012
(7) Put the placard on the center of the surface and install. Make sure you remove air pockets during installation.

S 424-013
(8) Rub down placard thoroughly with firm hand pressure and a cheesecloth pad.

S 114-014
(9) If the primed surface shows around the placard, remove unwanted adhesive with naphtha cleaner.

ALUMINUM FOIL MARKERS - REMOVAL/INSTALLATION

1. General
   A. This procedure contains two tasks. The first task is the removal of aluminum foil markers. The second task is the installation of aluminum foil markers.
   B. This procedure is optional for paper-backed, pressure-sensitive decals and placards.
   C. Replace aluminum foil markers that have creases, damaged edges, or words that you cannot read.
   D. Replace aluminum foil markers that are not satisfactorily bonded to external primed or painted surfaces.
   E. Remove and replace aluminum foil markers that are not satisfactorily bonded to internal primed or painted surfaces.
   F. Remove and replace aluminum foil markers that are not satisfactorily bonded to bare metal surfaces.

      NOTE: For aluminum foil markers that you will install on textured surfaces or that do not bond satisfactorily, you can use the procedure for pressure-sensitive placards. This gives a better installation (Ref 20-10-13, Removal/Installation).

   G. Do not install aluminum foil markers on used aluminum foil markers. Remove the used aluminum foil marker and install the new aluminum foil marker.

TASK 20-10-14-004-001

2. Pressure Sensitive Placards - Removal
   A. Consumable Materials
      (1) B00148 Methyl Ethyl Ketone (MEK) - TT-M-261
      (2) B00084 Xylene - ASTM 845 or 846
   B. Procedure

      S 024-023
      (1) Put a sharp knife, or equivalent object, under the edge of the placard and remove the placard from the adhesive area.

      S 114-024
      (2) On primed, painted, or plastic interior surfaces, use xylene to remove all adhesive from surfaces and markers.

      S 114-025

      WARNING: DO NOT GET SOLVENT IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS . REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.
      (3) On metal surfaces, use a cheesecloth that is wet with solvent, Series 88 (AMM 20-30-88/201), to remove all adhesive from surfaces and markers.

TASK 20-10-14-404-026

3. Aluminum Foil Marker - Installation

A. Equipment

(1) Model C, IBM typewriter with Pica type, with a medium dark opaque or blueprint black ribbon

B. Consumable Materials

(1) A00134 Adhesive - BMS 5-14
(2) A00119 Adhesive RUBBER CEMENT - BMS 5-55
(3) A00016 Adhesive Film - BMS 5-91
(4) B00046 Corrosion Remover - MIL-M-10578, Type II, Phosphoric Acid Corrosion Removing and Metal Conditioning Compound
(5) C00034 Finish, Protective - BMS 3-11 Fire Resistant Hydraulic Fluid
(6) B00083 Aliphatic Naphtha, TT-N-95
(7) B00148 Methyl Ethyl Ketone (MEK) - TT-M-261
(8) B00316 Solvent - Aliphatic Naphtha, TT-N-95, Type I
(9) B00084 Xylene - ASTM 845 or 846
(10) B00137 Abrasive Paper - P-P-121, 180-grit aluminum oxide
(11) G00033 Wiper (cheesecloth) - BMS 15-5

C. References

(1) AMM 20-30-80/201, Solvent, Series 80
(2) AMM 51-24-01/701, Hydraulic Fluid Resistant Finish

D. Prepare for Installation

S 934-002

(1) If it is necessary, use an electric typewriter with pica type set at the highest impression level to add data to the placard.

S 214-027

(2) Make sure all typed data is clear with letters that do not cut through the aluminum foil marker.

S 804-003

(3) If it is necessary, trim the aluminum foil marker before you remove the protective backing.

S 804-004

(4) If the placard has a mark that shows BMS 5-91 adhesive is used, it is not necessary to prepare the placard. Go directly to the installation steps.

S 844-005

(5) If the placard has no backing adhesive, prepare the placard as follows:
(a) Use abrasive paper to make the rear surface of the placard rough.
(b) Clean the placard with naphtha cleaner.

(c) Remove the release paper from one side of the BMS 5-91 adhesive film and apply to the rear of the placard. Trim the unwanted film.
(d) Use one of these steps to bond the adhesive film to the placard:

NOTE: This step is not necessary, but it does make sure the adhesive film is tightly bonded to the placard. Be careful not to move the release paper after you apply heat. The release paper bond will be soft.

1) Roll the placard on a heated roll laminator that is 140°F.
2) Heat the placard to not more than 140°F with a dry air blast or some other applicable heat source. Rub the release paper side with cheesecloth.

S 844-006
(6) If the placard has an adhesive backing other than BMS 5-91, prepare the placard as follows:
(a) Remove the release paper from the rear of the placard.
(b) Remove the release paper from one side of the BMS 5-91 adhesive film and apply adhesive film to the rear of the placard. Trim the unwanted film.
(c) Bond the adhesive film to the placard with heat as specified in the last step.

S 114-007
(7) Do these steps to clean aluminum surfaces immediately before you install the aluminum foil markers on the aluminum surfaces:
(a) Clean aluminum surfaces that have corrosion as follows:
1) Use a brush, rag, or sponge to clean the surfaces with a solution, by volume, of one-fourth corrosion remover (MIL-M-10578, Type II) and three-fourths water.
2) Let the solution stay on the surfaces for approximately one minute.
3) Rub the surface with a moist cheesecloth and then with a dry cheesecloth until the surface is dry and free of corrosion.
(b) If the aluminum surface has a heavy layer of grease, use a cheesecloth and clean with BMS 3-2 solvent.

S 114-008
(8) Do these steps to clean special surfaces immediately before you install aluminum foil markers:
(a) Clean aluminized paint (EC-843) coated surfaces as follows:
1) Sand the surface with 180-grit, aluminum oxide, abrasive paper.
2) Clean with BMS 3-2, Type I, solvent.
(b) Clean cork surfaces as follows:
1) Lightly sand the surface with 180-grit, aluminum oxide, abrasive paper until you get a clean cork surface.

2) Rub the surface with a clean cheesecloth to remove all dust.

S 804-009

(9) Do these steps on cadmium-plated surfaces, laminated not painted polyester materials, laminated not painted phenolic materials, and laminated not painted rough surfaces:
   (a) Apply a light layer of BMS 5-14 adhesive to the cleaned surface.
   (b) Let the adhesive dry for 5 to 20 minutes. The adhesive must be tacky but will not bond to a clean finger when lightly touched.

S 804-010

(10) Do these steps on primed or painted rough interior surfaces:

NOTE: Do not use this procedure on external surfaces open to the weather.

   (a) Apply a light layer of BMS 5-55 adhesive to the cleaned surface.
   (b) Let the adhesive dry for 5 to 20 minutes. The adhesive must be tacky but will not bond to a clean finger when lightly touched.

E. Install Aluminum Foil Marker

NOTE: Do not use an aluminum foil marker that is not flat or is damaged.

S 494-011

(1) Use supports for surfaces of thin panels during the installation of markers.

S 214-012

(2) Make sure the aluminum foil marker and the open surface are free of moisture.

S 804-013

(3) During the installation of a large or complicated aluminum foil marker, keep a small section of backing attached.

NOTE: A small section of backing will help you to touch and move the aluminum foil marker.

S 844-014

(4) To install a cellophane-backed aluminum foil marker, do these steps:
   (a) Put the aluminum foil marker in water (50°-120°F) for approximately 30 to 120 seconds.
   (b) Remove the aluminum foil marker from the water and remove unwanted water with a clean, dry cheesecloth.
   (c) With dry hands, move a finger across the edge of the aluminum foil marker and move back the cellophane.

(d) Hold the loosened edge of the backing and carefully remove the backing from the marker.

S 844-020

(5) To install a paper-backed foil marker, do these steps:
(a) Remove the paper backing from the marker, but be careful not to touch the adhesive coating:
(b) When the paper backing has a cut, bend the paper backing lightly along the cut. Hold the backing and move it slowly away from the aluminum foil marker to prevent damage to the marker.
(c) When the paper backing does not have a cut, move a finger across the edge of the aluminum foil marker to move back one edge of the paper backing. The backing can also have a tab which will help to remove the backing.

NOTE: Do not soak paper-backed markers to remove the backing.

S 844-021

(6) To install foil markers without self-contained adhesive, do these steps:
(a) On primed, painted, or plastic interior airplane surfaces that are not open to the weather do these steps:
1) Clean the open surface as specified in this procedure before you put the marker in its position.
2) Apply one layer of BMS 5-55 adhesive to the rear of the aluminum foil marker.
3) Let the adhesive dry (5 to 20 minutes) until it is tacky but will not bond to a clean finger when lightly touched.
(b) On bare metal surfaces, do these steps:

NOTE: Do not use these steps on external surfaces open to the weather.

1) Clean open surfaces as specified in this procedure.
2) Apply a light layer of BMS 5-14 adhesive to the rear of the aluminum foil marker.

3) Let the adhesive dry (5 to 20 minutes) until it is tacky but will not bond to clean fingers when lightly touched.

S 424-015

(7) Put the marker in the correct position and push down to attach it.
   (a) Use a roller and start at one end of the marker and roll the marker into its position.

S 424-016

(8) To remove air bubbles, make a small hole with a pin and make a smooth surface with a roller. Be careful not to cause damage to the marker with the roller.

S 114-017

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING.

(9) If you used BMS 5-14 adhesive, remove unwanted adhesive with a cheesecloth wet with solvent, Series 80 (AMM 20-30-80/201).

S 114-018

(10) If you used BMS 5-55 adhesive, remove unwanted adhesive with solvent (BMS 3-1, Type I) or aliphatic naphtha (TT-N-95).

S 034-019

(11) On a marker with a protective paper layer, remove the paper. Remove it at almost 180 degrees to the marker.

S 394-022

(12) For protection of markers from BMS 3-11 Hydraulic Fluids, apply an edge sealer as follows:
   (a) Clean open surfaces as specified in this procedure.
   (b) Apply the mixture with a brush.

NOTE: Use a mixture, by volume, of two-thirds 683-3-2 base to one-third X-310A catalyst (AMM 51-24-01/701).

STENCIL MARKINGS - REMOVAL/INSTALLATION

1. General
   A. This procedure contains one task. The task is the installation of stencil or insignia markings.
   B. For decorative finishes used on external surfaces of the airplane, refer to "Decorative Exterior Finishes" (Ref 51-21-10).
   C. The surface you paint and the type of finish necessary will tell you which paint to use for markings. Make sure the paint is correct to use with the initial surface finish.
   D. In areas where a skydrol 500 resistant finish is necessary, apply BMS 10-60, Type II enamel.
   E. Where letter sizes are less than two inches in height and width, use BMS 10-60 enamel for letters.

      NOTE: Use BMS 10-79, Type II primer on painted or not painted surfaces when you use BMS 10-60, Type II.

   F. For markings installed directly over corogard EC 843 or EC 843S, use EC 942 black.

   TASK 20-10-15-374-001
2. Install Stencil or Insignia Markings
   A. General
      (1) Make sure you do not get clean surfaces dirty when you clean adjacent surfaces.
      (2) Use a polyethylene wash bottle to apply solvents. Make sure you know the contents of the bottle.
      (3) Avoid overspray contamination of adjacent areas.
      (4) Make sure all coatings or finishes are uniform, homogeneous, and free from gelled particles.
      (5) Apply primer and stencil paint with spray equipment only. Do not spray adjacent surfaces.
      (6) Make sure all coating or finish materials are mixed correctly and identified with a label. Discard materials with expired pot life.

(7) Make sure painted markings are well formed and have a solid, homogeneous color.

B. Equipment
(1) Bottles, Polyethylene - size as necessary, with nozzle
(2) Brush, Fiber - soft bristle
(3) Burnishing Tool - plastic or wood
(4) Gloves, Knitted Cotton - lightweight, white
(5) Spray Equipment

C. Consumable Materials
(1) Solvents
(a) B00316 or B00083 Solvent - Aliphatic Naphtha, TT-N-95, Type I or Type II
(b) B00148 Methyl Ethyl Ketone (MEK), TT-M-261
(c) B00083 Aliphatic Naphtha, TT-N-95, Type II
(2) G00117 Tape, Masking - Permacel P112
(3) G00033 Wipers, BMS 15-15, Classes A and B
(4) G00251 Abrasive Paper - 280 grit or finer
(5) Finishes
(a) C00319 BMS 10-79, Type II Primer
(b) C00032 BMS 10-60, Type II Enamel
(c) C00035 EC 942 Black (Corogard)
(6) B00151 Methyl Isobutyl Ketone (MIBK)
(7) B00079 Butyl Acetate

D. References
(1) AMM 20-30-98/201, Solvent, Series 98
(2) AMM 51-21-01/701, Paint Stripping
(3) AMM 51-21-02/701, Prepaint Cleaning and Treatment
(4) AMM 51-21-10/701, Decorative Exterior Finishes

E. Prepare Surface for Stencil Markings

S 954-002
(1) Mask or use a protective cover on all adjacent surfaces which you will not clean, treat, or paint.

S 034-003
(2) If it is necessary to remove old markings, do the steps that follow:
(a) Strip markings (Ref 51-21-01)
(b) Prepare surface (Ref 51-21-02)
(c) Apply a layer of material equivalent to the initial material (Ref 51-21-10).

S 114-004
(3) Do these steps to clean the surface:
(a) To remove loose dirt and unwanted grease or oil, rub or scrub. Be careful not to get dirt on a larger area than necessary.

WARNING: DO NOT SPRAY SOLVENTS. DO NOT KEEP SOLVENTS IN OPEN CONTAINERS. DO NOT USE FLAMMABLE SOLVENTS IN AIRPLANE. SOLVENTS AND CLEANERS CONTAIN TOXIC INGREDIENTS. WEAR PROTECTIVE GLOVES WHEN YOU USE THEM. DO NOT GET SOLVENT OR CLEANER ON YOUR SKIN OR EYES. MAKE SURE YOU HAVE SUFFICIENT VENTILATION OR USE RESPIRATOR MASKS.

CAUTION: DO NOT USE SOLVENTS OTHER THAN THOSE SPECIFIED. THEY CAN CAUSE DAMAGE TO THE FINISH.

(b) Use the applicable solvent as follows:

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

1) For tedlar, teflon, and solvent resistant finishes only, use solvent, Series 98 (AMM 20-30-98/201).
2) For acrylic surfaces, use naphtha, TT-N-95, Type II.
3) For all other surfaces and for hydraulic fluid contamination, use BMS 3-2.

(c) Use a polyethylene bottle to apply the solvent to the work surface or to a clean wiper.

NOTE: Do not put wiper into the solvent container.

(d) Rub the surface with force with a wiper or soft brush.
(e) Flush the surface with clean solvent. Use clean wipers.
(f) To remove excess solvent, let surface drain then rub dry.

S 114-005

(4) Do these steps to clean the surface again:
(a) Apply solvent to a clean wiper.

NOTE: Do not put the wiper into the solvent container.

(b) Rub the surface with the solvent-soaked wiper. Immediately rub dry with a clean, dry wiper.

NOTE: Do not let the solvent dry by air. Rub dry. Replace the dirty wiper frequently with a clean one.

(c) Repeat the last two steps until the wiper shows no dirt.

NOTE: If the prepared surface becomes dirty with dust, dirt, grease, grit, or other contaminates, clean again as specified in this procedure.

S 114-006

(5) For plastic laminates and painted surfaces only, do these steps:
(a) Clean, if necessary, as specified in this procedure.

CAUTION: DO NOT SAND THE PAINTED SURFACE AROUND THE DECAL EDGE IF CLEAR HYDRAULIC FLUID RESISTANT COATING WAS USED AS EDGE SEALER FOR THE DECAL. YOU CAN BREAK THE EDGE SEAL.

(b) Lightly sand the surface with 280-grit or finer abrasive paper.
(c) Clean again as specified in this procedure.

F. Apply Stencil Markings

S 214-007

(1) Make sure all stencil cuts are sharp and free of burrs.

S 434-008

(2) Attach the stencil tightly to the surface to prevent paint penetration under the edges.

S 374-009

(3) To paint the stencil marking, use the paint applicable to the surface finish as follows:
(a) If you use BMS 10-60, Type II Enamel or BMS 10-79, Type II Primer, refer to Decorative Exterior Finishes for preparation instructions (AMM 51-21-10/701).

WARNING: STORE EC 942 IN A OPEN CONTAINER TO PREVENT CONCENTRATION OF FLAMMABLE HYDROGEN GAS. EC 942 CHEMICALLY REACTS WITH METAL CONTAINERS AND FREES FLAMMABLE HYDROGEN GAS.

(b) If you use EC 942 Black (Corogard 12), do these steps:
1) Mix thoroughly.

CAUTION: DO NOT ADD MORE THINNER THAN A QUANTITY EQUAL TO ONE-FIFTH OF THE BASE MATERIAL.

2) Thin the base material with mixture (by volume) of 5/8 methyl isobutyl ketone and 3/8 butyl acetate.

NOTE: You can use this material for up to 16 hours after you thin it (pot life is 16 hours).

S 374-012

WARNING: DO NOT BREATHE THE VAPORS OF FINISHES AND SOLVENTS. THEY CONTAIN TOXIC AND FLAMABLE COMPONENTS. USE APPROVED RESPIRATORY PROTECTION AS NECESSARY. DO NOT GET IN EYES OR ON SKIN AND CLOTHING. KEEP MATERIALS AWAY FROM SOURCE OF IGNITION. INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

CAUTION: DO NOT APPLY FINISHES WHEN AMBIENT TEMPERATURE IS LESS THAN 50 DEGREES FAHRENHEIT OR RELATIVE HUMIDITY IS MORE THAN 85 PERCENT.

(4) Spray apply paint and make sure you have a sufficiently wet layer to get uniform flowout but not to cause runs and sags.

S 354-011

(5) After the marking is dry, remove rough edges from the markings with BMS 3-2 solvent or a burnishing tool.

NOTE: Another procedure to remove rough edges is to remove masking tape while paint film is still wet. This permits paint to flow out.

RECESSED BOSS SEAL FITTINGS - REMOVAL/INSTALLATION

1. General
   A. This procedure contains two tasks. The first task is the removal of the fitting from the boss. The second task is the installation of the fitting into the boss.

TASK 20-10-16-004-001

2. Remove the Fitting from Boss (Fig. 401)
   A. Procedure

S 034-002
(1) Loosen the jamnut.

S 034-003
(2) Disconnect the elbow fitting from the hose or tube, as applicable.

S 024-004
(3) Loosen the fitting from the boss and remove.

TASK 20-10-16-404-005

3. Install the Fitting into Boss (Fig. 401)
   A. Procedure

S 434-006
(1) Install the jamnut on the fitting and turn to the stop.

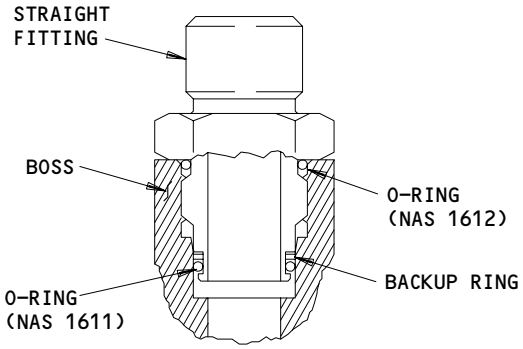
S 644-007
(2) Lubricate the O-ring and backup ring with the applicable system lubricant.

S 434-008
(3) Install the O-ring and backup ring on the fitting.

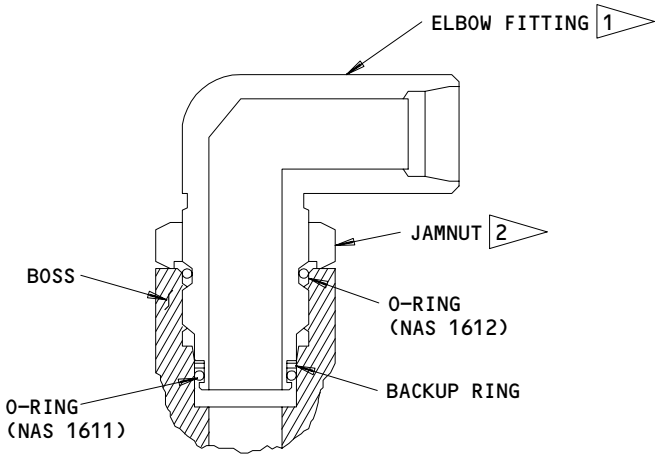
S 424-009
(4) Turn the fitting into the boss until it touches bottom, then loosen until the elbow is aligned with the hose or tube (one turn maximum).

S 434-010
(5) Hold the fitting stable and tighten the jamnut.

S 434-011
(6) Connect the elbow fitting to the hose or tube.



STRAIGHT (STYLE E) FITTINGS



ELBOW (STYLE S) FITTINGS

1 A 45° OR 90° ELBOW MAY BE USED
2 JAMNUTS NAS 1410 DD, AN 6298, OR MS28773 ARE OPTIONAL

Recessed Boss Seal Fitting Installation
Figure 401

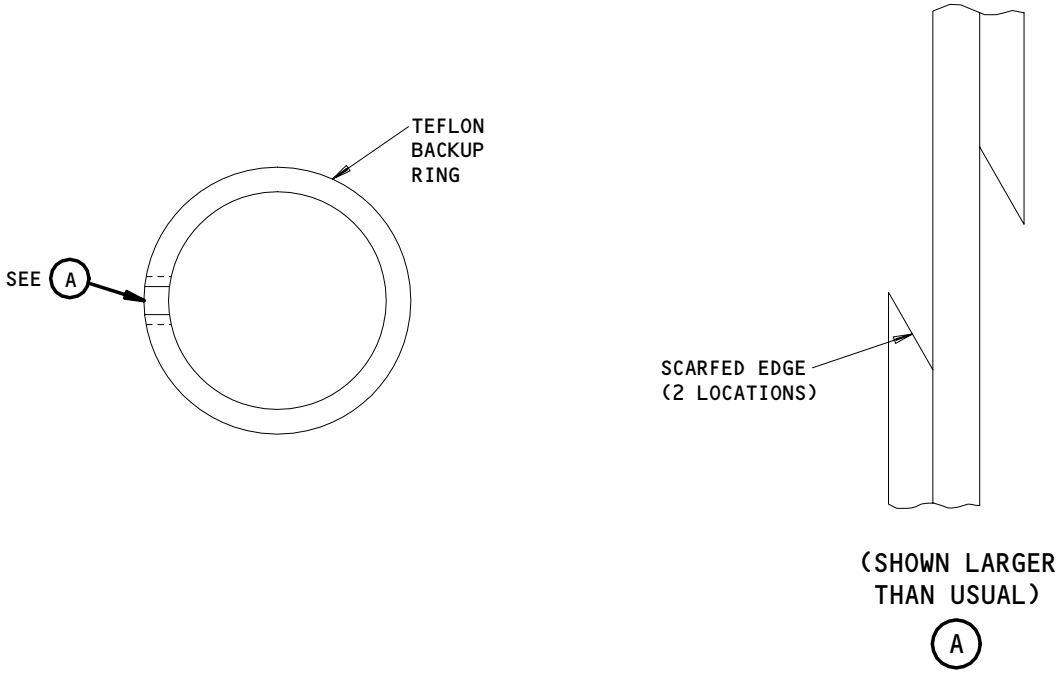
TEFLON BACKUP RINGS - REMOVAL/INSTALLATION

1. General
   A. This procedure contains one task. The task is the installation of teflon backup rings.

   TASK 20-10-17-404-001

2. Install Teflon Backup Rings
   A. Procedure

      S 424-002
      (1) Install the teflon backup rings with the direction of the spiral clockwise and the scarfed edges as shown in Fig. 401.



Teflon Backup Ring Installation
Figure 401

O-RINGS - REMOVAL/INSTALLATION

1. General
   A. This procedure contains one task. The task is the installation of O-rings.
   B. Use this procedure for the installation of O-rings over sharp edges. Sharp edges include threaded fasteners, keyways, slots, splines, and ports.
   C. Before installation, examine the O-rings for cuts, abrasions, deformities, and surface defects.

TASK 20-10-19-404-001

2. Installation of the O-Rings (Fig. 401)
   A. Equipment
      (1) O-ring Installation Tool - ST848-XXX
   B. Consumable Materials
      (1) Fluid used with component or system.
   C. Procedure

S 804-002

(1) Use the applicable ST848 series O-ring installation tools.

TOOL NO.	FLARED AND FLARELESS TUBE OR HOSE FITTING SIZE (INCH)
ST848-187	3/16
-250	1/4
-312	5/16
-375	3/8
-500	1/2
-625	5/8
-750	3/4
-1000	1
-1250	1-1/4
-1500	1-1/2
-1750	1-3/4

S 644-003

(2) Apply a thin layer of the fluid used with the component or system on the O-ring.

S 434-004

CAUTION: DO NOT MAKE THE ELASTOMERIC O-RING INNER DIAMETERS LARGER BY MORE THAN 50 PERCENT DURING INSTALLATION. DO NOT MAKE THE TEFLON AND PLASTIC O-RING INNER DIAMETERS LARGER BY MORE THAN 5 PERCENT DURING INSTALLATION. FAILURE COULD OCCUR.

(3) Put the thimble over the fitting.

S 434-005
(4) Put the O-ring on the thimble.

S 424-006
(5) Move the expanding body over the thimble and against the O-ring and push the O-ring into the groove.

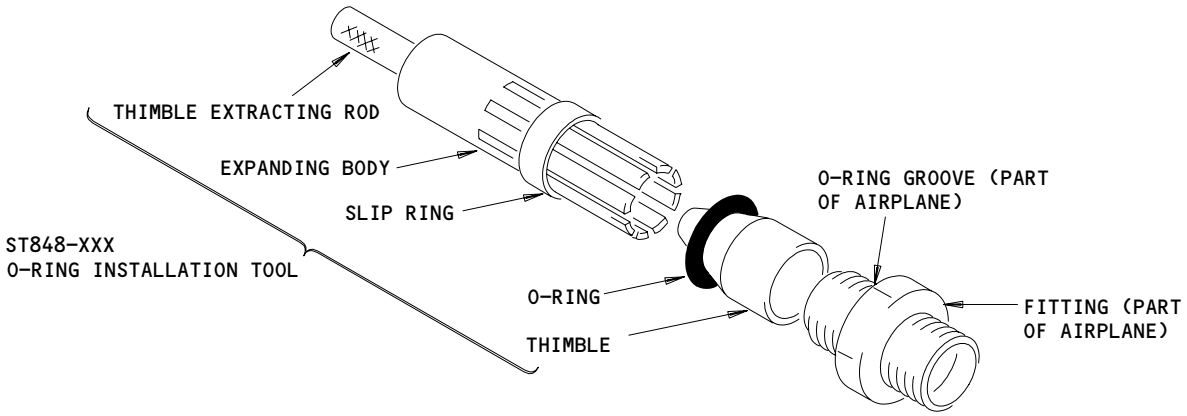
S 034-007
(6) Use the extracting rod to remove the expanding body from the thimble.

S 034-008
(7) Remove the thimble.

S 024-010

CAUTION: MAKE SURE THE O-RINGS DO NOT HAVE PINCHES. MAKE SURE THE BOLTS AND FITTINGS ARE CORRECTLY ATTACHED. IF NOT, FAILURE COULD OCCUR.

(8) Examine the O-ring for twists and pinches caused by installation.
(a) Align the O-ring to remove twists and pinches.



O-Ring Installation
Figure 401

ELECTRICAL BONDING - REMOVAL/INSTALLATION

TASK 20-10-21-904-009

1. Electrical Bonding - Removal/Installation
   A. General
      (1) Refer to SWPM 20-20-00, Electrical Bonding and Grounding, in the Standard Wiring Practice Manual, D6-54446.

ELECTRICAL BONDING - INSPECTION/CHECK

TASK 20-10-21-216-008

1. Inspection/Check of Electrical Bonding
   A. General
      (1) Refer to SWPM 20-20-00, Electrical Bonding and Grounding, in the Standard Wiring Practice Manual, D6-54446.

METAL SURFACES CLEANING/PAINTING

1. General
   A. This procedure contains five tasks. The first task is to hand clean with abrasives. The second task is to spot clean with a rotary bonding brush. The third task is to spot clean with a rotary abrasive disk. The fourth task is to remove paint with lacquer thinner or methyl ethyl ketone. The fifth task is to solvent clean bare, clad, or plated metal.
   B. Use the tasks in this procedure to clean the faying surface bonds and bonding jumper installations. Do not use abrasives or wire brushes on plated surfaces, alclad aluminum that is not painted, or CRES that is not painted.

TASK 20-10-22-127-001

2. Hand Clean with Abrasives
   A. General
      (1) Use this task for titanium. No other task in this procedure is applicable to titanium.
      (2) Do not apply abrasives to plated surfaces, alclad aluminum, or CRES.
   B. Consumable Materials
      (1) B00137 Abrasive Paper, 180 grit, Federal Spec P-P-121
      (2) B000138 Abrasive Cloth, 180-Grit, Federal Spec P-C-451
   C. Procedure

      S 127-002

      CAUTION: DO NOT LET PARTICLES FROM THE ABRASIVE CAUSE CONTAMINATION TO THE MECHANISMS OR ELECTRICAL EQUIPMENT. DAMAGE CAN OCCUR.

      (1) Use a circular or elliptical movement of the abrasive paper or cloth to give an equally smooth surface.

TASK 20-10-22-147-003

3. Spot Clean with a Rotary Bonding Brush
   A. General
      (1) Use this task to remove paint from metal or to remove Alodine, Iridite, or light anodize from aluminum.

(2) Do not use rotary bonding brushes on plated surfaces or on metals not painted (for example, CRES or alclad aluminum). Clean these surfaces with a solvent.

B. Equipment
(1) Drill motor or other applicable drive
(2) Bonding brush, stainless steel, of correct size (Fig. 701).

C. Procedure

NOTE: Identify the bonding brush housings you can use on each metal. Refer to Remove Paint with Lacquer Thinner.

S 147-026

CAUTION: DO NOT USE CARBON STEEL BONDING BRUSHES. STEEL PARTICLES IN METAL SURFACES COULD CAUSE DANGEOUS CORROSION.

DO NOT USE ROTARY WIRE BRUSHES OR ABRASIVE DISKS ON TITANIUM. REFER TO PROCEDURE, HAND CLEAN WITH ABRASIVES, TO CLEAN TITANIUM.

(1) Clean the necessary spot diameter.

NOTE: Use a drill motor or other applicable drive with a stainless steel bonding brush of the correct size.

(a) Apply brush intermittently and keep the cutting face parallel with surface.
(b) Examine the results after each time you apply the brush.

NOTE: Keep the surface loss of metal to minimum.

(c) Continue the procedure until the necessary area is clean.
(d) If you cannot get through an anodic film, use the procedure, Spot Clean with a Rotary Abrasive Disk.

TASK 20-10-22-147-005

4. Spot Clean with a Rotary Abrasive Disk

A. General
(1) Use this task to remove not painted anodize, Iridite, Alodine, BMS 3-11 resistant finish, or other hard finishes. You can use this task to remove paint but the disk will quickly become clogged.

Rotary Bonding Brushes and Abrasive Disk Mandrels
Figure 701

BRUSH OR DISK DIA. (IN.)	PILOT DIA. (IN.)	SHANK DIA. (IN.)	BONDING BRUSHES						DISK MANDRELS
			WIRE SIZE (IN.)		OSBORN NO.	MORRIS NO.	MANUFAC-TURERS BRUSH CO.	BOEING ST NO.	BOEING ST NO.
			MAX	MIN					
11/32	1/4	1/4	0.005	0.004				ST913K-34-24	ST913M-34-24
1/2	3/32	1/4	0.005	0.004	94-SV-37	P-31-SS	220-NN	ST913K-50-09	ST913M-50-09
1/2	1/8	1/4	0.005	0.004	94-SV-47	P-32-SS	221-NN	ST913K-50-12	ST913M-50-12
1/2	5/32	1/4	0.005	0.004	94-SV-48	P-33-SS	222-NN	ST913M-50-16	ST913M-50-16
1/2	3/16	1/4	0.005	0.004	94-SV-36	P-34-SS	223-NN	ST913M-50-19	ST913M-50-19
3/4	3/16	1/4	0.006	0.005		P-31-516-SS	224-NN	ST913K-75-19	ST913M-75-19
3/4	1/4	1/4	0.006	0.005		P-31-517-SS	225-NN	ST913K-75-25	ST913M-75-25
3/4	5/16	1/4	0.006	0.005		P-31-53-SS	226-NN	ST913K-75-31	ST913M-75-31
1.0	3/16	1/4	0.008	0.006		P-36-SS	227-NN	ST913K-100-19	ST913M-100-19
1.0	1/4	1/4	0.008	0.006		P-36-S1-SS	228-NN	ST913K-100-25	ST913M-100-25
1.0	5/16	1/4	0.008	0.006		P-36-S5-SS	229-NN	ST913K-100-31	ST913M-100-31

(2) Do not use this task on plated surfaces or metals not painted, for example, CRES or alclad aluminum. Clean these surfaces with a solvent.

B. Consumable Materials
(1) B00109 Abrasive Disk, Cloth, Open Coat, 150-grit
(2) B00138 Abrasive Cloth - Federal Spec P-C-451

C. Equipment
(1) Disc Mandrel of Correct Size (Fig. 701)

D. Procedure

S 147-006

CAUTION: DO NOT LET PARTICLES FROM THE ABRASIVE CAUSE CONTAMINATION TO THE MECHANISMS OR ELECTRICAL EQUIPMENT. DAMAGE COULD OCCUR.

(1) Clean the necessary spot diameter.

NOTE: Use a drill motor or other applicable drive with an abrasive disk of correct size.

(a) Apply the disk intermittently with light pressure and keep the face of the disk parallel to metal surface.
(b) Examine the results after each time you apply the brush.

NOTE: Keep the surface loss of metal to minimum.

(c) Continue the procedure until the necessary area is clean.

TASK 20-10-22-157-007

5. Remove Paint With Lacquer Thinner or Solvent

A. General
(1) Use this task to remove primer or lacquer-based paint or enamel from clad aluminum or other metal surfaces. Do not use lye, alkaline paint remover, or hydroxides to clean surfaces.
(2) This chart gives the color codes to help you identify the bonding brush necessary for each metal.

BONDING BRUSH COLOR CODE

METAL	COLOR CODE	COLOR IDENTIFICATION
Aluminum	None	None
Ferritic	Blue	J7-42-5200
Magnesium	Green	J7-42-5700
Beryllium	Brown	J7-42-5400

B. References
(1) AMM 20-30-80/201, Solvent - Series 80
C. Consumable Materials
(1) B00139 Lacquer Thinner - Federal Spec TT-T-266, or equivalent
(2) B00148 Methyl Ethyl Ketone (MEK) - TT-M-261
(3) G00033 Lint-free cheesecloth
D. Procedure

S 157-023

WARNING: DO NOT GET SOLVENT IN YOUR MOUTH, OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES .

(1) Apply lacquer thinner or solvent, Series 80 (AMM 20-30-80/201) to the specified area with a clean cheesecloth.

NOTE: Use a clean piece of the cheesecloth each time you apply lacquer thinner or solvent. Do not let lacquer thinner or solvent touch areas where it is not necessary to remove paint.

S 117-009
(2) When the specified area is completely clean, immediately rub dry with a clean cheesecloth.

TASK 20-10-22-117-010
6. Solvent Clean Bare, Clad, or Plated Metal
A. General
(1) Use this task to clean plated surfaces and CRES or alclad aluminum that is not painted.
B. Equipment
(1) Nonmetallic brush or cloth applicator
C. Consumable Materials
(1) G00033 Lint-free cheesecloth
(2) B00316 Solvent - Aliphatic Naphtha, TT-N-95, Type I
D. Procedure

S 117-011
(1) Apply solvent to the bonding surfaces with a brush that is not metal or a cloth applicator.

S 117-012
(2) Rub with force to remove contamination you can see.

S 117-013
(3) Immediately dry surfaces with lint-free cheesecloth.

LOCKWIRES - REMOVAL/INSTALLATION

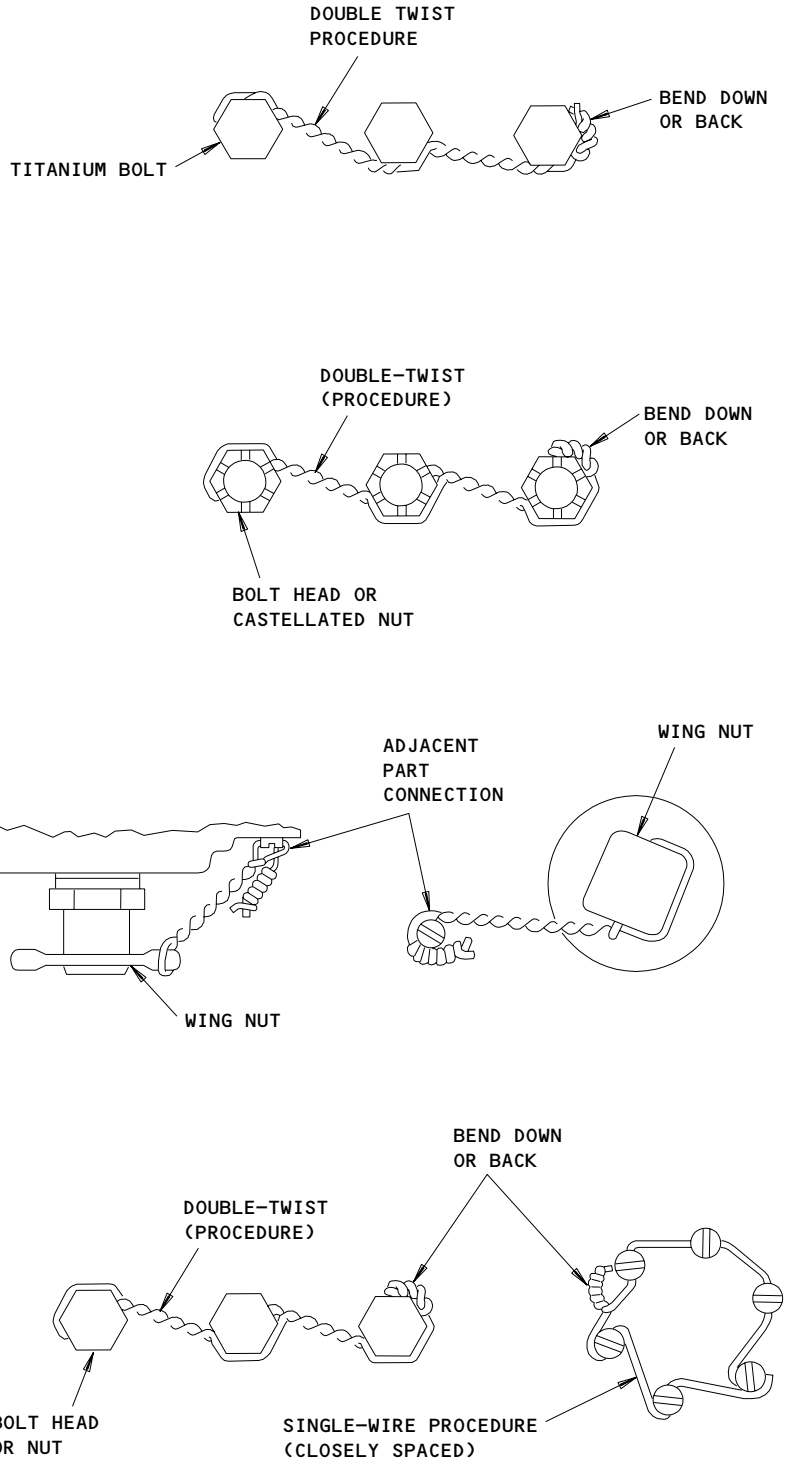
1. General
   A. This procedure contains two tasks. The first task is the removal of lockwires. The second task is the installation of lockwires.
   B. If this procedure does not agree with specified maintenance procedures, use the specified maintenance procedures.
   C. Use lockwires one time only. If lockwires are used more than one time, failure can occur.
   D. Install the lockwire so when parts become loose they will put the lockwire in tension.
   E. Twist the ends of the lockwire three to six times. Bend the twisted ends back or under to make a shield around the ends. Make sure the ends cannot catch something.
   F. Use the double-twist lockwire procedure for all lockwires unless a single-wire procedure is specified.
   G. Install and twist the safety wire so the loop around the head stays down. (If the loop tended to come up over the bolt head there would be a slack loop.)
   H. For multiple fasteners spaced less than four inches apart, the maximum number which can be safety wired together shall be the number than can be wired with a 24-inch length of wire.
   I. For fasteners four to six inches apart, wire together in series no more than three fasteners.
   J. Where fasteners are more than six inches apart, do not tie them in series unless tie points are provided on adjacent parts to shorten the wire span to less than six inches.
   K. Use a right-handed twist for all double twist installations.
   L. Safety-wire diameter shall be between 1/3 and 3/4 of the hole diameter, 0.032-inch diameter minimum.
   M. Safety-wire 0.020 inch in diameter may be used if:
      (1) The safety-wire hole is 0.045 inch diameter or smaller, or
      (2) The spacing between parts is less than two inches and the safety wire hole diameter is between 0.045 and 0.062 inch diameter.

TWIST PER INCH					
Safety Wire Dia. Inch	Less Than 0.019	0.019 to 0.026	0.023 to 0.042	0.043 to 0.065	More Than 0.065
Twists/Inch	11 to 14	9 to 12	7 to 10	5 to 8	4 to 7

TASK 20-10-23-004-001

2. Remove Lockwire
   A. Procedure

      S 024-009
      (1) Cut the lockwire and remove it or remove the pin.



Lockwire Installation
Figure 401

TASK 20-10-23-424-010

3. Install Lockwire

NOTE: The figures in this section show the lockwire installed on right threads. Install lockwire on left threads opposite to that shown.

A. General

(1) Use these types of wires for lockwire:

(a) In elevated temperature areas, use monel, inconel, or corrosion resistant lockwire.

(b) Use copper wire, 0.020 in. diameter, only on emergency devices. Use it where a seal is necessary on emergency equipment to indicate these devices have not been used. Emergency equipment includes portable fire extinguishers, first aid kits, emergency valve and oxygen regulators.

(c) Use clad 5056 aluminum alloy wire for lockwire that touches magnesium. This wire prevents galvanic corrosion.

NOTE: This table shows BAC standard wire sizes:

MATERIAL	SIZE (IN)				
Monel or Inconel	.020	.032	.040	.051	.091
Corrosion Resistant Steel	.020	.032	.040	.051	.091
Aluminum Alloy	.020	.032	.040	.051	.091

B. Procedure

S 424-003

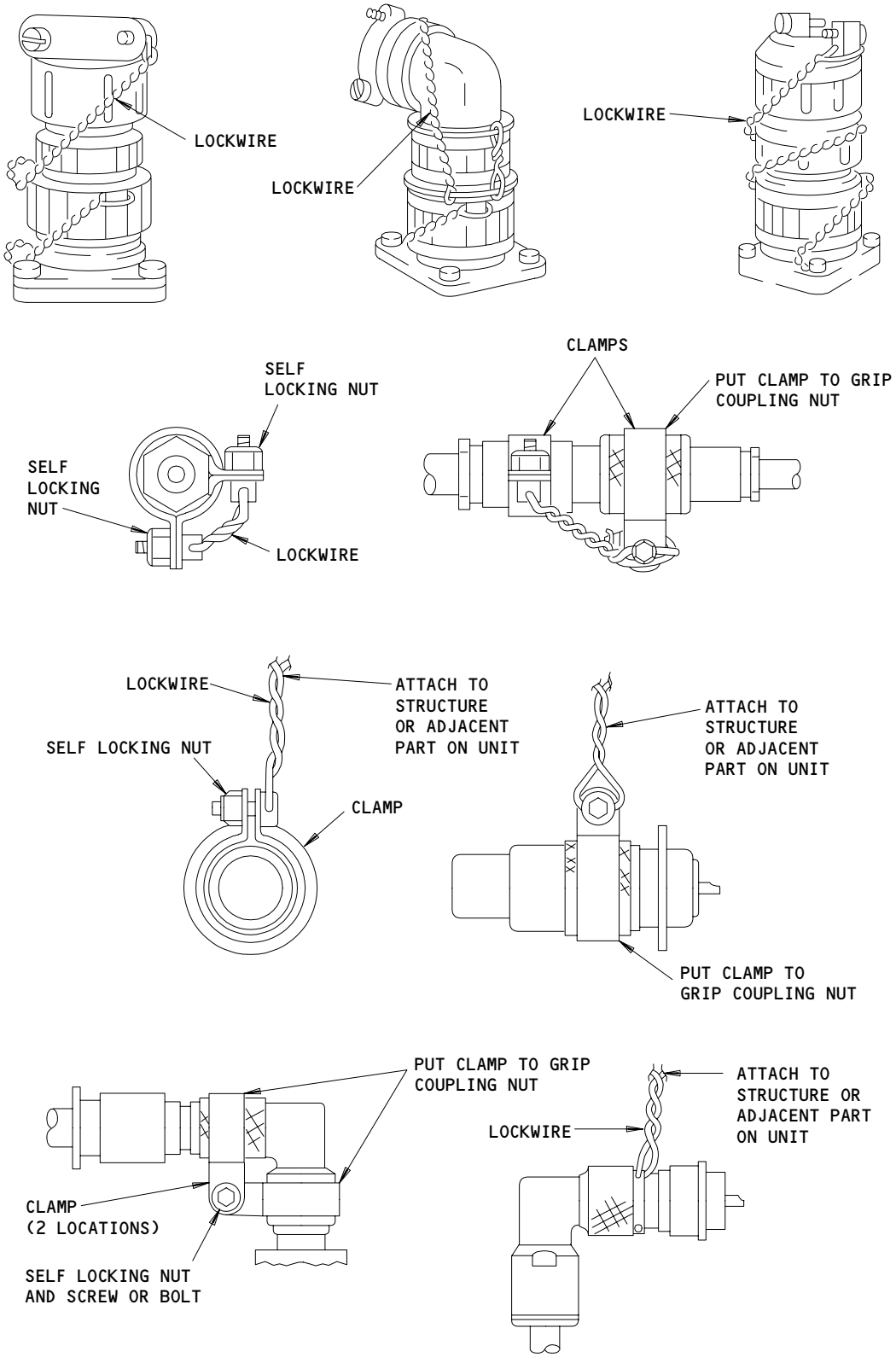
(1) To install lockwires on bolts and screws, see Fig. 401.

NOTE: For fittings on which lockwire is necessary, install the lockwire on the mating part or an adjacent part.

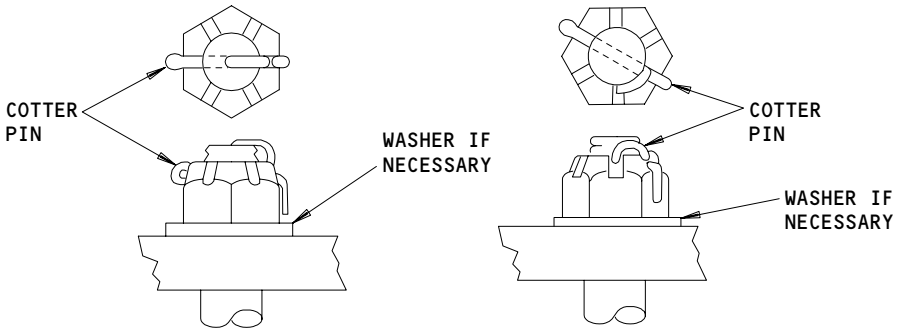
(a) Make sure the loop of the double wire goes around, not over, the head of the bolt or screw.

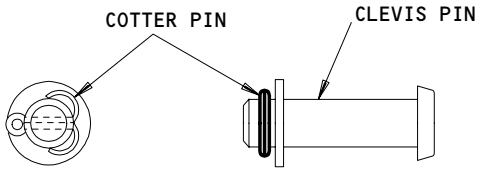
CAUTION: NEVER LOOSEN OR TIGHTEN A NUT OR BOLT OUT OF ITS SPECIFIED TORQUE RANGE. DAMAGE CAN OCCUR.

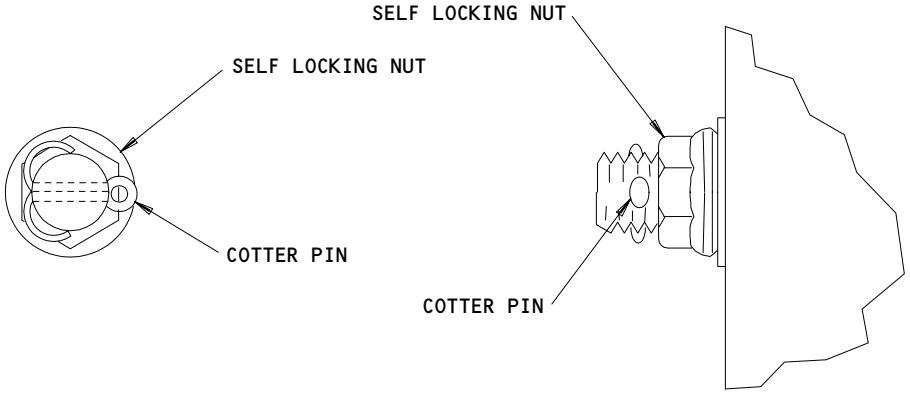
(b) Tighten the nut or bolt to the low specified torque value. If necessary, continue to tighten until a slot aligns with the safety hole.

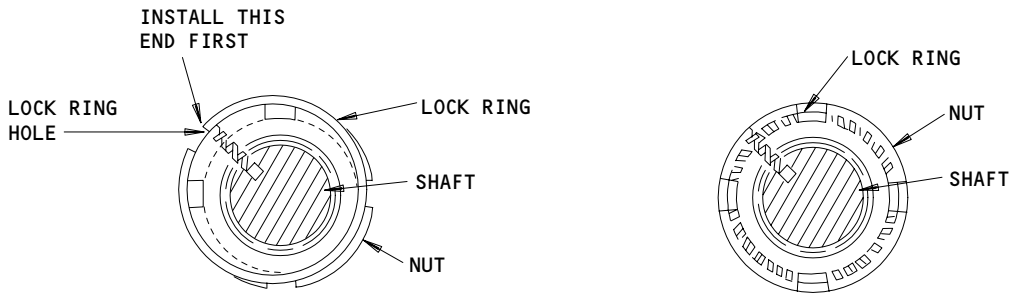


Connector Lockwire - Installation
Figure 402









BEFORE INSTALLATION AFTER INSTALLATION

Locking Pins - Installation
Figure 403

S 424-004

(2) To install lockwires on electrical connectors, see Fig. 402.

NOTE: Specifications for the installation of lockwires to bolt and screws are also applicable to electrical connectors.

S 424-005

(3) To install cotter pins, see Fig. 403.
   (a) To install cotter pins in castellated nuts, install the head of the cotter pin parallel to the slot in the nut. Bend the ends of the cotter pin to the bolt end or to the castellated nuts slit next to the pin end.
   (b) To install cotter pins and washers on clevis pins, put the pin through the hole on the bolt and bend the pin ends around the side of the bolt.
   (c) To install cotter pins in non-castellated nuts, install the cotter pin through the hole on the bolt and bend the pin ends back on each side of the bolt approximately 90 degrees.

S 424-006

(4) To install lock rings, see Fig. 403.
   (a) Put the bent hook of the lock ring into an aligned locking hole in the shaft and nut. Do not let the ring move apart.
   (b) Move the lock ring over the flange into the groove with minimum expansion of the lock ring.

RIG PINS - MAINTENANCE PRACTICES

1. General
   A. This procedure contains a list of rig pins used for maintenance on the 757. The list gives the Maintenance Manual (MM) rig pin number and rig pin size (diameter and length). Each MM rig pin number has a letter prefix:
      A = Aileron
      AT = Autothrottle
      CD = Cargo Doors, Lower Lobe
      E/ST = Elevator and Stabilizer
      LDG = Landing Gear
      LE = Leading Edge Slats
      LGB = Landing Gear Brakes
      LGD = Landing Gear Doors
      NS = Nose Steering
      PD = Passenger Doors
      R = Rudder
      RR = RR Engine
      TE = Trailing Edge Flap
      TR = Thrust Reverser
   B. The B20003-91 Rig Pin set incorporates and replaces the -83 and -84 rig pin sets.

      NOTE: The -83 and -84 rig pin sets are applicable until replacement is necessary.

TASK 20-10-24-992-001

2. Table - Rig Pins
   A. General

Rig Pin Set B20003-91		Rig Pin Size	
		Diameter	Length
MM Rig Pin No.	Rig Pin P/N	+0.00/-0.002 in.	±0.01 in.
A 1	B20003-27	0.311	11.00
A 2	B20003-25	0.311	10.00
A 3	B20003-23	0.311	7.00
A 4	B20003-23	0.311	7.00
AT 1	B20003-67	0.311	10.00
CD 1	B20003-12	0.311	1.50
E/ST 1	B20003-21	0.311	6.00
E/ST 2	B20003-21	0.311	6.00
E/ST 3	B20003-21	0.311	6.00

Rig Pin Set B20003-91		Rig Pin Size	
		Diameter	Length
MM Rig Pin No.	Rig Pin P/N	+0.00/-0.002 in.	±0.01 in.
E/ST 4	B20003-21	0.311	6.00
E/ST 5	B20003-21	0.311	6.00
E/ST 6	B20003-21	0.311	6.00
E/ST 7	B20003-21	0.311	6.00
E/ST 8	B20003-21	0.311	6.00
E/ST 9	B20003-21	0.311	6.00
E/ST 10	B20003-21	0.311	6.00
E/ST 11	B20003-21	0.311	6.00
LDG 1	B20003-18	0.311	3.00
LE 1	B20003-3	0.311	1.50
LE 2	B20003-3	0.311	1.50
LE 3	B20003-61	0.250	3.50
LGB 1	B20003-28	0.311	12.00
LGB 2	B20003-28	0.311	12.00
LGB 3	B20003-28	0.311	12.00
LGD 1	B20003-15	0.311	2.00
NS 1	B20003-20	0.311	4.00
NS 1A	B20003-20	0.311	4.00
NS 2	B20003-24	0.311	8.00
NS 3	B20003-5	0.311	3.00
NS 4	B20003-5	0.311	3.00
NS 5	B20003-5	0.311	3.00
NS 6	B20003-5	0.311	3.00
NS 7	B20003-15	0.311	2.00
PD 1	B20003-9	0.1875	5.00
PD 2	B20003-8	0.1875	4.00
PD 3	B20003-11	0.250	2.50
PD 4	B20003-6	0.1875	2.00
PD 5	B20003-6	0.1875	2.00
PD 6	B20003-7	0.1875	2.50
PD 7	B20003-10	0.1875	6.00
PD 8	B20003-11	0.250	2.50
PD 9	B20003-8	0.1875	4.00
R 1A	B20003-26	0.311	10.25
R 1B	B20003-26	0.311	10.25

Rig Pin Set B20003-91		Rig Pin Size	
		Diameter	Length
MM Rig Pin No.	Rig Pin P/N	+0.00/-0.002 in.	±0.01 in.
R 2	B20003-22	0.311	6.75
R 3	B20003-16	0.311	2.50
R 4	B20003-19	0.311	3.25
R 5	B20003-17	0.311	2.75
R 6	B20003-17	0.311	2.75
R 7	B20003-13	0.311	1.75
R 8	B20003-13	0.311	1.75
R 9	B20003-54	0.061	2.80
RR 1	B20003-14	0.311	1.60
RR 2	B20003-29	0.311	3.25
TE 1	B20003-53	0.311	3.00
TE 2	B20003-4	0.311	1.50
TE 3	B20003-4	0.311	1.50
TE 4	B20003-4	0.311	1.50
TE 5	B20003-4	0.311	1.50
TR 1	B20003-80	0.311	1.50

FLOOR PANEL PROTECTION - MAINTENANCE PRACTICES

TASK 20-10-25-612-001

1. Protection of Floor Panel
   A. General
      (1) To prevent possible floor panel damage during maintenance, do these steps:
         (a) Let only one person at a time use the ladder, stand, or scaffolding.
         (b) Use plywood bearing pads that are a minimum of 1/2-inch thick and one-foot square under each leg, if you have these conditions:
         (c) You use ladders, stands, or scaffolding with leg-bearing surfaces. Leg-bearing surfaces include rollers, screws, and sharp edges.
            1) You have a leg-bearing surface of less than eight square inches for each leg.

HEAT GUNS, SOLDERING GUNS AND SOLDERING IRONS - MAINTENANCE PRACTICES

TASK 20-10-26-302-001

1. Use of Heat Guns, Soldering Guns, and Soldering Irons

A. General

(1) This procedure gives the minimum recommended safety procedures for heat guns, soldering guns, and soldering irons used near airplanes. These are general procedures. If regulations made by local agencies or procedures made by the airline are more applicable, use them. Boeing cannot know or write about all possible conditions which the airlines can have.

(2) You must examine the conditions and be careful. Customer airlines must know how heat guns, soldering guns, and soldering irons are used.

(3) Heat guns, soldering guns, and soldering irons can cause an explosion. Components in all of these devices can operate at temperatures higher than the fuel ignition temperature (450°F). Heat guns and soldering guns also can contain electrical switches which can cause sparks. These sparks can cause the fuel to burn.

(4) We do not recommend you use a device to supply heat in the fuel tanks. You can have a good flow of air in the fuel tanks. You can make them safe when you fill the fuel tanks with nitrogen. For the repair of the wires in the fuel tanks, we recommend you use procedures that use crimped splices and sleeves with nylon ties. These procedures are specified in WDM Chapter 20.

(5) Do not use heat guns, soldering guns, or soldering irons less than 100 feet from an airplane during these operations:
- When you fuel
- When you defuel
- When the fuel tanks are open.

(6) You can use heat guns, soldering guns, and soldering irons when and where smoking is permitted. If you use these devices where smoking is not permitted, you must first make sure there are not dangerous levels of fuel vapors in the work area.

(7) Zero is the safe fuel vapor level at which to use devices that can cause ignition.

(8) Measure the fuel vapor level with a combustible gas indicator that reads in "PRECENT LOWER EXPLOSIVE LIMIT" or "PRECENT EXPLOSIVE". For example, you can use Mine Safety Appliances, Model 2 or Davis, Model D-16. If you can read a fuel fume level on this equipment, two conditions have occurred:
- A liquid fuel or fume source is near
- The local fuel fume levels are high or the ventilation is not sufficient.

Use the equipment to measure the initial fuel fume levels. Make sure the fuel fume levels are sufficiently low. Continue to monitor the fuel fume levels during the repair.

(9) Do not use a possible ignition source near open fuel tanks, fuel vents, or fuel leaks where fume concentrations cannot be known or controlled.

(10) If you use a possible ignition source near an airplane where smoking is not permitted, make sure a person monitors the work and any other work in the area. The person must be authorized to monitor airplane fire safety.

(11) A person who can measure the risk of the repair to be done must identify the emergency or fire fighting equipment necessary at the work area of the repair. The person must be authorized to monitor airplane fire safety.

(12) Do not start or continue to do work on a fuel system component while equipment that can cause the fuel to burn is near.

(13) Keep the number of maintenance and safety persons included to a minimum.

FLIGHT CONTROL SURFACES SAFETY HARNESS RECEPTACLE - MAINTENANCE PRACTICES

1. General
   A. This procedure contains one task. The task is to attach the safety harness to the flight control surfaces.
   B. Receptacles for the safety harness are on the top surfaces of the wing and horizontal stabilizer. Maintenance persons who work high above the ground will attach their safety harnesses to these receptacles.

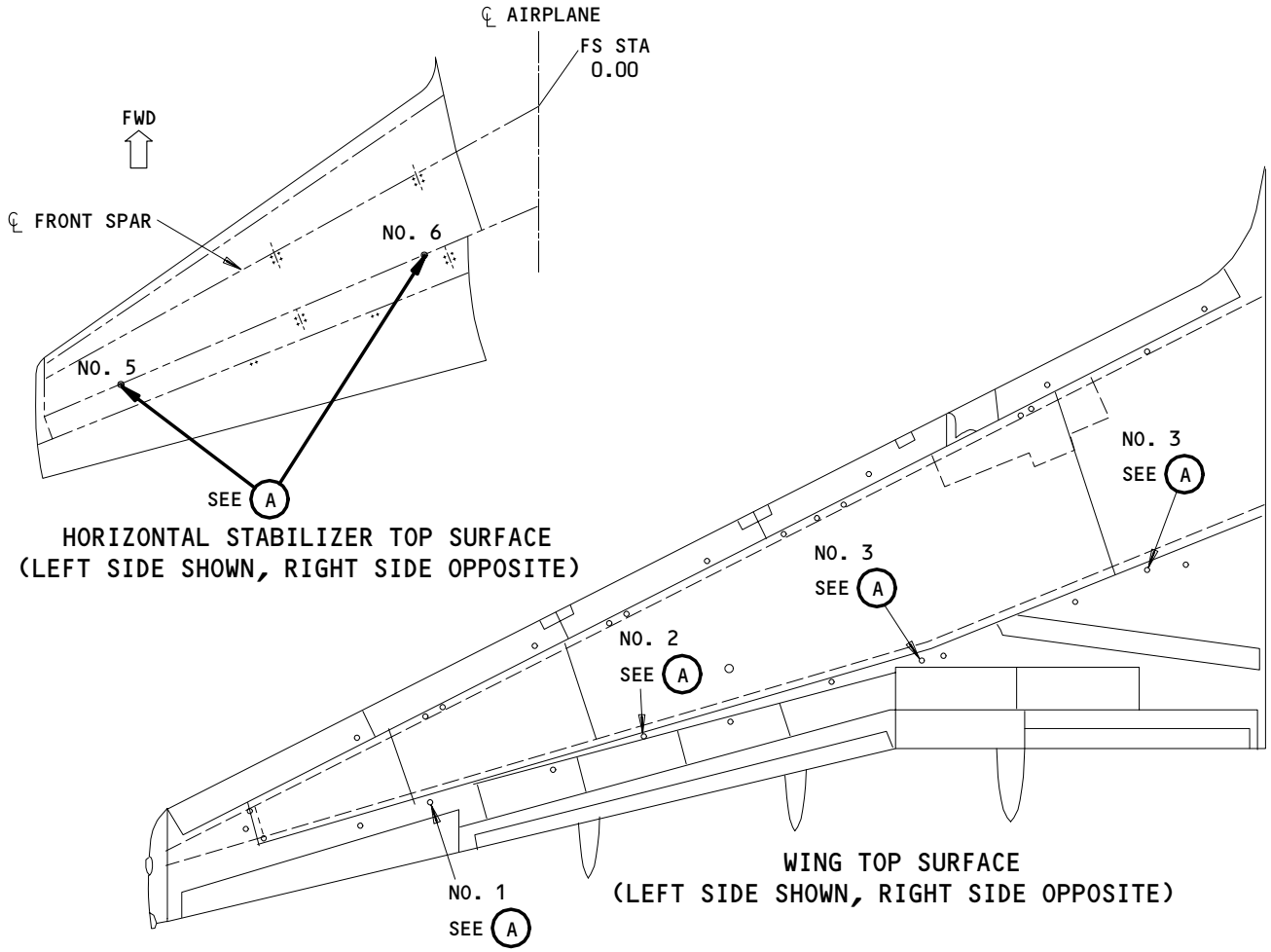
TASK 20-10-27-402-001

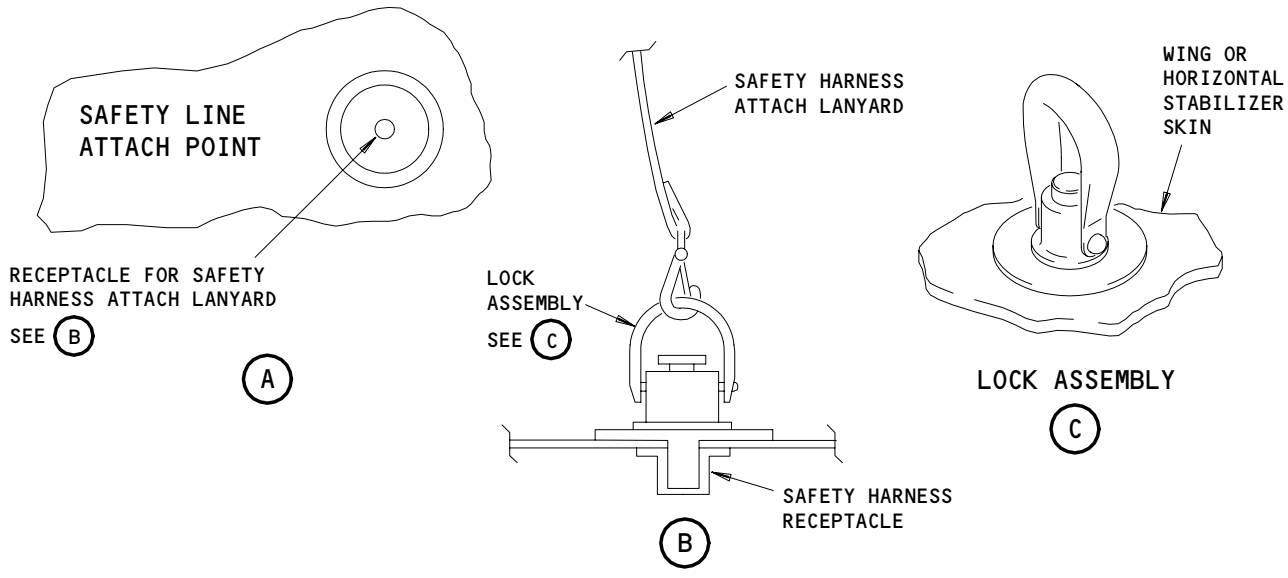
2. Attach the Safety Harness (Fig. 201)
   A. General
      (1) There are four receptacles on the wing top surface and two receptacles on the horizontal stabilizer top surface.
      (2) The safety harness attach lanyard uses a lock assembly.
   B. Equipment
      (1) Attach Lanyard - Wing/Horizontal Stabilizer Safety Harness, B20001-5
   C. Procedure

      S 822-002
      (1) Adjust the lock assembly until it is aligned with the airplane skin. If not aligned, there is a risk the lock assembly will not engage correctly.

      S 492-003
      (2) Attach the safety harness attach lanyard to the receptacle.

      S 492-004
      (3) Attach the safety harness to the safely harness attach lanyard.





Locations of Safety Harness Receptacle on Flight Controls
Figure 201

LUBRICATION FITTINGS - MAINTENANCE PRACTICES

1. General
   A. This procedure gives instructions to lubricate fittings that are damaged or came out.

TASK 20-10-29-602-001

2. Temporary Lubrication for Blown-out Lubrication Fittings
   A. General
      (1) This task contains the instructions to lubricate a component using a blown-out lubrication fitting when replacement of the lubrication fitting replacement is inconvenient.
      (2) This procedure is only to be used in the event that a grease fitting has been blown out and the maintenance to repair the fitting is inconvenient, but lubrication is necessary to continue service.
         (a) This procedure is only a temporary and should only be used until the fitting can be conveniently repaired or replaced.
   B. Equipment
      (1) Rubber-Tipped Grease Gun Adapter - B411 (Alemite P/N)
   C. References
      (1) AMM 20-30-04/201, Lubricants
   D. Lubricate the Blown-out Fitting

S 012-002

CAUTION: MAKE SURE THAT YOU FOLLOW THE NORMAL LUBRICATION PROCEDURES FOR THE COMPONENT BEING LUBRICATED. FAILURE TO COMPLY MAY RESULT IN DAMAGE TO THE COMPONENT.

(1) Gain access to the blown-out lubrication fitting.

S 942-003

(2) Use the applicable grease gun and grease for the location (AMM 20-30-04/201).
   (a) Attach the rubber-tipped grease adapter to the grease gun.

S 642-004

(3) Press the rubber-tipped adapter firmly against the opening where the lubrication fitting was blown out.

S 642-005

(4) Gently pump the grease into the fitting opening, making sure that the rubber tip remains firmly seated against the opening.

S 142-006

(5) Clean up any excess grease.

S 412-007

(6) Close any panels opened for access.

S 842-008

(7) Return the aircraft to normal.

LUBRICATION FITTINGS - REMOVAL/INSTALLATION

1. General
   A. This procedure gives instructions for installation of press-in type lubrication fittings.

TASK 20-10-29-424-001

2. Install Lubrication Fittings
   A. General
      (1) This task has instructions for installation of new lube fittings and lube fittings that were blown-out.
   B. Equipment
      (1) Drive Tool - 5253-3 (for Alemite Type 1728B lubrication fittings)
      (2) Drive Tool - 5254-1 (for Alemite 1646B and 1992B lubrication angle fittings)
   C. Consumable Materials
      (1) B00025 Solvent - P-D-680
      (2) Cleaner:

          NOTE: Choose one of the cleaners that follow.

      (3) B00143 Solvent (Freon) MIL-C-81302
      (4) G00262 Nitrogen - Liquid, MIL-P-27401
      (5) C00316 Primer - Loctite Grade T (747I)
      (6) Adhesive:
          (a) G00106 Compound - Retaining Loctite 675 or MIL-R-46082
          (b) G00106 Loctite - RC/680 or MIL-R-46082
      (7) Cotton swabs, Commercially Available
   D. Procedure for Installation of a New Lube Fitting

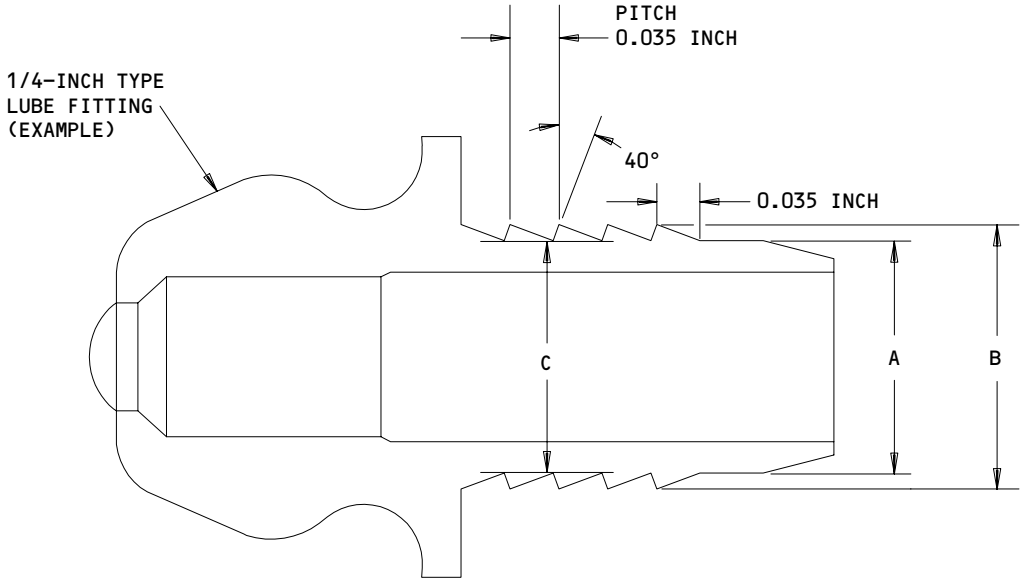
      S 434-015

      CAUTION: MAKE SURE YOU USE THE PROPER TOOL TO INSTALL THE LUBRICATION FITTING. MOVE THE LUBRICATION FITTING IN STRAIGHT TO PREVENT DAMAGE TO THE MATING PART.

      (1) Get a specified standard lube fitting for installation in the applicable hole.

DESIGN LUBE HOLE DIAMETER IS 0.188/0.189 INCHES

LUBE HOLE DIAMETER (X) (INCHES)	LUBE FITTING DIAMETER (INCHES)
0.194 MAX	3/16 1
0.195–0.247	1/4 MODIFIED 1
0.248–0.249	1/4 2
0.250–0.254	1/4 1



ALL DIMENSIONS ARE IN INCHES
X (NOT SHOWN) = HOLE DIAMETER IN MATING COMPONENT
A = SHANK DIAMETER (X MINUS 0.007/0.012)
B = SERRATION OUTER DIAMETER (X PLUS 0.005/0.010)
C = SERRATION ROOT OUTER DIAMETER (X MINUS 0.003/0.010)

1 INSTALL WITH ADHESIVE
2 INSTALLATION WITH ADHESIVE OPTIONAL

Lubrication Fitting Modification and Installation
Figure 401

S 164-003

(2) Clean the lube fitting hole as follows:

(a) Use cotton swabs to remove as much grease as possible from the lube fitting hole.

(b) Use cleaner on a clean cotton swab to clean the hole to a depth of 0.5 inch minimum. Do the procedure until no more grease or dirt you can see is removed.

S 434-004

(3) Use the correct drive tool to put the lube fitting into the hole in the mating part.

E. Procedure for Installation of a Lube Fitting which was Blown-Out

S 434-005

(1) Get a specified standard size or a modified size lube fitting for installation in the applicable hole.

S 164-006

(2) Clean the lube fitting hole as follows:

(a) Use cotton swabs to remove as much grease as possible from the lube fitting hole.

(b) Use cleaner on a clean cotton swab to clean the hole to a depth of 0.5 inch minimum. Do the procedure until no more grease or dirt you can see is removed.

S 624-007

(3) Do the steps that follow to apply the primer.

(a) Use a cotton swab to apply a thin coat of primer to the bore of the hole.

(b) Let the primer air dry at room temperature a minimum of five minutes before you apply the retainer compound.

S 434-013

CAUTION: TO PREVENT OBSTRUCTION OF THE LUBRICATION PASSAGES, DO NOT APPLY TOO MUCH ADHESIVE ON THE LUBE FITTING AND THE MATING PART.

(4) Use a cotton swab to apply a thin coat of adhesive to the bore of the hole. The depth of the adhesive should be 0.25 to 0.40 inch.

S 434-009

(5) Put the lube fitting into liquid nitrogen for a minimum of 1 minute to make sure the lube fitting cools equally.

S 434-010

(6) Use the correct drive tool to put the lube fitting into the hole in the mating part.

NOTE: Put the lube fitting into the hole in the mating part as quickly as possible so that it does not warm up too much.

S 844-011

(7) Let the lube fitting cure for 12 hours at room temperature or let the fitting cure as specified in the technical data sheet for the adhesive material used.

NOTE: The cure time will vary depending upon the type of adhesive material used, the temperature, the type of fitting material, and the type of substrate material. The technical data sheet for the adhesive material will provide data needed to accelerate the cure time based upon these variables.

SEALS ON OPEN ELECTRICAL TERMINALS IN FLAMMABLE LEAKAGE ZONES - MAINTENANCE PRACTICES

1. General
   A. This procedure contains one task. The task is to seal the open electrical terminals and connections in flammable leakage zones.
   B. When you replace or install components on the lighting systems in flammable leakage zones, seal these open items:
      (1) Lamp terminals
      (2) Terminal strips
      (3) Circuit breakers
      (4) Transformers
      (5) Switches
      (6) Hardwire
      (7) Wire junctions
   C. Lamp terminals with a rubber sleeve are open.
   D. Do not seal the dual grounds in flammable leakage zones or the wire junctions in fuel tanks.
   E. Do not seal the generator terminals on the engines or APU.
   F. Install wire and protectors on all secondary switch leads and seal all secondary switch terminals in the flammable leakage zones.
      (1) Make sure that insulated splices are not open.

TASK 20-10-31-392-001

2. Seal the Open Terminals (Fig. 201)
   A. Equipment
      (1) Paint brush, 1-inch wide - Commercially available
   B. Consumable Materials
      (1) B00083 Aliphatic Naphtha - TT-N-95
      (2) A00767 Sealant BMS 5-45 TYPE II
      (3) A00230 Sealant BMS 5-37
      (4) A00247 Sealant BMS 5-95
      (5) A50009 Sealant BMS 5-142
   C. References
      (1) SWPM 20-30-00 Protection of Electrical Connections in a Flammable Leakage Zone.

D. Procedure

S 112-002

(1) Remove all dirt and grease for a minimum of one inch adjacent to the area you will seal. Use a cloth made moist with Naphtha.

S 392-004

CAUTION: DO NOT SEAL THE SHANK OF LAMP TERMINALS THAT ARE A SPRING-LOADED PART OF THE BAYONET LAMP SOCKET BASE. SEAL ONLY THE TERMINAL END AND ATTACHED HARDWARE. SEALANT ON THE SHANK LIMITS MOVEMENT OF THE LAMP CONTACT WHICH CAN CAUSE THE LIGHT ASSEMBLY TO BECOME TOO HOT. IF IT BECOMES TOO HOT, A FAILURE CAN OCCUR.

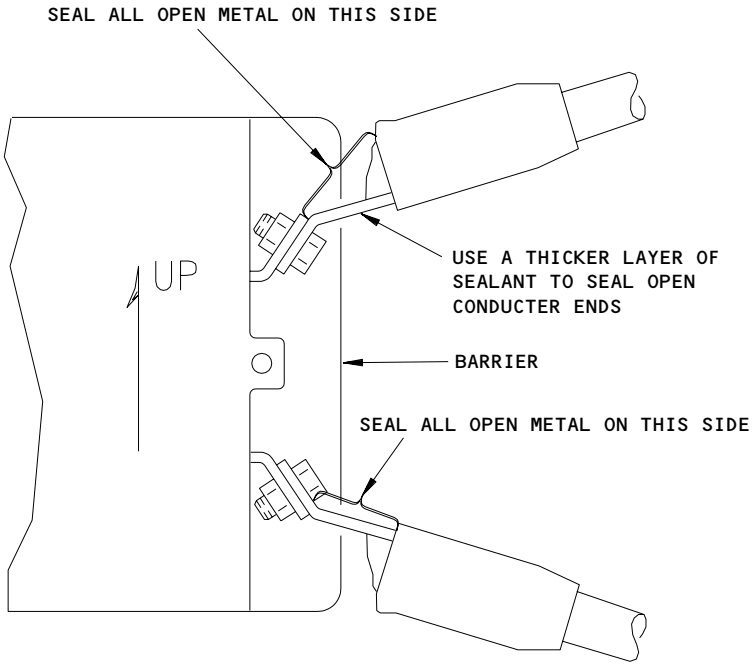
(2) Use a brush to apply one layer of sealant to the open areas. Make sure you seal all the open areas.
   (a) Refer to SWPM 20-30-00 for approved sealants.

S 392-005

(3) On ring torque terminals, apply sealant as follows:
   (a) Apply sealant to the side of the terminal that a metal object can hit if it falls (Fig. 201).

      NOTE: Seal each terminal as far as the attached hardware. You can fully seal the attached hardware. If there are barriers between phases or between components, the seal must extend into the space given protection by the barriers.

   (b) If the edges of the terminals are less than 0.5 inch from each other, apply sealant to the edges.



Sealant Installation on Ring Tongue Terminals
Figure 201

COAXIAL CABLE - MAINTENANCE PRACTICES

1. General
   A. The maintenance procedures that follow are applicable to all of the antenna coaxial cable trouble-shooting in Chapters 23 and 34. A Time Domain Reflectometer (TDR) is used. (The ADF system uses a shielded pair wire for each sense and loop antenna. Use the same trouble-shooting procedures for these wires as used for the coaxial cables.) Do the applicable tests and problem analysis procedures to make sure a line replaceable unit (LRU) is not defective. Also, do the necessary tests to make sure the system problem is in the antenna system.
   B. Use the 3M Advanced System Tester 900AST series (recommended) TDR or the Tektronix Model 1502 (optional) TDR to examine the coaxial cable.

TASK 20-10-32-762-001

2. Coaxial Cable Test (Fig. 201)
   A. General
      (1) Refer to the Tektronix Model 1502 or 900AST Instruction Manual for information on how to test the coaxial cables.

HARTWELL TYPE LATCHES - ADJUSTMENT/TEST

1. General
   A. This procedure contains two tasks. The first is testing Hartwell latches. The second is adjusting Hartwell latches.
   B. Hartwell type latches are used on small flush-fitting service access doors such as those for the potable water and lavatory service panels and the forward and mid drain mast access doors.

TASK 20-10-34-705-005

2. Test Hartwell Latches, Series 5100
   A. Procedure

S 725-002

(1) Test Hartwell series 5100 latches.
   (a) Check that door turns freely to within +0.100 or -0.030 inch of contour at latch position.
   (b) The latch you want to check, press door to fit and come in line at door edge as shown in Fig. 501. Lock latch and check that preload is there by pushing latch bolt at location mentioned in Fig. 501. There must be 0.010 to 0.030 inch depression free play at this point. Adjust per par. 3 if you do not get free play.
   (c) Check that door latch bolt overlap on structure to be 0.25 inch as shown in Fig. 501.

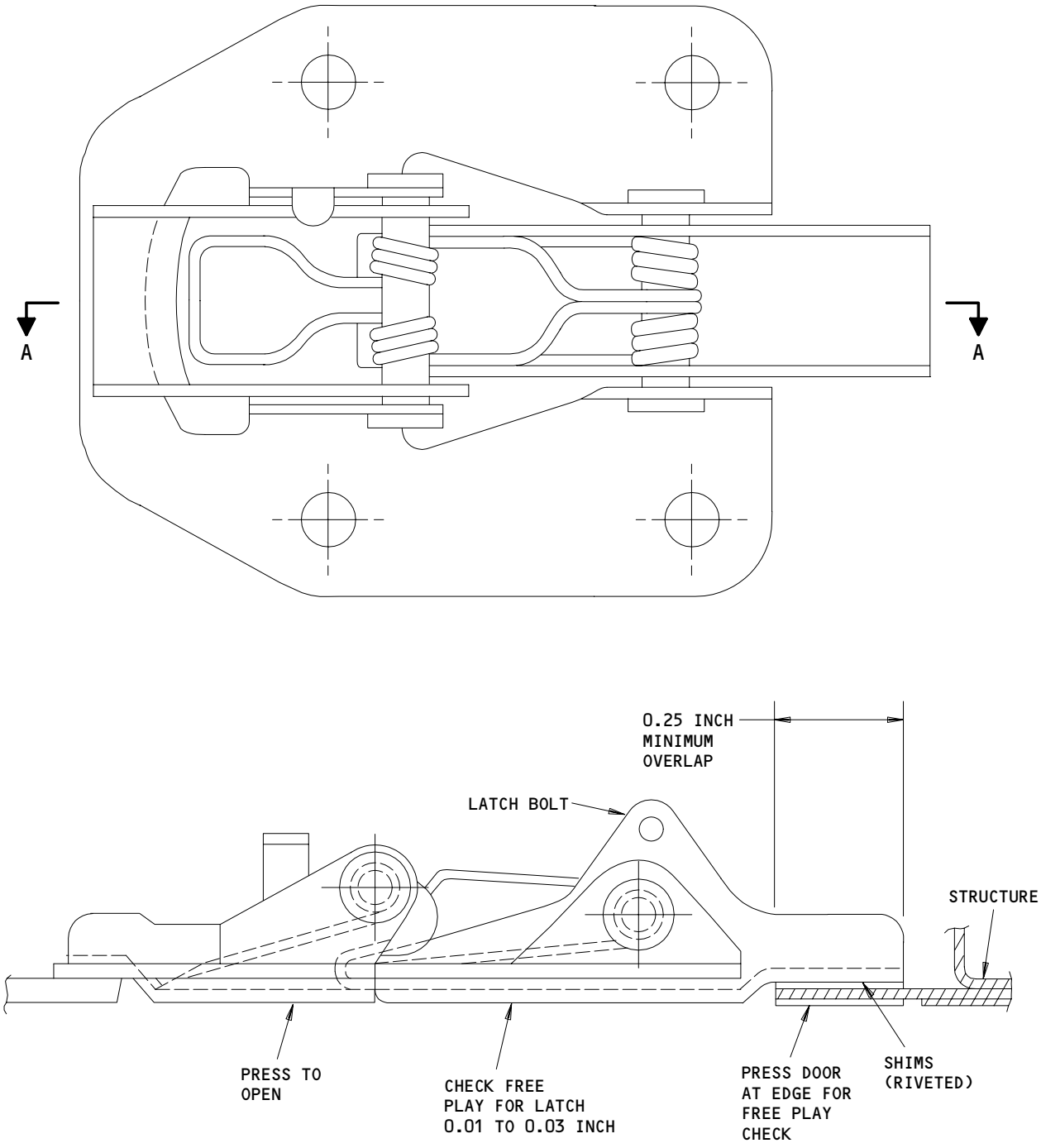
TASK 20-10-34-825-006

3. Adjust Latches (Fig. 501)
   A. Procedure

S 825-004

(1) If you cannot get 0.010 to 0.030 inch depression free play, add or subtract phenolic shims.

NOTE: Nominal 0.030 and 0.040 inch shims are installed to get dimensional condition shown in Fig. 501. Shim thickness may be different.



A-A

Hartwell Latches, Series 5100, Adjustment
Figure 501

POWER DEVICE CARTRIDGE - REMOVAL/INSTALLATION

1. General
   A. This procedure contains two tasks.
      (1) The first task is the removal of cartridge.
      (2) The second task is the installation of cartridge.

   TASK 20-10-36-004-001

2. Remove the Power Device Cartridge (Squib)
   A. General
      (1) This task contains the information for the removal of power device cartridges (squibs).
   B. Equipment
      (1) Cap - Shorting or Faraday - STD-1168
      (2) Ohmmeter - Resistance Measuring Bridge - STD-1045
      (3) Wrist Strap - Adjustable, Conductive Static Control, 14810
   C. References
      (1) AMM 20-41-00/201, Static Grounding
      (2) AMM 24-22-00/201, Control (Supply Power)
   D. Remove the power device cartridge (squib).

      S 944-002
      (1) Do this task to ground the airplane: "Static Grounding Procedure" (AMM 20-41-00/201).

      S 944-003
      (2) Make sure you remove electrical power before you remove the power device cartridge (squib), do this task: "Control (Supply Power)" (AMM 24-22-00/201).

      S 944-004
      (3) Wear a static control wrist strap during the removal of the squib.

      S 764-005

      WARNING: USE A WRIST STRAP WITH A MINIMUM GROUNDING LEAD RESISTANCE OF 250 KILOHMS AND A MAXIMUM OF 1.5 MEGOHMS. IF YOU USE A WRIST STRAP WITH THE INCORRECT RESISTANCE AND YOU ACCIDENTALLY TOUCH A COMPONENT THAT HAS HIGH VOLTAGE, INJURIES CAN OCCUR.

      (4) Do these steps to do a resistance test of the static control wrist strap:
         (a) Use an ohmmeter to make sure the static control wrist strap assembly has a minimum resistance of 250 kilohms and a maximum of 1.5 megohms.

WARNING: MAKE SURE THAT THE GROUNDING LEAD ON THE WRIST STRAP TOUCHES YOUR SKIN. IF YOU INSTALL THE WRIST STRAP INCORRECTLY, DAMAGE TO EQUIPMENT AND INJURIES TO PERSONNEL CAN OCCUR.

(b) Put the static control wrist strap on the wrist of the person that will remove the squib
(c) Use an ohmmeter to make sure the resistance is less than 10 megohms.

S 944-006
(5) Connect the static control wrist strap to an applicable electrostatic ground jack.

S 944-007

WARNING: PUT A PROTECTIVE COVER ON THE SQUIB. IF YOU DO NOT PUT A PROTECTIVE COVER ON THE SQUIB, IT CAN FIRE SUDDENLY AND CAUSE INJURY TO PERSONNEL.

(6) Stray voltage on the airplane can cause the squib to discharge. Make sure any stray voltage is discharged before you remove the aircraft electrical connector.

S 024-008
(7) Remove the electrical connector.

S 484-009
(8) Make sure the faraday cap (protective cover) is installed on the squib whenever the airplane electrical connector is removed from the squib.

NOTE: The faraday cap is attached to the squib. This protective cover has electrically conductive surfaces to prevent possible squib explosion because of static discharge.

S 944-010
(9) After the faraday cap is attached to the squib, the wrist strap may be removed.

TASK 20-10-36-404-011

3. Install the Power Device Cartridge (Squib)

A. General

(1) This task contains the information to install the power device cartridge (squib).

B. Equipment

(1) Cap - Shorting or Faraday - STD-1168
(2) Ohmmeter - Resistance Measuring Bridge - STD-1045
(3) Wrist Strap - Adjustable, Conductive Static Control, 14810

C. References

(1) AMM 20-41-00/201, Static Grounding
(2) AMM 24-22-00/201, Control (Supply Power)

D. Install the power device cartridge (squib).

S 944-012

(1) Make sure you remove electrical power before you install the power device cartridge (squib), do this task: "Control (Supply Power)" (AMM 24-22-00/201).

S 944-013

(2) Wear a wrist strap during installation of the squib.

S 764-014

WARNING: USE A WRIST STRAP WITH A MINIMUM GROUNDING LEAD RESISTANCE OF 250 KILOHMS AND A MAXIMUM OF 1.5 MEGOHMS. IF YOU USE A WRIST STRAP WITH THE INCORRECT RESISTANCE AND YOU ACCIDENTALLY TOUCH A COMPONENT THAT HAS HIGH VOLTAGE, INJURIES CAN OCCUR.

(3) Do these steps to do a resistance test of the static control wrist strap:

(a) Use an ohmmeter to make sure that the static control wrist strap assembly has a minimum resistance of 250 kilohms and a maximum of 1.5 megohms.

WARNING: MAKE SURE THAT THE GROUNDING LEAD ON THE WRIST STRAP TOUCHES YOUR SKIN. IF YOU INSTALL THE WRIST STRAP INCORRECTLY, DAMAGE TO EQUIPMENT AND INJURIES TO PERSONNEL CAN OCCUR.

(b) Put the static control wrist strap on the wrist of the person that will install the squib.
(c) Use an ohmmeter to make sure that the resistance is less than 10 megohms.

S 944-015

(4) Connect the static control wrist strap to an applicable electrostatic ground jack.

S 484-016

WARNING: PUT A PROTECTIVE COVER ON THE SQUIB. IF YOU DO NOT PUT A PROTECTIVE COVER ON THE SQUIB, IT CAN FIRE SUDDENLY AND CAUSE INJURY TO PERSONNEL.

(5) Make sure the faraday cap (protective cover) is installed on the squib whenever the airplane electrical connector is removed from the squib.

NOTE: The faraday cap is attached to the squib. This protective cover has electrically conductive surfaces to prevent possible squib explosion because of static discharge.

S 944-017

(6) Stray voltage on the airplane can cause the squib to discharge. Make sure that any stray voltage is discharged before you install the aircraft electrical connector.

S 424-018

(7) Remove the faraday cap and install the electrical connector.

S 944-019

(8) After the electrical connector is installed, the wrist strap may be removed.

STANDARD TORQUE VALUES - MAINTENANCE PRACTICES

TASK 20-11-00-912-001

1. Refer to the Figures that Follow for the Torque Data
   A. General
      (1) When it is not easy to get access use an adapter. For this condition, a corrected torque wrench value is necessary. Follow the examples in Fig. 201 to find the corrected torque wrench value T1 when you use an adapter.
      (2) The torque values shown in Fig. 202 give data for the correct quantity of pressure necessary to tighten fasteners. Some fasteners have threads that are lubricated. Some fasteners have threads that are not lubricated. The values which are necessary to tighten the fastener by the nut or by the bolt are also supplied.
      (3) The minimum torque necessary to turn the self-locking nuts must be the value shown in Fig. 203. If the nut turns too easily or turns too hard when you install the nut on the bolt, refer to Fig. 203 to do a test of the nut.
      (4) Torque values are given in Fig. 204 for Reduced Head Bolts.
      (5) Torque values are given in Fig. 205 for Rigid Tube Coupling Connectors.
      (6) Torque values are given in Fig. 206 for Pipe Thread Fittings.
      (7) Torque values are given in Fig. 207 for Low Pressure and Return Line Fittings.
      (8) Torque values are given in Fig. 208 for High Pressure Line Flareless Fittings with lubricated threads.
      (9) Torque values are given in Fig. 209 for V-Band Clamps, Channel Band Clamps, Duct Support Clamps, Hose Clamps and Roylyn Couplings.
      (10) Make sure that one male thread (minimum), plus the chamfer of the male thread, extends above the top of the nut. If the male thread does not have a chamfer, the male thread must extend one and one-half threads (minimum) above the top of the nut.

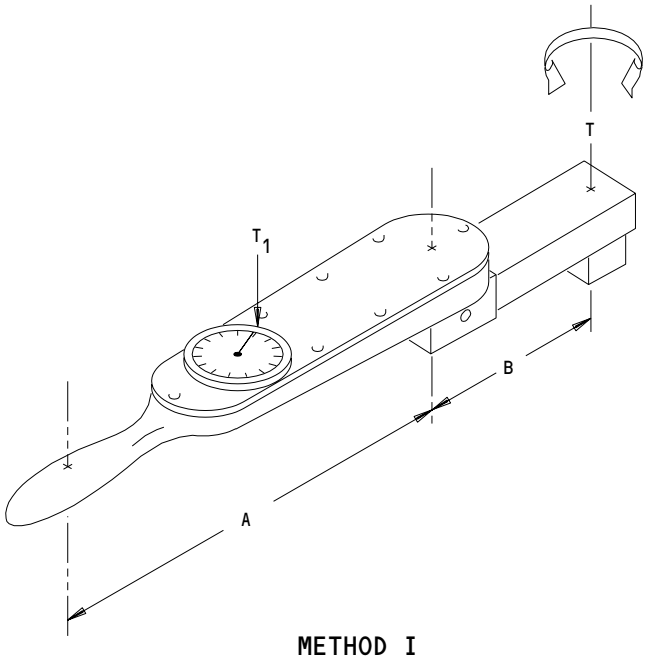
$$T_1 = \frac{TA}{A+B}$$

A = TORQUE LENGTH OF TORQUE WRENCH
B = TORQUE LENGTH OF ADAPTER
T = ACTUAL TORQUE OF NUT
T_1 = TORQUE OF WRENCH SHOWN
(CORRECTED TORQUE)

EXAMPLE A = 12 IN.
B = 3 IN.
T = 160 POUND-INCHES

$$T_1 = \frac{160 \times 12}{12+3}$$

T_1 = 128 POUND-INCHES

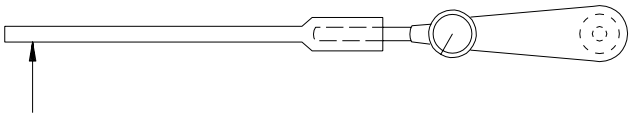


METHOD I

Torque Wrench Adapter
Figure 201 (Sheet 1)

USE THE HANDLE EXTENSION ONLY.
NO CORRECTION IS NECESSARY.

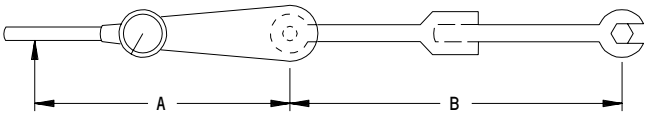
$T_1 = T$



METHOD II

USE THE ADAPTER WITH THE EXTENSION BETWEEN THE ADAPTER AND THE WRENCH BOTH IN LINE WITH THE WRENCH. SHOWN TORQUE T_1:

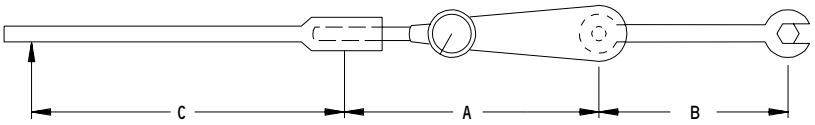
$$T_1 = \frac{TA}{A+B}$$



METHOD III

USE BOTH THE HANDLE EXTENSION AND THE ADAPTER, SHOWN TORQUE T_1:

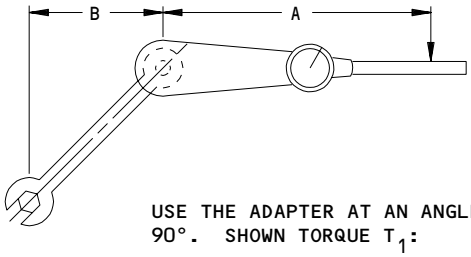
$$T_1 = \frac{T\ (A+C)}{A+B+C}$$



METHOD IV

IF POSSIBLE, METHODS V AND VI SHOULD NOT BE USED. WHEN IT IS NECESSARY TO USE THESE METHODS, THE FOLLOWING CONDITIONS MUST BE APPLICABLE:

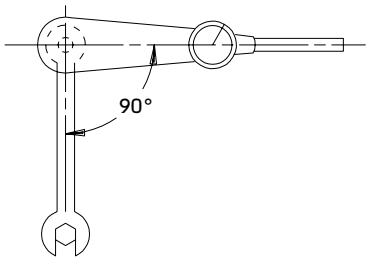
1. THE ADAPTER LENGTH PLUS ANY EXTENSIONS USED BETWEEN THE WRENCH AND THE ADAPTER MUST NOT BE MORE THAN THE LENGTH OF THE WRENCH.
2. WHEN A FORCE IS APPLIED AT 90 ±3 DEGREES TO THE HANDLE OF THE WRENCH, IT IS RECOMMENDED THAT A STIRRUP-TYPE HANDLE WITH A POINTER (WHICH INDICATES THE ANGLE OF LOAD) BE USED TO MAKE SURE THE WRENCH INSTALLS THE NUT AT THE CORRECT ANGLE.



USE THE ADAPTER AT AN ANGLE OTHER THAN 90°. SHOWN TORQUE T_1:

$$T_1 = \frac{TA}{A+B}$$

METHOD V



USE THE ADAPTER AT A RIGHT ANGLE TO THE WRENCH. NO CORRECTION IS NECESSARY.

METHOD VI

Torque Wrench Adapter
Figure 201 (Sheet 2)

NUT TIGHTENING TORQUE 1 5

NUT	PART NUMBER AND STYLE	N10HR (12-POINT), N10JG (12-POINT), N10HC (BARREL NUT), N10YN (12-POINT), N11X (BARREL NUT)	NAS1804-1805 (12-POINT), N10GW (12-POINT), N10JA (PLATE-NUT), N10B (12-POINT), N10JB (PLATE-NUT), N10RM (PLATE-NUT), NAS577 (BARREL-NUT), N10JD (CASTELLATED NUT THICK STYLE 7/16 MTHRU 1-1/4 ONLY), N10ZC (BARREL NUT), N11W (HEX), N11Z (12-POINT), AS3485 (HEX), AS3486 (12-POINT) 4				N10JC (SHEET METAL HEX-SIZES #4 THRU 7/16 ONLY), ALL PLATE-NUTS EXCEPT N10JA, N10JB, AND N10RM, ALL CLIP-NUTS, INSERTS, AND TAPPED HOLES, MS21042 HEX, MS21043, N10JD (CASTELLATED-THICK STYLE ALL SIZES 3/16 THRU 3/8), MS14144 (CASTELLATED-THICK STYLE), N10R (HEX), N10YR (HEX) N11AG (HEX), MS21045 (HEX) NAS679 (HEX), N11N (CASTELLATED-THICK STYLE ALL SIZES 3/16 THRU 1-1/4) 4					N10JC, MS21245 (HEX SIZES 1/2 THRU 1-1/2) N10JD, N11N, MS14145 (CASTELLATED-THIN STYLE ALL SIZES -103 THRU -120) 4		BACN10YJ NYLON NUT
	STYLE	12-POINT	12-POINT	HEX HEAD	PAN HEAD	100° HEAD	INTERNAL WRENCHING	12-POINT	HEX HEAD	PAN HEAD	100° HEAD	SOCKET HEAD	ALL		ALL
BOLT	PART NUMBER	B30MT 1 B30NG B30NH B30US B30TR	B30FD 2 B30LE 2 B30MR B30PN 2 B30XL B30ZF MS21250	B30LM B30NE B30NM B30XJ NAS6603 THRU NAS6620 NAS6703 THRU NAS6720	B30EM B30LN B30NS NAS1216	B30EM B30LP B30LR B30LU B30MS B30NN B30XJ	B30UG MS20004 THRU MS20024	B30LT B30NL B30NJ B30UU	B30LJ B30NR B30NF B30PF B30PU B30PW B30XN NAS428 NAS563 THRU 572 NAS1801 NAS1802 NAS6203 THRU NAS6220	B30BE B30BG B30LK B30NT B30Z6 NAS600 THRU NAS606 NAS623 NAS1217 NAS1218 NAS8204 THRU NAS8206	B30LH B30LR B30LU B30PC B30SW B30TP B30WP B30ZC NAS514 NAS517 NAS7604 THRU NAS7616	MS21262 MS24678 NAS1351 NAS1352	ALL (EXCEPT REDUCED SHEAR AND B30XD)		ALL (EXCEPT REDUCED SHEAR AND B30XD)

TORQUE RANGE (POUNDS-INCH)

THREAD SIZE	DRY BOLT	LUBED BOLT 3	DRY BOLT	LUBED BOLT 3	DRY BOLT	LUBED BOLT 3	DRY OR LUBED BOLT 3	DRY OR LUBED BOLT 3
2-56 OR 2-64	---	---	---	---	---	---	---	---
4-40 OR 4-48	---	---	---	---	---	---	---	---
6-32 OR 6-40	---	---	---	---	---	---	---	5-6
8-32 OR 8-36	---	---	---	---	---	---	---	
10-32	82-88	53-57	---	---	25-35	---	---	6-7
1/4-28	107-113	73-77	82-88	63-67	63-67	63-67	39-41	---
5/16-24	204-216	155-165	165-175	107-113	120-130	107-113	78-82	---
3/8-24	388-412	290-310	310-330	194-206	194-206	170-180	126-134	---
7/16-20	655-695	388-412	514-546	330-350	290-310	262-278	243-258	---
1/2-20	1070-1140	558-592	825-876	529-561	616-654	529-56	388-412	---
9/16-18	1510-1590	873-927	1210-1280	786-834	946-1000	786-834	650-690	---
5/8-18	2040-2160	1460-1550	1600-1700	1060-1130	1260-1340	1070-1130	795-845	---
3/4-16	3690-3910	2960-3140	2860-3040	1790-190	2570-2730	1860-1980	1600-1700	---
7/8-14	5720-6070	4070-4320	4460-4730	2910-3090	3390-3600	2910-3090	2320-2470	---
1-12 OR 1-14	8680-9210	6400-6800	6790-7210	4410-4680	5430-5760	4410-4680	3630-3860	---
1-1/8-12	11000-11600	8580-9060	8530-9060	5620-5970	6790-7210	5620-5970	4460-4730	---
1-1/4-12	17000-18000	11200-11800	13200-14000	8340-8850	10600-113000	8340-8850	6790-7210	---
1-3/8-12	21400-22600	16000-17000	---	---	---	---	---	---
1-1/2-12	---	---	---	---	---	---	---	---

1 WHEN ANY BOLT IS TO BE INSTALLED BY WRENCHING THE HEAD, SUCH AS WHEN YOU INSTALL BOLTS INTO PLATE-NUTS, CLIP-NUTS, BARREL-NUTS, INSERTS, OR TAPPED HOLES, THE INSTALLATION TORQUE MUST BE THE MAXIMUM TORQUE SHOWN IN THE TABLE FOR THE NUT ±10%.

2 WHEN B30LE OR PN BOLTS ARE INSTALLED WITH N10HR NUTS, USE THE INSTALLATION TORQUE SHOWN FOR N10GW NUTS.

3 LUBRICATED BOLTS INCLUDE DRY-FILM-LUBRICATED (MIL-L-8937) BOLTS AND BOLTS WITH ANTI-FRICTION COMPOUNDS SUCH AS EASE-OFF 990, MIL-C-11796, AND MIL-PRF-23827 APPLIED TO THE THREADS.

4 WHEN YOU SAFETY FINE CASTELLATED NUTS, TIGHTEN THE NUT TO THE LOW SIDE OF THE SELECTED TORQUE RANGE; IF NECESSARY, CONTINUE TO TIGHTEN IT UNTIL A SLOT ALIGNS WITH THE SAFETY HOLE.

5 IF THE NUT AND BOLT ARE SHOWN, BUT NOT IN THE SAME COLUMN, USE THE TORQUE RANGE WITH THE LOWEST MAXIMUM LIMIT.

Torque Values for Bolts and Nuts
Figure 202 (Sheet 1)

77464

TORQUE NECESSARY TO TIGHTEN THE NUT 1			
NUT	PART NUMBER AND STYLE	COARSE THREADED NUTS, INSERTS AND TAPPED HOLES	
BOLT	STYLE	ALL	
	PART NUMBER	ALL	
THREAD SIZE		TORQUE (POUND-INCHES)	
		DRY BOLT	MAXIMUM 6
---		---	---
---		---	---
---		---	---
---		---	---
10-24		13.5-14.5	21
1/4-20		29-31	45
5/16-18		49-52	100
3/8-16		97-103	170
7/16-14		146	280
1/2-13		262-278	520
9/16-12		349-371	650
5/8-11		466-494	900
3/4-10		800-850	1500
7/8-9		1500-1590	2700
1-8		2520-2670	4500
1-1/8-7		3540-3760	7200
1-1/4-7		4360-4630	10,000
---		---	---
---		---	---

6 THE MAXIMUM TORQUE PERMITTED FOR THE ALIGNMENT OF THE CASTELLATED NUT AND THE HOLE TO PUT IN A COTTER PIN OR THE OTHER SAFETY DEVICE.

Torque Values for Bolts and Nuts
Figure 202 (Sheet 2)

TORQUE - SELF-LOCKING NUTS 1						
	FINE THREADS (REF BPS-N-70)				COARSE THREADS (REF MIL-N-25027)	
	TORQUE (POUND-INCHES)				TORQUE (POUND-INCHES)	
	USED NUT		NEW NUT			
SIZE	MINIMUM BREAKAWAY	MAXIMUM LOCKING	MINIMUM 1ST CYCLE BREAKAWAY	SIZE	MINIMUM LOCKING	MAXIMUM LOCKING
4-48		-	-	2-56	0.2	2.5
6-40	1.0	10	-	4-40	0.5	5
8-36	1.5	15	-	6-32	1.0	10
10-32	2.0	18	-	8-32	1.5	15
1/4-28	3.5	30	7	10-24	2.0	18
5/16-24	6.5	60	12	1/4-20	4.5	30
3/8-24	9.5	80	18	5/16-18	7.5	60
7/16-20	14.0	100	26	3/8-16	12.0	80
1/2-20	18.0	150	34	7/16-14	16.5	100
9/16-18	24.0	200	46	1/2-13	24.0	150
5/8-18	32.0	300	60	9/16-12	30.0	200
3/4-16	50.0	400	90	5/8-11	40.0	300
7/8-14	70.0		135	3/4-10	60.0	400
1-14	90.0	800	180	7/8-9	82.0	600
1-12	90.0	800	180	1-8	110.0	800
1-1/8-12	117.0	900	234	1-1/8-7	137.0	900
1-1/4-12	143.0	1000	285	1-1/4-7	165.0	1000
1-3/8-12	165.0	1100	330	1-3/8-6	200.0	1200
1-1/2-12	195.0	1250	386	1-1/2-6	230.0	1400
1-3/4-12	245.0	1450	490	1-3/4-5	300.0	1800
2-12	300.0	1700	600	2-4.5	360.0	2200
				2-1/4-4.5	430.0	2600
				2-1/2-4.5	500.0	3000

1 THE FOLLOWING CONDITIONS MUST BE USED FOR TORQUES (REF BPS-N-70):

A. THE MINIMUM-TO-MAXIMUM TORQUE RANGE IS USED TO FIND THE CONDITION OF A USED SELF-LOCKING NUT AND BOLT SET.

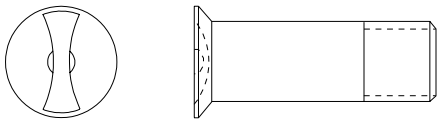
B. ALL NUT THREADS SHALL BE NEW OR UNDAMAGED. A NUT IS CONSIDERED INSTALLED WHEN A MINIMUM OF ONE THREAD PLUS THE CHAMFER OF THE MALE THREAD EXTENDS BEYOND THE TOP OF THE NUT. IF THE MALE THREAD DOES NOT HAVE A CHAMFER, THE MALE THREAD MUST EXTEND ONE AND ONE-HALF THREADS (MINIMUM) ABOVE THE TOP OF THE NUT.

C. THE REMOVAL WILL BE COMPLETE WHEN THE LOCKING DEVICE IS DISENGAGED.

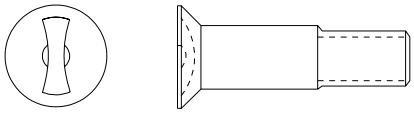
D. THE MINIMUM BREAKAWAY TORQUE IS THE TORQUE REQUIRED TO TURN A NUT OR BOLT FROM AN INSTALLED POSITION. THIS CONDITION IS FOR BOLT THREADS WITH NO LOAD ON THE BASE OF THE NUT.

E. THE MAXIMUM LOCKING TORQUE IS THE MAXIMUM TORQUE DURING THE INSTALLATION OR REMOVAL OF NUTS WITH NO LOAD ON THE BASE OF NUT.

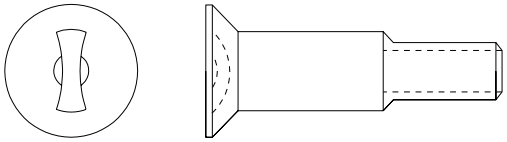
Torque Values for Self-Locking Nuts
Figure 203



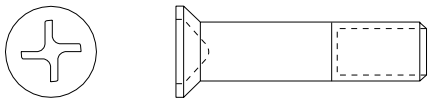
BACB30DP (CRES)
BACB30EL (STEEL)
NAS1581 (CRES)



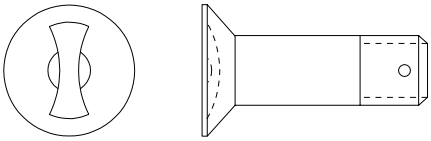
BACB30FB (STEEL)
BACB30RF (STEEL)
BACB30UW (STEEL)



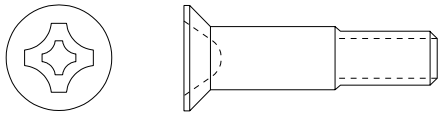
BACB30NU (TITANIUM)



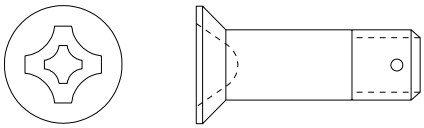
BACB30UR (TITANIUM)



BACB30LL (CRES)



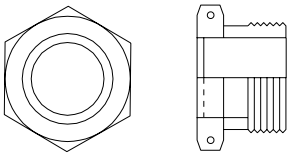
BACB30VF (TITANIUM)
BACB30XD (TITANIUM)



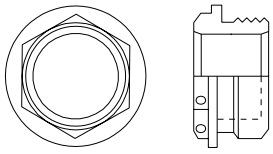
BACB30ZE (CRES)

BACB30DP, BACB30EL, BACB30FB, BACB30LL, BACB30RF, BACB30NU, BACB30UR, BACB30UW, BACB30VF, BACB30XD, BACB30ZE, NAS1581	
BOLT SIZE	TORQUE RANGE POUND -INCHES (Nm)
1/4-28	38-40 (4.29-4.52)
5/16-24	92-98 (10.39-11.07)
3/8-24	97-103 (10.96-11.64)
7/16-20	155-165 (17.51-18.64)
1/2-20	223-237 (25.20-26.78)
9/16-18	300-320 (33.90-36.15)
5/8-18	407-433 (45.98-48.92)
3/4-16	660-700 (74.57-79.09)
7/8-14	1070-1130 (120.89-127.67)
1-12 OR 1-14	1600-1700 (180.77-192.07)

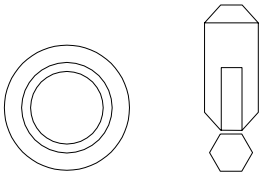
Torque for Reduced-Head Bolts
Figure 204



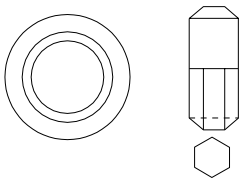
NAS591



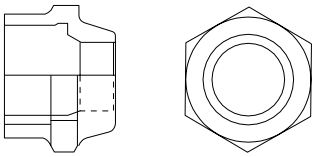
NAS594



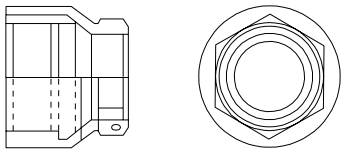
NAS592



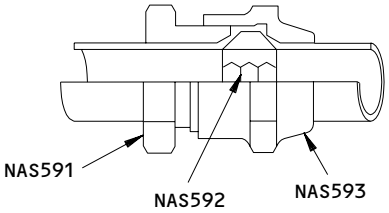
NAS595



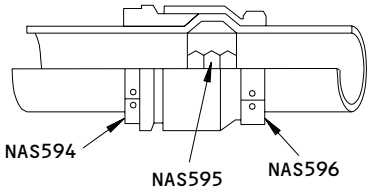
NAS593



NAS596



CONNECTION ASSEMBLY (REF)



CONNECTION ASSEMBLY (REF)

TUBE OD (INCHES)	ALUMINUM ALLOY FITTINGS NAS591-593		STAINLESS STEEL FITTINGS NAS594-596	
	TORQUE (POUND-INCHES)		TORQUE (POUND-INCHES)	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
1	480	720	480	720
1-1/4	600	900	600	900
1-1/2	600	900	600	900
2	900	1200	900	1200
2-1/2	1500	1800	1800	2100
3			1800	2100
4			2400	2700

Standard Torque Values for Rigid Tube Coupling Connectors
Figure 205

PIPE THREAD SIZE (INCHES)	ALL PIPE EXCEPT STAINLESS STEEL TO STAINLESS STEEL		STAINLESS STEEL TO STAINLESS STEEL PIPE FITTINGS	
	TORQUE (POUND-INCHES)		TORQUE (POUND-INCHES)	
	WORKING	MAXIMUM	MINIMUM	MAXIMUM
1/8	100	175	100	150
1/4	150	300	100	275
3/8	225	450	100	400
1/2			100	500
3/4			150	600
1			200	800

Torque Values for Pipe Thread Fittings
Figure 206

TUBE OUTSIDE DIAMETER (INCHES)	FITTING NUT SIZE	TORQUE 1 (POUND-INCHES)	TORQUE 2 (POUND-INCHES)
1/4	-4	110	65
5/16	-5	140	90
3/8	-6	170	130
1/2	-8	280	260
5/8	-10	360	360
3/4	-12	450	500
1	-16	750	700
1-1/4	-20	900	900
1-1/2	-24	900	900
2	-32		2000

1 TORQUE VALUES ARE APPLICABLE TO:

(1) FLARED ALUMINUM TUBE ENDS
(2) FLARELESS ALUMINUM TUBE ENDS WITH BACS13BD OR BACS13BX SWAGED SLEEVES
(3) FLARELESS TYPE HOSE END FITTINGS WITH ALUMINUM INSERTS
(4) STANDARD MS FLARELESS TUBE ENDS ON 6061-T6 ALUMINUM TUBING AND ANNEALED CRES TUBING. ANNEALED CRES TUBING IS IDENTIFIED BY A WIDE YELLOW BAND ADJACENT TO TUBING-USE IDENTIFICATION CODE MARKINGS

2 TORQUE VALUES ARE APPLICABLE TO FLARED HOSE END FITTINGS WITH ALUMINUM INSERTS

NOTE: TORQUE VALUES ARE APPLICABLE TO ALL WALL THICKNESSES FOR A GIVEN DIAMETER TUBE AND HAVE A ±5% TOLERANCE.

Torque Values for Low Pressure and Return Line Fittings
Figure 207

TUBING SIZE (INCHES)		INSTALLATION TORQUE ON FLARELESS TUBING FITTINGS/BOSSES 3 4 (POUND-INCHES, ±5%) NOTE: YOU MUST USE CARE WHEN YOU SELECT THE CORRECT TORQUE FOR REDUCER FITTINGS. YOU MUST FIND THE CORRECT FITTINGS INSTALLATION TORQUE FOR THE SIZE OF THE BOSS OR BULKHEAD.	
OD	TUBE DASH NO.	STEEL AND TITANIUM TUBES 1	ALUMINUM AND ANNEALED CRES TUBES 2
3/16	-3	100	80
1/4	-4	140	110
5/16	-5	190	140
3/8	-6	270	170
1/2	-8	500	280
5/8	-10	700	360
3/4	-12	900	450
1	-16	1200	750
1-1/4	-20	1600	900
1-1/2	-24	2000	900
2	-32	2000	---

NOTE: 1. TO USE ALUMINUM TUBE TORQUE VALUES FOR ALUMINUM, STEEL, OR TITANIUM FITTINGS IN ALUMINUM BOSSES.
2. TO USE STEEL TUBE TORQUE VALUE FOR STEEL OR TITANIUM FITTINGS INSTALLED IN STEEL OR TITANIUM BOSSES.

1 THESE TORQUE VALUES ARE APPLICABLE TO THESE TUBE ENDS:
A. 21-6-9 STEEL WITH BACS13BD OR BACS13BX SWAGED SLEEVE
B. CRES STEEL WITH BACS13BD OR BACS13BX SWAGED SLEEVE
C. MIL-T-6845 CRES WITH BACS13AP PRESET SLEEVE 5
D. HOSE END FITTINGS WITH STEEL INSERTS (NIPPLES)
E. ALL TITANIUM TUBE ENDS.

2 THESE TORQUE VALUES ARE APPLICABLE TO THESE TUBE ENDS:
A. ALUMINUM WITH BACS13BD & BACS13BX SWAGED SLEEVES
B. 6061-T6 ALUMINUM WITH PRESET BACS13AP SLEEVES 6
C. ANNEALED CRES WITH PRESET BACS13AP SLEEVES 6
D. HOSE END FITTINGS WITH ALUMINUM INSERTS (NIPPLES).

Installation Torque for Flareless Tubing Fittings
Figure 208 (Sheet 1)

3> YOU MUST USE CARE WHEN YOU SELECT THE CORRECT TORQUE FOR REDUCER FITTINGS. YOU MUST FIND THE CORRECT FITTINGS INSTALLATION TORQUE FOR THE SIZE OF THE BOSS OR BULKHEAD.

4> TUBE MATERIAL SPECIFICATIONS:
A. 6061-T6 ALUMINUM - MIL-T-7081, WW-T-700/6
B. ANNEALED CRES - MIL-T-8504, MIL-T-8606, MIL-T-8808
C. 1/8 HARD CRES - MIL-T-6845
D 21-6-9 CRES - BMS 7-185
E. TI-3AL-2.5V - BMS 7-234

5> THESE TORQUE VALUES ARE APPLICABLE TO STANDARD MS FLARELESS TUBE ENDS (BACS13AP SLEEVES) ON MIL-T-6845 (304-1/8h) TUBING WITH THE MINIMUM WALL THICKNESS GIVEN BELOW:

SIZE	-4	-5	-6	-8	-10	-12
WALL THICKNESS	0.020	0.020	0.028	0.034	0.049	0.049

USE THESE TORQUE VALUES FOR SPECIAL THIN WALL MIL-T-6845 (304-1/8h) TUBING:

SIZE	-8	-10	-12
WALL THICKNESS	0.028	0.035	0.042
TORQUE (LB-IN)	375	575	725

6> USE THESE TORQUE VALUES FOR STANDARD MS FLARELESS TUBE ENDS (BACS13AP SLEEVES) ON 6061-T6 ALUMINUM AND ANNEALED CRES TUBING WITH THE MINIMUM WALL THICKNESS BELOW:

SIZE	-3	-4	-5	-6	-8	-10	-12	-16
WALL THICKNESS	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.035

USE THESE TORQUE VALUES FOR SPECIAL THIN WALL ANNEALED CRES TUBING:

SIZE	-6	-10	-12
WALL THICKNESS	0.020	0.020	0.020
TORQUE (LB-IN)	160	250	325

Torque Values for Flareless Tubing Fittings
Figure 208 (Sheet 2)

BOEING PART NUMBER	DASH NUMBER ( )	TORQUE (INCH-POUNDS)	TORQUE (NEWTON-METERS)
BACC10AC	150-200	40-50	4.52-5.65
	225-300	60-70	6.78-7.91
	315-550	120-140	14.01-15.81
BACC10AUU()	250-275	70	7.91
	300-500 550-600	100	11.30
BACC10BR8()	100-900	100	11.30
BACC10CT2()	100-600		
BACC10DP()A	150-250	50	5.65
BACC10DP()B	300		
BACC10DP()AB	350-400		
	450-600	70	7.91
BACC10DU()AB	100-175	50	5.65
	200-275	55	6.21
	300-450	60	6.78
	500-600	65	7.34
	700-1000	75	8.47
BACC10EY()B	150-800 425-800	105	11.86
	150-400	75	8.47
BACC10EZ()B	125-275		
	300	105	11.86
	125-300		
BACC10GY()	150-175	40	4.52
	200-275	45	5.08
	300-450	50	5.65
	475-600	55	6.21
	650-900	65	7.34
BACC10HX()	100-300	10	1.13
	325-500	15	1.69
	550-800	20	2.26

BOEING PART NUMBER	DASH NUMBER ( )	TORQUE (INCH-POUNDS)	TORQUE (NEWTON-METERS)
BACC10KH	200-275	45	5.08
	300-475	55	6.21
	500-550	60	6.78
	600-650	65	7.34
	700	70	7.91
BACC10LE()	500-600	55	6.21
	650-900	65	7.34
NUCO (U430453)	125	55-65	6.21-7.34

COUPLING CLAMPS, V-BAND, AND CHANNEL-BAND 1

1 THE RECOMMENDED TIGHTENING PROCEDURE IS AS FOLLOWS:
1. APPLY THE INSTALLATION TORQUE AS GIVEN IN THE TABLE.
2. HIT THE ENTIRE CIRCUMFERENCE OF THE CLAMP LIGHTLY WITH A WOOD, LEATHER, OR SOFT PLASTIC MALLET.
3. DO STEPS 1 AND 2 UNTIL THE TORQUE WILL STAY CONSTANT.

Standard Torque Values for Clamps
Figure 209 (Sheet 1)

CHANNEL BAND CLAMPS		
TYPE	DUCT OD (INCHES)	TORQUE (POUND-INCHES)
BACC10CT	1.00-6.00	100-105 2

DUCT-SUPPORT CLAMPS		
TYPE	DUCT OD (INCHES)	TORQUE (POUND-INCHES)
BACC10AD	2.00-8.00	20-25

HOSE CLAMPS		
TYPE	HOSE OD (INCHES)	TORQUE (POUND-INCHES)
BACC10BN	1.75-20.00	20

ROYLYN COUPLING		
TYPE	DUCT OD INCHES/MATERIAL	TORQUE (POUND-INCHES)
BACR12H	1.50/5052-0 1.50/STAINLESS 1.75/5052-0 2.00/5052-0 2.50/5052-0	600-1000 900-1200 900-1200 1300-2500 2000-3000

2 INSIDE OF COUPLING IS NOT LUBRICATED.

Standard Torque Values for Clamps
Figure 209 (Sheet 2)

OFF-AIRPLANE DATA LOADING - MAINTENANCE PRACTICES

1. General
   A. On-board software loadable LRUs can be loaded with software on the airplane using the AMM Software Installation procedures for each software loadable LRU or off the airplane using these off-airplane loading procedures. The AMM on-airplane Software Installation procedure for each software loadable LRU is contained within the respective ATA chapter for the LRU. This procedure provides details for the software loading of an LRU off the airplane.

   TASK 20-15-01-472-001

2. Off-Airplane Software Installation
   A. Equipment
      (1) Off-airplane data loading equipment may have the capability to support various interfaces: i.e., ARINC 429, ARINC 629, RS232, and PC cards. Off-airplane data loading equipment may be used to load several software loadable LRUs. Reference the airlines off-airplane data loading policy to determine which LRUs can be off-airplane loaded with the following equipment. For off-airplane data loading equipment information contact an off-airplane data loading equipment vendor directly.
         (a) QSL7X7, Shop Data Loader
             Qualtair Equipment and Engineering (Vendor Code 1HEC2)
             15720 Mill Creek Boulevard, Suite 200, Mill Creeek, WA 98012
         (b) 615 FDS, Flightline Dataload Station
             Qualtair Equipment and Engineering (Vendor Code 1HEC2)
             15720 Mill Creek Boulevard, Suite 200, Mill Creeek, WA 98012
         (c) Data Loader - Shop
             Pentar Avionics Headquarters
             19820 North Creek Parkway Suite 102, Bothell, WA 98011
         (d) or equivalent.
   B. Procedures

      S 022-002
      (1) Off-airplane data loading is accomplished on software loadable LRUs that are removed from the airplane or are taken out of stores.

      S 422-003
      (2) An LRU which is removed from the airplane for the purpose of off-airplane loading must be installed using the AMM Removal and Installation procedures. The R & I procedures will require that you make sure that the correct software is installed in the LRU.

S 942-004

(3) Refer to the appropriate airline's documentation for the correct software part number or numbers for each software loadable LRU prior to performing this software loading procedure.

S 942-005

(4) The procedures for software loading using off-airplane data loading equipment are documented in the respective supplier's off-airplane data loading equipment user's manual.

S 942-006

(5) Refer to the airline's off-airplane data loading policy for additional off-airplane loading equipment and procedures information.

ON-AIRPLANE SOFTWARE INSTALLATION - MAINTENANCE PRACTICES

TASK 20-15-11-402-001

1. On-Airplane Software Installation

A. General

(1) Software Installation Times

(a) The time required to install software in a component is variable and is dependent on several factors that include:

1) Retrieval of the correct software media, applicable equipment and Maintenance Manual procedure.
2) Setup procedures.
3) Data transfer time.
4) Software configuration check.
5) Return to usual airplane configuration.
6) Airline completion procedures.

(2) Data Transfer Times

(a) The data transfer time is the time from disk or disks insertion into the data loader until the data transfer is complete.

(b) The data transfer time depends on:

1) The number of disks.
2) The type and size of software files on each disk.
3) The unique protocols and processors of the data loader.
4) The unique internal protocols and processors of the component.
5) Disks inserted in a timely manner.

(c) Typical data transfer times are:

1) Operational Program Software (OPS): approximately 5 to 16 minutes for each disk; for example, if the OPS has four disks, then the complete installation can take as long as 64 minutes.
2) Operational Program Configuration (OPC): approximately 1 to 3 minutes for each disk.
3) Databases (DB): approximately 3 to 15 minutes for each disk.
4) Airline Modifiable Information (AMI): approximately 3 to 15 minutes for each disk.

(d) Short Load
1) Some components can do a short load.
2) During a short load, only pieces of software that are different from what is already in the component are installed during data transfer. This can cause a data transfer time that is much shorter than the time given in Table 201. It is possible that some disks will not be used during software installation.
3) You know that the correct software is installed when the correct software part number shows for the software configuration check.
4) The flight management computer (FMC) is an example of a component that can do a short load.

(3) Table 201 - Data Transfer Times
(a) Table 201 shows data transfer times for components that are approved for on-airplane software installation. Not all components are installed on all airplanes. If a component is installed on an airplane, then there is a software installation procedure applicable to that airplane. The software installation procedure is in the AMM chapter-section given in the table.
(b) The types of software installed in a component on one airplane can be different than the types of software installed in the component on a different airplane. For example, the FMC navigation data base software must be installed in the FMC in all airplanes, but the other software that is necessary for the FMC is different for different FMC software part numbers.
1) A component on the list can have some hardware part numbers that are approved for software installation and other hardware part numbers that are not approved for software installation. An example of this is the flight data acquisition unit.
2) Refer to airline part number records to find software part numbers for applicable components.
(c) Data transfer times are approximate times in minutes for software installed from disks with a data loader. Data transfers can fail, and failure of the data transfer will increase the total time necessary for software installation. Data transfer times are supplied only as an aid to help you schedule work.
(d) The times given are for the installation of one piece of software into one component.
1) If a component has more than one piece of software, then you must add the time for each piece to find the total data transfer time for the component.

2) If a system has more than one of a given component, and software is to be installed in each one, you must multiply the time given in the table by the total number of components to find the total data transfer time for the system.
   a) For example, if a left and a right component are installed on the airplane, you must multiply the time given in the table by two to find the total data transfer time for the two components.
   b) Some systems can cross-load software between components. Usually it is faster to cross-load software than to install software with a data loader. The Flight Management Computer System (FMCS) and Engine Indicating and Crew Alerting System (EICAS) are examples of systems that can cross-load.

Table 201

AMM Chapter Section	Component	Software	Data Transfer Time (in Minutes)
22-11	Flight Control Computer (FCC) (757-300)	OPS OPC	2 to 16 1 to 3
23-15	Satellite Data Unit (SDU) (Rockwell Collins)	OPS ORT (DB)	15 to 48 1 to 5
23-15	Satellite Data Unit (SDU) (Honeywell)	USER ORT (DB) SECURED ORT (DB)	1 to 5 1 to 5
23-15	SATCOM Multi-Purpose Display Unit (MIDU) (Allied Signal)	OPS *[1]	3 to 6
23-22	ACARS Management Unit (MU/CMU) (some Allied Signal units)	CORE & Application (OPS) Airplane Database (DB)	5 to 16 1 to 15
23-22	ACARS Communications Management Unit (CMU) (Honeywell Mark III)	OPS HGI Database (DB) AGI Database (DB)	120 to 140 8 to 9 8 to 9
23-22	ACARS Management Unit (MU/CMU) (some Rockwell Collins units)	CORE (OPS) AOC (DB)	2 to 16 3 to 15
23-22	ACARS Management Unit (MU/CMU) (some Teledyne units)	Application (OPS)	5 to 16
23-22	ACARS Multi-Purpose Display Unit (MIDU) (Allied Signal)	OPS *[1]	3 to 6
23-32	Video System Control Unit (Sony)	Database *[1]	3 to 15
23-32	Digital Interface Unit (Passenger Flight Information Display System)	Airshow DB *[2]	3 to 15
31-31	Digital Flight Data Acquisition Unit (some units)	DFDAU Mandatory (OPS) *[3] ACMS Monitoring (OPS) *[3]	5 to 32 3 to 20
31-35	Optical Quick Access Recorder (Teledyne)	OPS *[4]	30

Table 201			
AMM Chapter Section	Component	Software	Data Transfer Time (in Minutes)
31-41	Engine Indicating & Crew Alerting (EICAS) Computer (-1000 Series)	OPS OPC	5 to 16 1 to 3
34-22	EFIS Symbol Generator (757-200)	OPS	5 to 16
34-46	Enhanced Ground Proximity Warning Computer (EGPWC)	DB *[1]	5 to 45
34-61	Flight Management Computer (FMC) (FMC SW P/N -90X)	OPS OPC AMI FIDO NAV DB	35 to 112 1 to 3 2 to 15 1 to 3 6 to 30
34-61	Flight Management Computer (FMCS) (FMC SW P/N -95X)	OPS NAV DB	5 to 16 6 to 30
34-61	Flight Management Computer (FMCS) (FMC SW P/N -93X, -94X)	NAV DB	6 to 30

*[1] Software is installed from PCMCIA card.
*[2] Software is installed from disk or CD-ROM.
*[3] Software is installed from disk or PCMCIA card.
*[4] Software is installed from disk drive at component front panel.

(4) Data Loaders
(a) This procedure supplies general information about data load equipment. You can find the data load equipment for the airplane configuration in the Flight Management Computer System (34-61).
(b) A data loader is a disk drive that connects to a component through interface wiring. Software disks are inserted into the disk drive and the data is transferred to the component.
(c) There are two types of data loaders: airborne data loaders and portable data loaders.
(d) An airborne data loader is a data loader that is installed in the flight compartment on the P61 panel.
(e) A portable data loader (PDL) is equipment that is moved to the airplane to install software. The PDL is removed from the airplane when the task is complete.

(f) If a data loader control panel is installed on the P61 panel, then software can be installed in components that have interface wiring for a data loader. The data loader control panel has a switch position for each component that can receive software. INOP labels are attached on switch positions that are not available for software installation.
(g) If the airplane has a data loader control panel, then it will also have an airborne data loader (ADL) or a connector panel for a portable data loader (PDL) on the P61 panel.
(h) If an FMC data base loader connector is installed in the flight compartment (left side), then FMC software is installed through that connector with a PDL.
(i) Figure 201 shows examples of data loader control panels, airborne data loaders, the connector panel for a portable data loader, and FMC data base loader connectors.

(5) Alternative Software Installation
(a) Usually software is installed with a data loader in the flight compartment. But some components have a disk drive, CD-ROM drive, PDL connector, or PCMCIA (personal computer memory card international association) interface for software installation at the front of the component.

(6) Airborne Data Loaders (ADL)
(a) This procedure supplies examples for operation of these ADLs:
1) Allied Signal (Sundstrand)
2) Teledyne
3) SFIM

(7) Portable Data Loaders (PDL)
(a) A PDL has an interface cable that is connected to the DATA TRANSFER UNIT RECEPTACLE connector (P61) or to the FMC DATA BASE LOADER connector (left side) in the flight compartment. The circuit breaker that supplies power for the PDL must be open when a PDL is connected or disconnected.
(b) PDLs are not Boeing supplied parts. Refer to the data loader supplier for instructions for PDL operation.

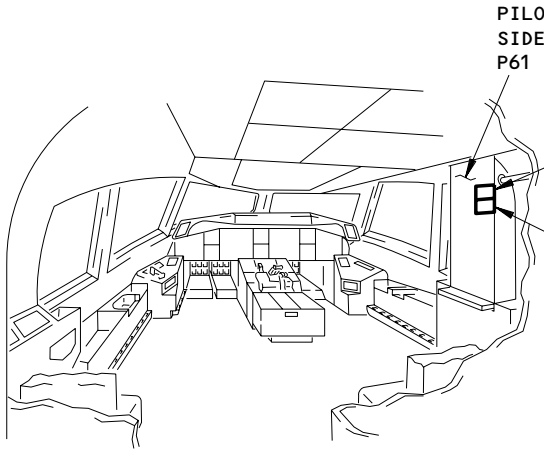
(8) OPC Content
(a) AIRPLANES WITH OPC;
OPC content can be found on myBoeingFleet.com via the "Airplane Loadable Software" link.

B. References
(1) AMM 24-22-00/201, Control

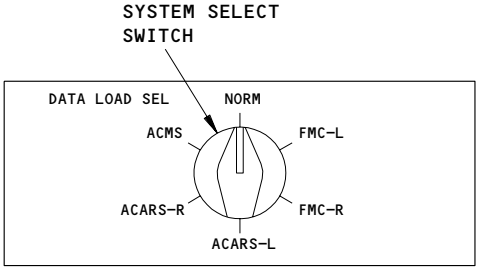
C. Allied Signal (Sundstrand) Airborne Data Loader Procedure

S 862-003

(1) The Allied Signal ADL has these status lights:
(a) PROG (In Progress) - shows as software installation occurs.
(b) CHNG (Change) - shows when it is time to install the next disk.
(c) COMP (Complete) - shows when the software installation is completed.

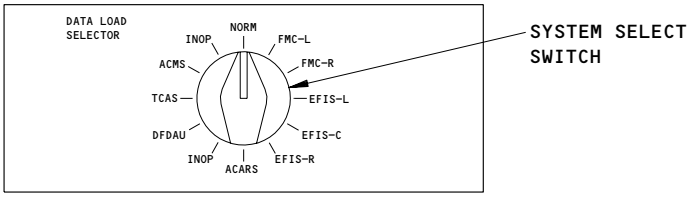


FLIGHT COMPARTMENT



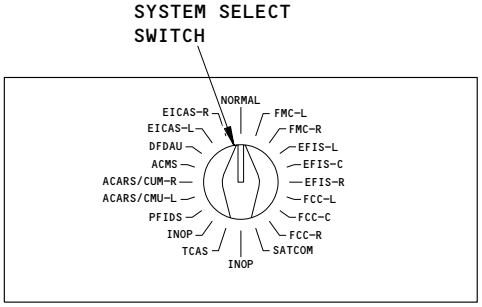
DATA LOADER CONTROL PANEL (EXAMPLE)

A



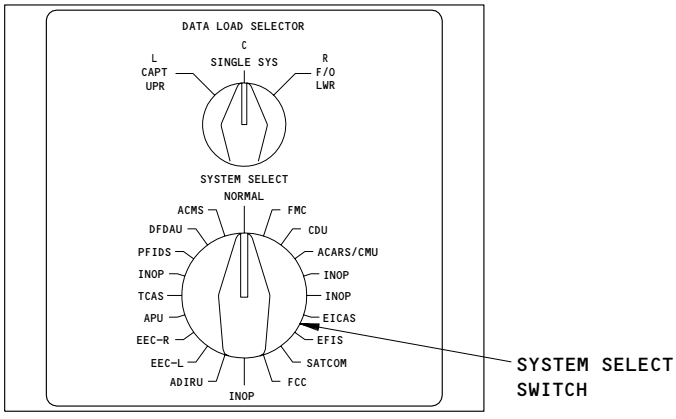
DATA LOADER CONTROL PANEL (EXAMPLE)

A



DATA LOADER CONTROL PANEL (EXAMPLE)

A



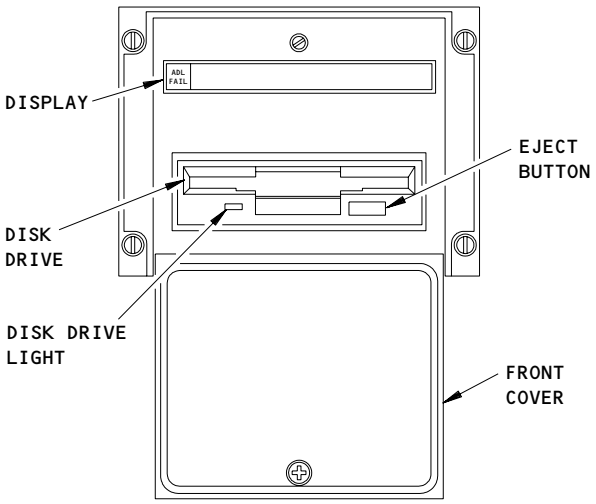
DATA LOADER CONTROL PANEL (EXAMPLE)

A

On-Airplane Software Installation
Figure 201 (Sheet 1)

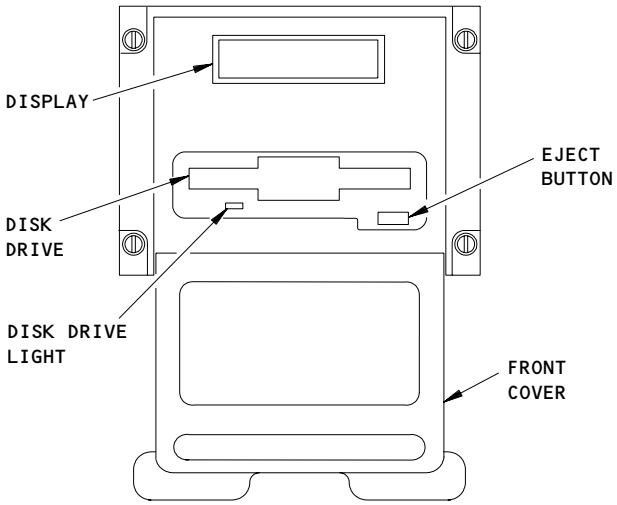
EFFECTIVITY
AIRPLANES WITH
DATA LOADER CONTROL PANEL

L03571



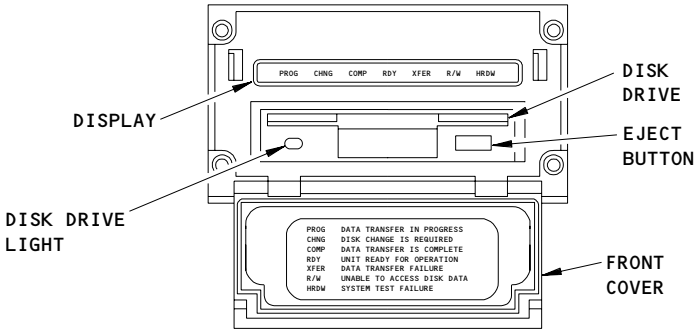
AIRBORNE DATA LOADER
(TELEDYNE)

B



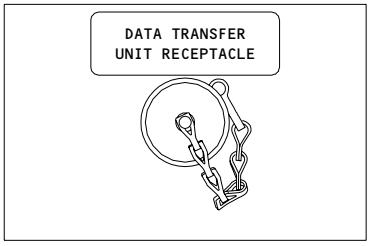
AIRBORNE DATA LOADER
(SFIM)

B



AIRBORNE DATA LOADER
[ALLIED SIGNAL (SUNDSTRAND)]

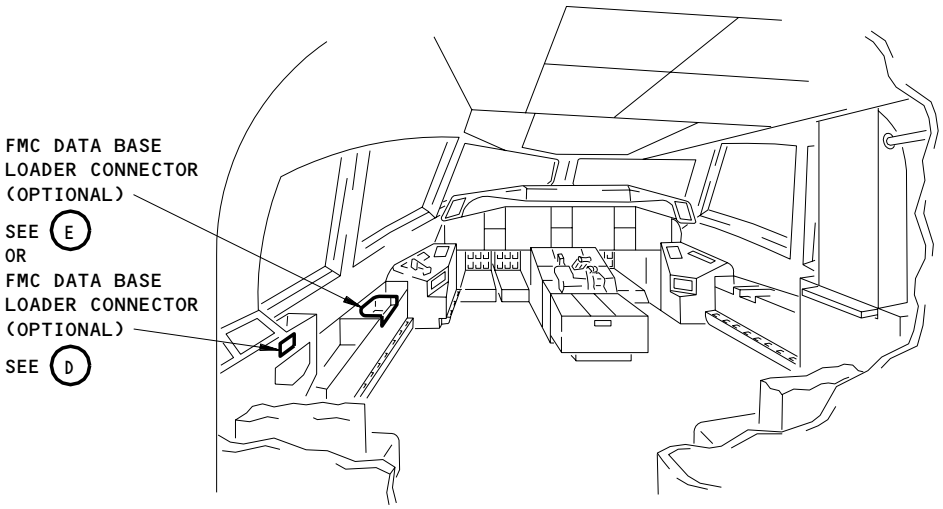
B



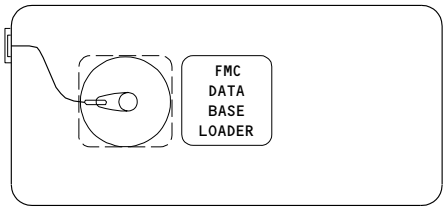
CONNECTOR PANEL
FOR PORTABLE DATA LOADER

C

On-Airplane Software Installation
Figure 201 (Sheet 2)

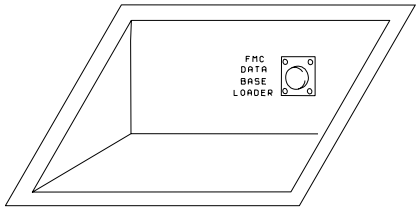


FLIGHT COMPARTMENT



FMC DATA BASE LOADER CONNECTOR
(EXAMPLE)

D



FMC DATA BASE LOADER CONNECTOR
(EXAMPLE)

E

On-Airplane Software Installation
Figure 201 (Sheet 3)

EFFECTIVITY
AIRPLANES WITH
FMC DATA BASE LOADER CONNECTOR

L04676

(d) RDY (Ready) - shows when the disk is in the disk drive and the ADL is ready to install the software in the component.
1) If the RDY indication flashes, then the data loader is in standby mode while it waits for the component to validate the data.
(e) XFER (Transfer Fail) - shows when the software installation is not completed. Open and close the circuit breaker for the component, and start the installation again.
(f) R/W (Read/Write) - shows when the ADL cannot read or write the data on the disk. Open and close the circuit breaker for the component, and start the installation again. If the problem continues, then replace the disk.
(g) HRDW (Hardware) - shows when the ADL fails the self test.

S 862-041
(2) Supply electrical power (AMM 24-22-00/201).
(a) Make sure that the power is not removed while you install software.

NOTE: A power interruption will cause a failure of the software installation.

S 862-004
(3) Make sure that the system select switch on the data loader control panel (P61) is set to the NORMAL position.

S 862-005
(4) Open this circuit breaker:
(a) On the overhead circuit breaker panel, P11:
1) 11F23, DATA LOADER

S 012-006
(5) To open the ADL front cover, pull at the top edge.

S 862-007
(6) Push the eject button on the ADL.
(a) If a plastic protective disk is ejected from the disk drive, then remove it.

S 862-008
(7) Close this circuit breaker:
(a) On the P11 panel:
1) 11F23, DATA LOADER

S 862-009
(8) Wait until all the status lights are off.

NOTE: The status lights will flash on and off while the ADL does a self test.

S 862-010

(9) Make sure that the circuit breakers are closed for the applicable component or system that will receive the new software.

S 422-012

(10) Do these steps at the ADL to install the software:

NOTE: You must know the correct software part numbers for the component. For the component to be an approved installation, software with the correct part numbers must be installed.

NOTE: This is a general procedure for software installation. Some components have other steps that are necessary. The software installation task for the component will include all necessary steps.

(a) Set the switch or switches on the data loader control panel to the applicable position for your component or system.
(b) Carefully push the first disk (label up) into the disk drive.

NOTE: If the destination component is active, the installation sequence will begin and the RDY light will come on. When the data transfer begins, the PROG light will come on. The RDY light can flash when the component validates the data. If the software is on more than one disk, the CHNG light will come on when it is time to put in the subsequent disk.

(c) If the CHNG light comes on, wait approximately 10 seconds and then push the eject button.

NOTE: The installation can fail if you wait too long before you remove and install disks.

1) Remove the disk from the disk drive.
2) Put the subsequent disk into the disk drive.
3) If there are more than two disks for the software installation, then remove and install disks until the COMP light shows.

(d) When the COMP light comes on, wait approximately 10 seconds and then push the eject button.
(e) Remove the disk from the disk drive.
(f) If there was a plastic protective disk in the disk drive before you installed software, then put it back into the disk drive.

S 862-013

(11) Set the system select switch on the data loader control panel to the NORMAL position.

S 412-014
(12) Close the front cover on the ADL.

S 742-015
(13) Make sure that the correct software part numbers are installed in the component.

NOTE: The software installation task for the component has the steps to do a software configuration check.

S 862-044
(14) Remove electrical power (AMM 24-22-00/201).

D. Teledyne Airborne Data Loader Procedure

S 862-042
(1) Supply electrical power (AMM 24-22-00/201).
(a) Make sure that the power is not removed while you install software.

NOTE: A power interruption will cause a failure of the software installation.

S 862-017
(2) Make sure that the system select switch on the data loader control panel (P61) is set to the NORMAL position.

S 862-018
(3) Open this circuit breaker:
(a) On the overhead circuit breaker panel, P11:
1) 11F23, DATA LOADER

S 012-019
(4) To open the ADL front cover, turn the cover knob clockwise and pull.

S 862-020
(5) Push the eject button on the ADL.
(a) If a plastic protective disk is ejected from the disk drive, then remove it.

S 862-021
(6) Close this circuit breaker:
(a) On the P11 panel:
1) 11F23, DATA LOADER

S 862-022

(7) Wait until the display shows INSERT DISK #1.

NOTE: The display lights and the ADL FAIL light will go on and off while the ADL does a self test. When the self test is complete, the display will show INSERT DISK #1.

S 862-023

(8) Make sure that the circuit breakers are closed for the applicable component or system that will receive the new software.

S 422-024

(9) Do these steps at the ADL to install the software:

NOTE: You must know the correct software part numbers for the component. For the component to be an approved installation, software with the correct part numbers must be installed.

NOTE: This is a general procedure for software installation. Some components have other steps that are necessary. The software installation task for the component will include all necessary steps.

(a) Set the switch or switches on the data loader control panel to the applicable position for your component or system.

(b) Carefully push the first disk (label up) into the disk drive.

NOTE: The display will show DISK INSERTED and then VOL:. If the destination component is active, the display will then show the file, extension and the percent of the file transfer completed. If there is more than one file, the ADL will install the next file until all files are completed. If the software is on more than one disk, then the display will show CHANGE DISK or INSERT DISK when it is time to put in the subsequent disk.

NOTE: If TRANSFER FAIL shows, then the installation is not completed. Open and close the circuit breaker for the component, and start the installation again.

IF READ/WRITE FAIL shows, then there is a problem with the disk. Open and close the circuit breaker for the component, and start the installation again. If the problem continues, then replace the disk.

(c) If CHANGE DISK or INSERT DISK shows on the display, wait approximately 10 seconds and then push the eject button.

NOTE: The installation can fail if you wait too long before you remove and install disks.

1) Remove the disk from the disk drive.
2) Put the subsequent disk into the disk drive.
3) If there are more than two disks for the software installation, then remove and install disks until LOAD COMPLETE shows on the display.

(d) When LOAD COMPLETE shows on the display, wait approximately 10 seconds and then push the eject button.
(e) Remove the disk from the disk drive.
(f) If there was a plastic protective disk in the disk drive before you installed software, then put it back in the disk drive.

S 862-025
(10) Set the system select switch on the data loader control panel to the NORMAL position.

S 412-026
(11) Close the front cover on the ADL.

S 742-027
(12) Make sure that the correct software part numbers are installed in the component.

NOTE: The software installation task for the component has the steps to do a software configuration check.

S 862-045
(13) Remove electrical power (AMM 24-22-00/201).

E. SFIM Airborne Data Loader Procedure

S 862-043
(1) Supply electrical power (AMM 24-22-00/201).
(a) Make sure that the power is not removed while you install software.

NOTE: A power interruption will cause a failure of the software installation.

S 862-040
(2) Make sure that the system select switch on the data loader control panel (P61) is set to the NORMAL position.

S 862-030
(3) Open this circuit breaker:
(a) On the overhead circuit breaker panel, P11:
1) 11F23, DATA LOADER

S 012-031
(4) To open the ADL front cover, pull at the top edge.

S 862-032
(5) Push the eject button on the ADL.
(a) If a plastic protective disk is ejected from the disk drive, then remove it.

S 862-033
(6) Close this circuit breaker:
(a) On the P11 panel:
1) 11F23, DATA LOADER

S 862-034
(7) Wait until UNIT READY shows in the display.

NOTE: While the ADL does a self test, the display indicators can flash on and off. TEST IN PROG, TEST COMPLETE and then UNIT READY will show on the display.

S 862-035
(8) Make sure that the circuit breakers are closed for the applicable component or system that will receive the new software.

S 422-036
(9) Do these steps at the ADL to install the software:

NOTE: You must know the correct software part numbers for the component. For the component to be an approved installation, software with the correct part numbers must be installed.

NOTE: This is a general procedure for software installation. Some components have other steps that are necessary. The software installation task for the component will include all necessary steps.

(a) Set the switch or switches on the data loader control panel to the applicable position for your component or system.

(b) Carefully push the first disk (label up) into the disk drive.

NOTE: If the destination component is active, the installation sequence will begin. READY and then TRANSF IN PROG will show on the display. Then the display will show the data bus transmitter number and the amount of data. If there is more than one file, the ADL will install the next file until all files are completed. If the software is on more than one disk, the display will show DISK CHANGE or INSERT DISK when it is time to put in the subsequent disk.

NOTE: If TRANSF FAIL shows, then the installation is not completed. Open and close the circuit breaker for the component, and start the installation again.

IF DISK ERROR shows, then there is a problem with the disk. Open and close the circuit breaker for the component, and start the installation again. If the problem continues, then replace the disk.

(c) If DISK CHANGE or INSERT DISK shows in the display, wait approximately 10 seconds and then push the eject button.

NOTE: The installation can fail if you wait too long before you remove and install disks.

1) Remove the disk from the disk drive.
2) Put the subsequent disk into the disk drive.
3) If there are more than two disks for the software installation, then remove and install disks until the display shows TRANSF COMPLETE.

(d) When TRANSF COMPLETE shows on the display, wait approximately 10 seconds and then push the eject button.
(e) Remove the disk from the disk drive.
(f) If there was a plastic protective disk in the disk drive before you installed software, then put it back into the disk drive.

S 862-037

(10) Set the system select switch on the data loader control panel to the NORMAL position.

S 412-038

(11) Close the front cover on the ADL.

S 742-039

(12) Make sure that the correct software part numbers are installed in the component.

NOTE: The software installation task for the component has the steps to do a software configuration check.

S 862-046

(13) Remove electrical power (AMM 24-22-00/201).

CONTROL CABLES - INSPECTION/CHECK

1. General
   A. Use these procedures to verify the integrity of the control cable system. The procedures must be performed along the entire cable run in each system. 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's controls, to expose those portions of the cables.
   B. The first task is an inspection of the control cable wire rope.
   C. The second task is an inspection of the control cable fittings.
   D. The third task is an inspection of the pulleys.
   E. These three tasks may be performed concurrently at one location of the cable system on the airplane if desired for convenience.

TASK 20-20-02-216-025

2. Inspection of the control cable wire rope.
   A. Examine the wire rope.

S 146-039

(1) Clean the cables (as necessary) for the inspection (AMM 12-21-31/301).

S 226-026

(2) Perform a detailed visual inspection to make sure that the cable does not contact parts other than pulleys, quadrants, cable seals or grommets installed to control the cable routing. The minimum cable clearance from other parts is 0.20 inches except 0.10 inches within 10 inches of a pulley or quadrant. Look for evidence of contact with other parts. Correct the condition if evidence of contact is found.

S 226-027

(3) Perform a detailed visual inspection of the cable runs for incorrect routing, kinks in the wire rope, or other damage.
   (a) Replace the cable assembly if:
      1) The individual wires in each strand appear to blend together (outer wires worn 40 percent or more, refer to Fig. 601).
      2) If a kink is found.
      3) If corrosion is found.

S 226-028

(4) Perform a detailed visual inspection of the cable. To do a check for broken wires, rub a cloth along the cable. The cloth will identify broken wires by catching on them.
   (a) Replace the 7 x 7 cable assembly if:
      1) There is two or more broken wires in 12 continuous inches of cable.
      2) There is three or more broken wires anywhere in the total cable assembly.

(b) Replace the 7 X 19 cable assembly if:
1) There is four or more broken wires in 12 continuous inches of cable.
2) There is six or more broken wires anywhere in the total cable assembly.

S 216-038
(5) Inspect the carbon steel control cable lubrication.
(a) Make sure there is sufficient lubrication on the control cable.
(b) If the lubrication is not sufficient, lubricate the control cable (AMM 12-21-31/301).

NOTE: Do not apply the grease or oil to stainless steel (CRES) control cables.

TASK 20-20-02-216-029
3. Inspection of the control cable fittings.
A. Examine the control cable fittings.

S 226-030
(1) Perform a detailed visual inspection to make sure that the means of locking the joints are intact, (wire locking, cotter pins, turnbuckle clips, etc.). Install any missing parts.

S 226-031
(2) Perform a detailed visual inspection of the swaged portions of swaged end fittings for surface cracks or corrosion. Replace the cable assembly if cracks or corrosion are found.

S 226-032
(3) Perform a detailed visual inspection of the unswaged portion of the end fitting. Replace the cable assembly if a crack is visible, if corrosion is present, or if the end fitting is bent more than two degrees.

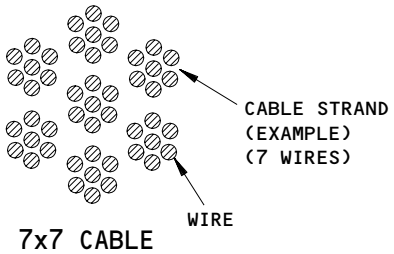
S 226-033
(4) Perform a detailed visual inspection of the turnbuckle. Replace the turnbuckle if a crack is visible or if corrosion is present.

TASK 20-20-02-216-034
4. Inspection of pulleys.
A. Examine the pulleys.

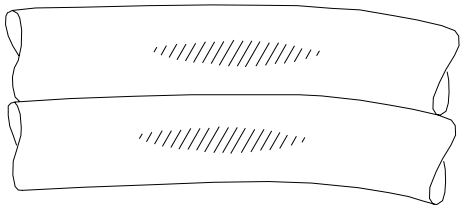
S 226-035
(1) Perform a detailed visual inspection to make sure that pulleys are free to rotate. Replace pulleys which are not free to rotate.

S 966-037

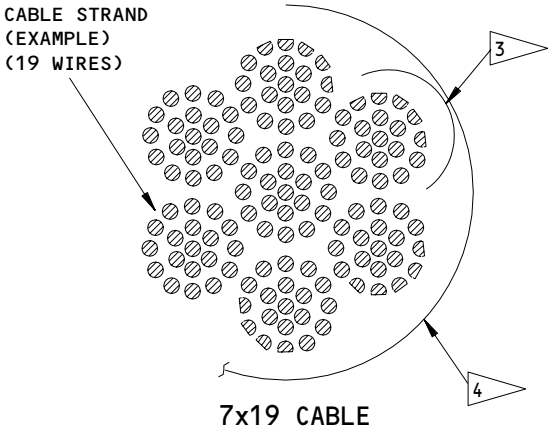
(2) Replace any pulleys that match the discription in Fig. 602.



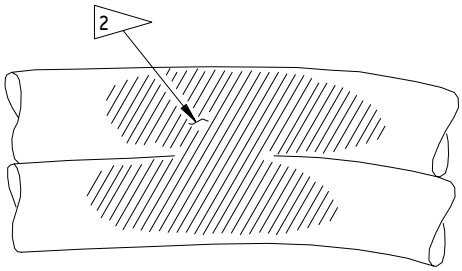
7x7 CABLE



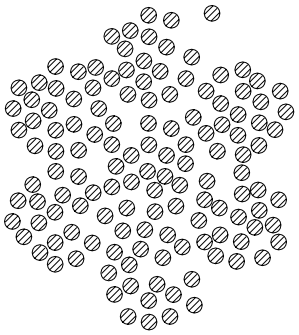
EACH OUTER WIRE WORN
LESS THAN 40%
(WORN AREAS NOT BLENDED)



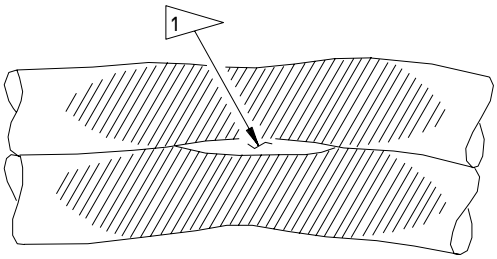
7x19 CABLE



EACH OUTER WIRE WORN 40–50%
(WORN AREAS ARE BLENDED)



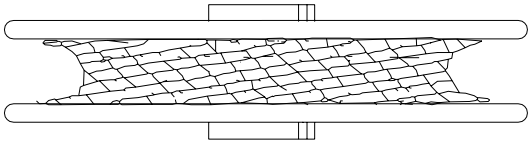
EXAMPLE OF INTERNAL WEAR



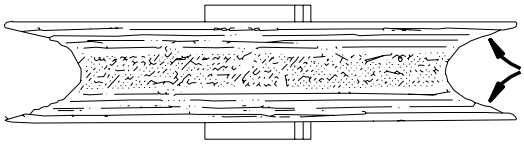
EACH WIRE IS WORN MORE THAN 50%

1. VISIBLE SPACE BETWEEN WIRES.
2. WEAR CONDITION RESULTING IN BLENDED SURFACES BETWEEN WIRES.
3. THE OUTER WIRE WEAR AREA ON CABLE STRAND. A VISIBLE SPACE BETWEEN WIRES 1 OR A FULLY BLENDED SURFACE 2
4. CABLE WEAR MAY OCCUR ON ONE SIDE ONLY OR ON FULL CIRCUMFERENCE. CABLE WEAR CAN EXTEND ALONG THE CABLE FOR A DISTANCE EQUAL TO USUAL CABLE TRAVEL.

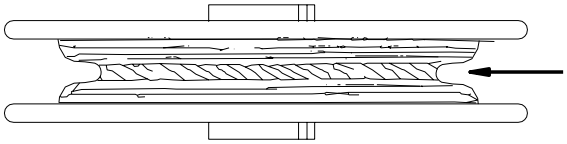
Cable Wear Patterns
Figure 601



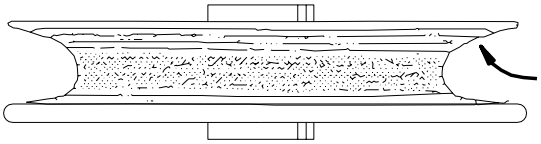
CABLE TENSION TOO HIGH



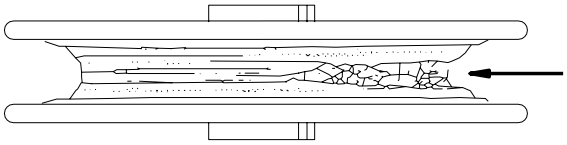
PULLEY NOT ALIGNED CORRECTLY



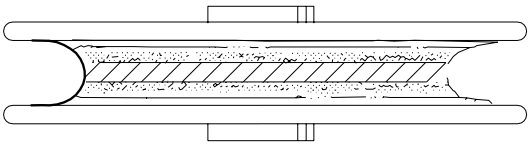
PULLEY GROOVE WITH EXCESSIVE WEAR



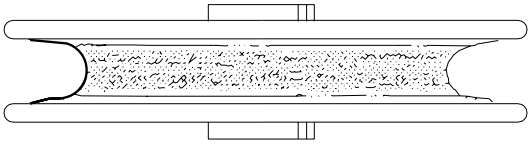
CABLE NOT ALIGNED CORRECTLY



PULLEY WILL NOT TURN



OR



NORMAL CONDITION

Pulley Wear Patterns
Figure 602

289175

SPECIFICATIONS AND MATERIALS - MAINTENANCE PRACTICES

TASK 20-30-00-992-001

1. Specifications and Materials
   A. General
      (1) The specifications and materials procedures contain lists of consumable materials that could be necessary during regular maintenance of the airplane. Lists are by material:
      - Adhesives, Cements, and Sealers
      - Cleaners and Polishes
      - Finishing Materials
      - Lubricants
      - Strippers
      - Miscellaneous Materials
      (2) The vendor code is a five-character code that identifies a company or a division of a company. Vendor codes are included to help you get the necessary material.
      (3) Use the vendor code to find the vendor in one of these sources:
         (a) The introduction of the Illustrated Parts Catalog contains lists of vendor codes, company names, and company addresses. The vendor codes are in alphabetical and numerical sequence.
         (b) The U.S. government catalog and handbook number H4/H8.

ADHESIVES, CEMENTS, AND SEALERS - MAINTENANCE PRACTICES

1. General
   A. This procedure contains a table of adhesives, cements, and sealers used during maintenance on airplanes. The table gives the material specification (if applicable), the material name and/or number, and the vendor code.

TASK 20-30-01-992-002

2. Table - Adhesives, Cements, and Sealers
   A. General

Material	Specification	Material Name and/or Number	Vendor Code
Adhesive		Bostik 7132C	CG024
		DC93-076-1/8	71984
		Eastman 910 Epoxy with 910 Catalyst	74364
		Epibond 126 HN9812 Hardener	99384
		Furane H.T. 1835HN9816 Hardener	98384
		Hysol A8-F5144 Resin	04347
		Hysol 356 Hardener	04347
		Loctite 416	05972
		Pro-Seal 727-A	83527
		RC 680	05972
		Rubber Cement, B.F. Goodrich No. 4	25472
		Scotchcast 5126	76381
		Silastic 140 Silicone Rubber Cement	71984
		SR529 Adhesive Base with SRC-18 Catalyst	71984
		Stabond T-100	82999
		Synthetic Rubber EC 1458 601 catalyst	13422

(continued)

Material	Specification	Material Name and/or Number	Vendor Code
		Type SWS-951	
		Versamid 115, 125	11884
		94-002	71984
	MIL-A-46051	Elmels Waterproof Glue	86142
	BAC 5010, Type 58		81205
	BAC 5010, Type 60	RTV 174	01139
		RTV 102	01139
		DCQ3-7063	71984
			71984
		Dow Corning 93-006-1 Base	71984
		(quick curing)	71984
		Catalyst 1	71984
		DC 1200 Primer	71984
			71984
		93-006-6 Base	71984
		(longer curing)	71984
		Catalyst 6	71984
		DC 1200 Primer	71984
	BAC 5010, Type 68	93-076 Base	71984
		93-076-2 Catalyst	71984
		DC 1204 Primer	71984
			71984
		DC3-6999-1/2 Base	71984
		DC3-6999-1/2 Catalyst	71984
		DC1204 Primer	71984
			71984
		RTV 430 Base	71984
		Beta 2, Beta 4, or Beta 11D	71984
		Catalyst	71984
		SS4155 Primer	71984
	BAC 5010, Type 72	Bostik 7132C with Boscodur 24 Catalyst	70707
	BAC 5010, Type 77	GE SR-529/SRC-18, Silicone Resin	89954
	BAC 5010, Type 84	RTV 730, D.C. Rubber Cement	71984
	BAC 5010, Type 98	GE RTV 133	01139
	BMS 5-7, Type II	EC4419	04963
	BMS 5-14	M6249	89616
	BMS 5-30	EC 1458	04963
		Bostik 4145	13932
	BMS 5-31	Pro-Seal 501	83574
	BMS 5-55	Scotch-Grip Industrial Adhesive 1870	04963

(continued)

Material	Specification	Material Name and/or Number	Vendor Code
	BMS 5-91, Type 1	3M Y9181	04963
		Tackmaster 3129-00	62344
	Type 2	3M468MP	04963
		3M9668MP	04963
		3M9668OMP	04963
	BMS 5-92,	EC2216 Gray (Part A)	76381
	Type I	EC2216 White (Part B)	76381
	Type III	EA9330 (Part A)	33564
		EA9330 (Part B)	33564
	BMS 5-105 Part V	5774 A/C	99384
	BMS 5-105 Part VI	5779 A/B	99384
	BMS 5-109	EA934NA	04347
	Type II Class 2	EA9394	12405
		EA9394S	12405
	Grade A	FR7010	26348
	BMS 5-126,	Component A:	
	Type I	Epon 828	86961
		LX-112	33913
		Component B:	
		Versamid 115	4F701
		Versamid 125	4F701
	BMS 5-126,	Component A:	
	Types II, III,	Epon 828	86961
	V, VI, classes	DER 331	96717
	1 & 2 (Grade 1)	Heloxy 68	0172B
		Component B:	
		Versamid 115	4F701
		Versamid 125	4F701
	BMS 5-126,	Liquid 2-part	0606B
	Type II	Natural - Colored	99384
	Class 1	Epibond 1534A/B	
	Grade 2		
	BMS 5-128	Hysol EA-956	04347
Compound Potting		DC738	71984
		Epocast 8623A (A component)	98384
		RTV 162	01139
		RTV 3145	96717

(continued)

Material	Specification	Material Name and/or Number	Vendor Code
	BMS 5-28, Type VI	Eposcast, 1636A/B	99384
	BMS 5-28, Type 9	EC-3524 Part A and B	76381
		Thermofoam 3056	33564
		Resin and Hardner	12405
		Epocast 87005A/B-80	99384
	BMS 8-40	PR-1201Q	83574
		Pro Seal 727	83527
		GC-1300	04011
	BMS 8-68, Type II	CS3808-68, Parts A and B	14439
		Primer, CS3808	14439
		Primer, CS9903	14439
Compound Retaining		Loctite 675 or MIL-R-46082	05972
Compound Sealing		3M No. 1300	04963
		Bead Safety Walk	76381
		DC4	71984
		DC 340	71984
		DC Silastic 732	71984
Sealants			
		Dow Corning FS3452	71984
		Dow Corning Q3-6093	71984
		Flexane 80 Urethane Resin	16059
		Loctite 290	05972
		Pro Seal 860	83527
		RTV 133	01139
		RTV 162	01139
		RTV 3145	71984
		Silicone 93-006	71984
	BMS 5-18, Type II	PR-810 Courtaulds Aerospace 5454 San Fernando Road Glendale, CA 91209	
	BMS 5-19 Class B 1/2	EC-1239B1/2	04963
		Pro-Seal 719B1/2	83527
		PR9021B1/2	83574
		EC-801	76381

(continued)

Material	Specification	Material Name and/or Number	Vendor Code
	BMS 5-45, Type II		
	Class A-2	Pro-Seal 890 A-2	COML
	Class B-2	Pro-Seal 890 B-2	83527
	BMS 5-44, Class B-1/2	Pro-Seal 890B-1/2	83527
	BMS 5-44, Class B-2	Pro-Seal 890B-2	83527
Non-Chromated	BMS 5-150, Class B-2	PR 1775 Sealant	85570
	BMS 5-63 Class B-4	Compound Depcocast 18-4 Primer - Dapco #1-100	58093
	BMS 5-79	Pro-Seal 898 B-8	83527
	BMS 5-16	Pro-Seal 567	83527
	BMS 5-79, Class B-1/2	Pro-Seal 890B-1/2	83527
	BMS 5-79, Class B-2	Pro-Seal 890B-2	83527
		GC-414B-2	04011
	BMS 5-79, Class B-4	Pro-Seal 898B-4	83527
		GC-414B-4	04011
Sealant, Fuel Tank	BMS 5-81 Type II,		
	Class 1	PR-1196	83574
	Class 2	PR-1197	83574
	BMS 8-45	EC1252A (Color Specified)	76381
	MIL-S-22473, Grade C	Thread	Coml
Compound, Self-Leveling	BMS 5-125, Type II,	PR 1440 L/S	ONYS9
	Type III	PL 422 GT	03481

(continued)

Material	Specification	Material Name and/or Number	Vendor Code
Sealant, Low Density	BMS 5-142	P/S 875	85570
Patch Kit Epoxy		Hysol EPD 608	12405
Sealant-Chromate	BMS 5-95,		
	Type I, Class B-1/4	PR 1826 B-1/4	83574
	Type I, Class B-1/4	PR 1828 B-1/4	83574
	Type I, Class B-1/2	PR 1826 B-1/2	83574
	Type I, Class B-1/2	PR 1828 B-1/2	83574
	Type I, Class B-1/2	PR 1436G B-1/2	83574
	Type I, Class B-2	PR 1436G B-2	83574
	Type I, Class B-4	PR 1436G B-4	83574
	Type I, Class E-2	PR 1436G E-2	83574
	Type I, Class F-1	PR 1432 GP	83527
	Type I, Class B-2	Pro-Seal 870B-2	83527
	Type I, Class C-20	Pro-Seal 870C-20	83527
	Type I, Class C-80	Pro-Seal 870C-80	83527
	Type I, Class C-168	Pro-Seal 870C-168	83527
	Type I, Class G-80	Pro-Seal 870 Sprayable -80	83527
	Type I, Class G-120	Pro-Seal 870 Sprayable -120	83527
	Type I, Class G-168	Pro-Seal 870 Sprayable -168	

(continued)

Material	Specification	Material Name and/or Number	Vendor Code
Sealant-Temperature Resistant	MIL-S-8802	Pro-seal 890	83527
Sealant-Windshield		1425 (Polysulphide)	83574
Tape-Thread Sealing		Permacel Tape No. 412	99742 99384

INITIAL SPECIFIED SEALANTS	PERMITTED ALTERNATIVE SEALANTS						
	BMS 5-45	BMS 5-63	BMS 5-95	BMS 5-142 1	PR-1826 2	PR-1828	BMS 5-150
BMS 5-19	YES	NO	NO	NO	YES	NO	NO
BMS 5-26	SEE TABLE C	NO	NO	NO	YES	YES	NO
BMS 5-32	YES	NO	YES	YES	YES	YES	NO
BMS 5-45	---	NO	NO	NO	YES	NO	NO
BMS 5-63	NO	---	NO	NO	NO	NO	NO
BMS 5-79	YES	NO	SEE TABLE B	YES	YES	YES	NO
BMS 5-95	YES	NO	---	YES	YES	YES	YES (CLASS B-2 ONLY)
BMS 5-142	YES	NO	YES	---	YES	YES	YES

PERMITTED SUBSTITUTES FOR INITIAL SPECIFIED SEALANT
TABLE A

INITIAL MATERIAL	ALTERNATIVE MATERIAL
BMS 5-79	BMS 5-95
CLASS B-1/2	CLASS B-1/2
CLASS B-2	CLASS B-2
CLASS B-4	CLASS B-4
CLASS B-8	NONE
CLASS C-24	CLASS C-20
CLASS C-48	CLASS C-80
CLASS D-2	BMS 5-16

BMS 5-79 SEALANT ALTERNATIVES
TABLE B

1 THIS ALTERNATIVE IS NOT PERMITTED FOR MATING SURFACE SEAL, PRE-BACK SEALING, AND WET FASTENER INSTALLATION PROCEDURES.

2 THIS SEALANT HAS A PRIMER THAT MUST ALSO BE USED.

Alternative Sealants Data
Figure 201 (Sheet 1)

BMS 5-26, TYPES, CLASSES, GRADE	SUPERSEDED BY BMS 5-45, CLASSES, GRADE
TYPE I, CLASS A-1/2, GRADE 1	CLASS A-2, GRADE 1 OR GRADE 2
TYPE I, CLASS A-2, GRADE 1	CLASS A-2, GRADE 1 OR GRADE 2
TYPE I, CLASS B-1/2	CLASS B-1/2
TYPE I, CLASS B-2	CLASS B-2
TYPE II, CLASS A-2, GRADE 1	CLASS A-2, GRADE 1
TYPE II, CLASS A-2, GRADE 2	CLASS A-2, GRADE 2
TYPE II, CLASS B-2	CLASS B-2
TYPE II, CLASS C-24	CLASS C-24
TYPE II, CLASS C-48	CLASS C-48
TYPE II, CLASS C-168	CLASS C-168

TABLE C

BMS 5-95, TYPES, CLASSES	AVAILABILITY, USES
TYPE I	AVAILABLE IN FORM B (BULK), FORM K (KIT), OR FORM P (MIXED AND FROZEN SEALANT, ALSO KNOWN AS PREMIXED AND FROZEN (PMF)).
TYPE II	AVAILABLE IN FORM P (MIXED AND FROZEN SEALANT, ALSO KNOWN AS PREMIXED AND FROZEN (PMF)) ONLY. SUPERSEDED BY TYPE I FOR FUTURE DESIGN AND PROCUREMENT.
CLASS B	FOR FILLETING, INJECTION, AND PREPACKING AND FAYING SURFACE APPLICATION.
CLASS C	FOR BRUSH AND FAYING SURFACE SEALING APPLICATIONS WHERE A LONG SQUEEZE-OUT LIFE IS REQUIRED.
CLASS E	FOR SPRAY APPLICATION AS COATING.
CLASS F	FOR SPRAY APPLICATION AS PRIMER.
CLASS G	FOR SPRAY, BRUSH, OR ROLLER APPLICATIONS WHERE LONG SQUEEZE-OUT LIFE AND LOWER VISCOSITY ARE REQURED.

TABLE D

Alternative Sealants Data
Figure 201 (Sheet 2)

CLEANERS AND POLISHES - MAINTENANCE PRACTICES

1. General
   A. The following is a list of cleaners and polishes that could be required during regular maintenance of the airplane. Listing is by material and grouped according to type and/or use. Acceptable vendors and/or material specification and/or Boeing process specifications are included as an aid in obtaining the required material.
   B. The specific usage and/or alternatives of any material are controlled by the applicable maintenance procedure. This listing provides a convenient list of materials listed in the maintenance procedures and does not provide authorization for material substitution. Refer to the applicable maintenance procedure for the proper material to be used.
   C. Materials other than those listed can be tested using the procedures in Boeing document D6-17487, Evaluation of Airplane Maintenance Materials, to verify that any substitute material will not be injurious to airplane surfaces when used as specified by the manufacturer.
   D. D6-7127, Cleaning Interiors of Commercial Transport Aircraft, outlines methods of evaluation for materials to be used in cleaning of Boeing commercial aircraft interiors. It contains materials and processes as a guideline for cleaning during general maintenance.
      (1) Because of new environmental protection regulations, alternatives to some solvents are now necessary. To make it easy to find applicable solvent, there are now new tables of solvent selections in the Aircraft Maintenace Manual (AMM). Refer to Subjects 20-30-80 and on for these tables, which give selections of solvents along with their material bulk code and related specifications.

          Table 1 shows a list of the tables of solvent selections, by the type of procedure and the surface to be cleaned, which you will find in Subjects 20-30-80 and on:

ATA	Table Description	Series	BAC Specification
20-30-80/201	General Cleaning of Metal	80	BAC 5750
20-30-81/201	General Cleaning of All Organic Coatings	81	BAC 5750
20-30-82/201	General Cleaning of Solvent Resistant Organic Coatings	82	BAC 5750
20-30-83/201	General Cleaning of Composites	83	BAC 5750
20-30-84/201	Final Cleaning of Metal Prior to Painting	84	BAC 5750
20-30-85/201	Final Cleaning of All Organic Coatings Prior to Painting	85	BAC 5750
20-30-86/201	Final Cleaning of Solvent Resistant Organic Coatings Prior to Painting	86	BAC 5750
20-30-87/201	Final Cleaning of Composites Prior to Painting	87	BAC 5750
20-30-88/201	Final Cleaning of Metal Prior to Non-Structural Bonding	88	BAC 5750
20-30-89/201	Final Cleaning of All Organic Coatings Prior to Non-Structural Bonding	89	BAC 5750
20-30-90/201	Final Cleaning of Solvent Resistant Coatings Prior to Non-Structural Bonding	90	BAC 5750
20-30-91/201	Final Cleaning of Composites Prior to Non-Structural Bonding	91	BAC 5750
20-30-92/201	Final Cleaning Prior to General Sealing	92	BAC 5000
20-30-93/201	Final Cleaning Prior to Fuel Tank Sealing	93	BAC 5504

ATA	Table Description	Series	BAC Specification
20-30-94/201	Final Cleaning Prior to Application of Rain Erosion Resistant Coating	94	BAC 5880
20-30-95/201	Final Cleaning Prior to Aerodynamic Smoothing and Fairing	95	BAC 5030
20-30-96/201	Final Cleaning of Oxygen Components Exposed to Oxygen	96	BAC 5402
20-30-97/201	Final Cleaning Prior to Structural Bonding	97	BAC 5514
20-30-98/201	Cleaning of Specific Polymerics	98	BAC 5750
	Cleaning of Phenolics or Nylon	98-1	BAC 5750
20-30-99/201	Final Cleaning of Composites Prior to Structural Bonding	99	BAC 5578

Table 2

(2) Each of the individual tables has a Series Bulk Code, and each of the solvents is identified in the table by it's name, bulk code, and applicable specification. In your orders to get a solvent from the list, you must identify a solvent by it's name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-file for the applicable vendors.

E. This procedure contains a table of cleaners and polishes used during maintenance on airplanes. The tables gives the material specification (if applicable), the material name and/or number, and the vendor code.

TASK 20-30-02-992-001

2. Table - Cleaners and Polishes

A. General

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Abrasive		Aluminum Oxide disks and sheets Type F Nylon pad	06565
		Aluminum Oxide disks and sheets Bear-Tex pad	21270
		Aluminum Oxide disks and sheets Microlon pad	70614
		Scotchbright No. 7447 Pad	76381
	P-P-121	Paper	Coml
	P-C-451	Cloth	Coml
		Paper, 600 grit or finer	Coml
		Disc, Abrasive-cloth, Open Core, 150 Grit	93642
		Paper, Silicon Carbide, 240 Grit or Finer	Coml
		Wool, Aluminum	Coml
		Wool, Stainless Steel	Coml
Compound, Corrosion Removal	AMS 1640B	Corrosion Removing Compound	
Brightener and Rust Preventer		Everite	04442
Chamois	KK-C-300	Oiltan Leather	Coml
		Scotchbrite Sheet, Pads, Finishing - Type A	76381
Cleaners Alkaline General		Alkaline abrasive Cee-bee Majorclean	71361
		Alkaline Heavy Duty Manual Airshow W	94058
		Alkaline Heavy Duty Manual Navee 427	

(continued)

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Cleaners Alkaline		Alkaline Heavy Duty	
		Manual Greasesolve	
		Ceebee 280	71361
		GMC 528B	09402
Cleaner Alkaline	MIL-C-87936	Cleaning Compound, Aircraft Exterior Surface, Water Diluatable	COML
	MIL-C-43616	Cleaning Compound, Aircraft Surface	COML
		Kelite 28	89138
Cleaners Alkaline, General		Metal Glo No. 2	61102
		Oakite 61	44389
		Oakite 204	44389
		Pennwalt 2271R	99987
			86460
		Turco Jet Clean C	61102
		Turco Jet Clean E	61102
		Dubois C-1102	72008
		Calla 301	19457
		TEC Formula No. 1	25227
		TEC 86-2	25227
		Pacific Chemical B-82	93965
		Metaclean AC	98364
Cleaners, Degreaser		MS-180	18598
		Freon TF	
Cleaners, Electrolytic		Electrocleaner - Wyandotte FS	83339
		Dowclene EC	COML
		Emulsion Oakite 74L	44389
		Dustless Acrylic Window Cleaner	28014
		Learock S-30, Buffing Compound	75554
		Learock 888, Buffing Compound	75554
		Meguiare Mirror Glaze MGH-17	14088
		Meguiare Mirror Glaze MGH-10	81205
			14088

(continued)

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
		Oakite 36	44389
		Phosphoric Acid Type for Aluminum Process K	89138
		Phosphoric Acid Type for Steel Heat Treated Below 220 ksi Turco W.O. No. 1	61102
		SE700	0903B
		TEC 86-2	25227
		1300A	91262
Cleaner	MIL-C-25769 Type 1	A&B 7316	21361
		Oakite Fleetline JC-5, JC-6	44389
		Octagon 37260	82925
		Formula-Y-1537	64807
		Airtech 19, 20	61102
		Pennywalt 791B	79555
		Cee-Bee A-69 P	71361
		Leeder 110-F	17209
		Brulin 815-M6	94058
		Novite SCD-SS	0192B
		Calla 505	19457
Cleaner, Glass Windows and Mirrors		Glasswax *[1]	53793
		Micro-Gloss Mirror Cleaner	81205
			32834
		*[1] Not to be used with Hydrophobic Coated Windows	
		Glyst Concentrated Glass Cleaner A-1859	61102
Cleaners Interior		Airplane interior Spraywhite E	89138
		Freon 113	18873
		Freon TF	18873

(continued)

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Cleaner, Polish Cleaning Agent		PLEX-I-GLOW	93920
		Potassium Silicate Solution, 66 Grade, Surface Preparation Medium	K3710
Corrosion Removers	MIL-M-10578	Phosphoric Acid Corrosion Remover and Metal Conditioning Compound (For Steel)	Coml
	O-A-88	Nitric Acid	Coml
		Oakite 31	44389
		Turco Prepaint	61102
		GMC 801	09462
Deodorants, Toilet Flushing		Elkee Formula - 1	04421
		Head-O-Matic Alex Milne Ass. Orenda Rd E Ontario, Canada 26T1G1	
		NFC A/C	0401B
		Aerofresh	15108
		Sani-Pack 41-100	18195
		Sani-Pack 41-008	18195
		Sanitex Qc	86938
Disinfectant		Deodorizer Lysol Spray	COML
		Disinfectant (for toilets) Brulin CDQ	94058
		Calla 7127	1KQX9
		Ogee 350	1KQX9
		Chengolu Yushen Aviation Technology Inc. Building 1-2-4B, No. 1 Biyun Road. Hongpailu, Wuhou District, Chengdu (610041), PR China	
Powder		(Moulding) Acrylic A100	77902
Soaps		Liquid, Turco 1526	89138
		Castile	Coml
Solvent		Chlorothene	71984
		Cyclohexanone	Coml
		Freon BF and TF mixture	18873
		Freon TMS	COML
		Naphtha	Coml
		RD2494 Kerosine	Coml
		Shell 360	86961
		Stoddard	

(continued)

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
		Stoddard Type 1	
		Stoddard Type 2	
		TL-52 thinner	98502
		MEK	
	ASTM 845 or 846	Xylene	Coml
	BMS 11-6	Trichlor	01988
		Permachlor NA	17125
		Triclean D	18873
		Blascosolv	07581
		Nialk MD	09287
		Trichlor	93915
	BMS 11-7	Sikkens 96.130	H5036
		Turco 4460	61102
		T-2279A	09869
		PFL-307-56	94684
		TL-4119	72556
		M-189	01630
		Pro-Seal T-825	71191
	JAN-T-171 Grade A	Toluene	76381
	MIL-C-81302	Trichlorotrifluoroethane	COML
	MIL-D-6998	Methylene Chloride	96717
	MIL-T-81533	Trichloroethane 1,1,1	Coml
	O-A-51	Acetone	Coml
	O-E-760 or O-A-396	Ethyl Alcohol	Coml
	O-M-232	Methyl Alcohol (Methonol)	Coml
	O-T-236	Tetrachloroethylene, Technical	Coml
	O-T-620	Methylcholoform (1,1,1 Tricholorethane)	COML
	P-D-680	Dry Cleaning	Coml

(continued)

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
	TT-B-838	Normal Butyl Acetate	COML
	TT-E-776	Ethylene Glycol Monobutyl Ether (Butyl Cellosolve)	COML
	TT-I-735	Isopropyl Alcohol	Coml
	TT-M-261	Methyl Ethyl Ketone	Coml
	TT-M-268	Methyl Isobutyl Ketone	Coml
	TT-N-95,	Aliphatic Naphtha	
	Type I		Coml
	Type II		Coml
	TT-T-266	Lacquer thinner	COML
	TT-T-548	Toluene, Technical	Coml
Strippers, Brush-on, Organic Paint		Turco 52923	61102
		Turco 5351	61102
Wax, Polish		Simonize Wax	81238
		MET-ALL	COML
		Brilliant Shine	COML

FINISHING MATERIALS - MAINTENANCE PRACTICES

1. General
   A. This procedure contains a table of finishing materials used during maintenance on airplanes. The table gives the material specification (if applicable), the material name and/or number, and the vendor code.

   TASK 20-30-03-992-001

2. Table - Finishing Materials
   A. General

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Coating, Antistatic Conducting	BMS 10-21, Type II	Base 528 X 306	85570
		Activator 910 X 464	85570
		Constant 10.5	85570
		Activation EC-110	85570
	Type III	Base 528 x 310	85570
		Activator 910 x 464	85570
		Constant 10.5	85570
		Base 10-P2-3	06367
		Activator EC-110	06367
		Constant 10.08	06367
		Base 463-6-84	98502
		Activator X-566	98502
		Constant 9.8	98502
Coating, Conversion	MIL-C-5541, Type II, Grade C, Class 1	Alodine 1200	84063
		Alodine 1200S	84063
	MIL-C-5541, Type II, Grade C, Class 3	Colored Surface Treatment (conversion coating) for Aluminum *Iridite 14-2 Alodine 600	 71410
Coating, Nonreflect-ive		Nextel Suede 3101 Primer 911-P4 Topcoat: 3101 Base Compound I 3101 Catalyst Compound II 3101 Compund III	76381

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Coating, Special Purpose	BAC 5710 Type 41	683-3-2 Base Protective Coating	98502
		X-310 Catalyst	98502
Edge , Sealer		Desothane Edge Seal CA8000/B900B	91209
		Desothane HS Activator CA8000B	91209
Coating		Duralon JF, White	0813B
Coating		0151 Clear Epoxy Epoxy - Patch Adhesives & Structural Material Division One Dexter Drive Seabrook New Hampshire 0387 Phone 603/474-5541	
Coating	BAC 5705, Type 1	Desothane HS Base Component CA8022/B7022 (BAC7022 white, semi-gloss) Curing Solution CA8020D	1ST28
Coating	BAC 5705, Type 1	Desothane HS Base Component CA8012/B701 (BAC701 black, flat Curing Solution CA8010D	1ST28
Topcoat	BAC 5710 Type 48	Chemglaze II Polyurethane, A371 Black Thinner - 9951	
	MIL-C-83231	Rain Erosion Resistant Astrocoat Kit 7400	
	BMS 5-108 Polyurethane Sealing	Type I Base Coat Type II Non-Skid decorative coating	Coml
Coating Erosion (Nose Radome)		Prestec Paint No: 2381 Optional BMS 10-60 Type II	59470

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Compound, Corrosion Preventive Fingerprint Remover	MIL-C-15074	FPR 44004	33150
		Braycote 120	98308
		Clarco 2161	91608
		Nox Rust 314	02847
		Rust Foil 15B	84591
		Cosmoline 1104	73277
		Royco 120, Code A-815	07950
		Tectyl 833	72527
		Tectyl 8531	72527

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Compound, Corrosion Preventive	MIL-C-16173, Grade 1	Valvoline Tectyl 890	81355
		Braycote 103	98308
		890-BC	81355
		Rusterrizer 12	96581
		Veedol Anorustol 297	96581
		Interfilm, Type II, Black	96581
		Interfilm, Type II, (Dist)	96581
		Rust-Foil 161-1	96581
		Cosmoline 1058	96581
		Jesco 707	96581
		Nox-Rust 201B	96581
		Petrotect 1X	96581
		Royco 103	81355
		No Rust 21B	96581
		Nokorode 731	96581
		Visconorust No. 1601, Black	96581

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
	MIL-C-16173, Grade 2	Valvoline Tectyl 502C	81355
		Braycote 137	81355
		Braycote 137E	86549
		502C-BC	81355
		Veedol Anorustol 280	86549
		Rust Preventive 1612A	84591
		Steelgard MS10	81355
		Nox-Rust 207	02847
		Petrotect 2	86459
		Royco 137R	86459
		ST 1502	81355
		No-rust 27	02847
		P2A	86459
		Visconorust No. 1602	86459

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
	MIL-C-16173, Grade 3	Valvoline	81355
		Braycote 153E	86459
		894 BC	81355
		Veedol Anorustol 270	86459
		Rust-Foil 161-3	81355
		Steel Gard MS-12	81355
		Nox-Rust 208	02847
		Oakite Special Protective Oil Q	44389
		Petrotect 3	86459
		Ferrocote 364-BL	77490
		Ferrocote 367-BL	77490
		Royco 153R	86459
		St 1894	81355
		No Rust 28	02847
		P3A	86459
		Visconorust No. 1603	86459
	MIL-C-16173, Grade 4	Valvoline Tectyl 846	81355
		Braycote 194	81355
		Braycote 194E	86549
		846-BC	81355
		Veedol Anorustol 275	86459
		P4A	86459

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
	MIL-C-16173, Grade 5	Valvoline Tectyl 511M	81355
		Braycote 198E	86459
		511M-BC	81355
		Petrotect 5	86459
		Royco 195	86459
		St 511	81355
		P5A	86459
Compound, Corrosion Preventive	MIL-C-11796 Class I	Braycote 202	98308
		H-2	84591
		H-10	84591
		Cosomoline 1060	73277
		Kendex 7010	75273
		Nox Rust 507	02847
		Tectyl 435	72527
	MIL-C-11796, Class II	No. 1882	70878
		Braycote 265	98308
		LH-4	84591
		Cosmoline 1061	73277
		Kendex 7011	75273
		Petrotect P-150	86459
		Tectyl 436	72527

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
	MIL-C-11796, Class III	Code 312D	70878
		Braycote 248	98308
		No. 903, MP-3	71881
		L-23B	84591
		Gulf No-Rust 7	89857
		Gulf No-Rust 7	34252
		Cosmoline 1062	73277
		Kendex 7012	75273
		Nokorode 963A	96581
		Nox-Rust 509	02847
		Petrotect P-250	86459
		Roycote 248	07950
		Royco 248R	07950
		Trio Compound	87951
		Tectyl 437	72527
Compound, Corrosion Inhibiting	BMS 3-29,	Dinitrol AV30	0L040

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Paste, Corrosion Inhibiting Non—Drying	BMS 3—38,		81205
Enamel	BMS 10-60, Type I	Gloss 643-3 Base	98502
		Semi-Gloss 653-3 Base	98502
		Flat 663-3-1 Base	98502
		Clear 683-3-1 Base	98502
		Catalyst X-310A	98502
		Thinner TL-59	98502
		Color Tints Tint Base BTC-X Reducer TL-62 Catalyst-X-310A	98502

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
	BMS 10-60, Type II	Gloss-Series 800 Catalyst-910X331A	85570
		Gloss-Series 800 Catalyst-910-1521 Thinner 020X310	85570
		Semi Gloss-Series 800 Catalyst 910X331	85570
		Flat-Series 800 Catalyst 910X331	85570
		Tints Tint Base DSE-X Catalyst 910X331A Thinner 020X325	85570
		Gloss-643-32 Catalyst X365 Thinner TL-102	85570
	BMS 3-11 Type IV Class 1	Hydraulic Fluid Resistance	
		Skydrol LD4	76541
		Chevron Hyjet IF-A and IV-A Plus	94548
	Class 2	Skydrol 500B-4	786541
	BMS 10-83, Type II	Polane L., Semi-gloss, Base F63 Series Catalyst V66V29 Reducer R7KB29 Reducer R7K84	86972
		653-28-1	70707
	BMS 10-11, Type II	Andrew Brown System	71191
		Finch System	98502

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Finish		Corogard	04963
		Aeroflex paint G-12-E-25	H0951
	BMS 10-20, Type II, Class A (Rule 66)	Corrosion Resistant 454-4-2 Base	98502
		CA 120 Activator	98502
	BMS 10-20, Type II, Class B	Corrosion Resistant 454-4-5 Base	98502
		X-395 Activator	98502
		TL 132 Thinner	98502
	BMS 10-73, Type I	Silk Screen Ink Finish	0360B
	BMS 10-73, Type II	Silk Screen Ink Finish	0360B
Paint	BMS 10-55, Type I	Internal Decorative Water Emulsion	98502
	BMS 10-55, Type II	Internal Decorative Water Emulsion	98502
Primer		Duralon EF	0813B
	TT-P-1757 Replaces MIL-P-8585	Primer Coating,	Coml
		Zinc Chromate,	98502
		Low Moisture - Sensitivity	98502

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
	BMS 10-11, Type I, Class A	Green Spray Base 1910091(515-003)	85570
		Curing Solution 6108148A (910-012)	85570
		Thinner (6108189)(910-025)	85570
		Base 515-706	85570
		Curing Solution (910-012)	85570
		Thinner (6108189)(910-025)	85570
		Base 463-4-4 Catalyst X-301 Thinner TL 52	98502
		Base 463-6-3 Catalyst X-306 Thinner TL-52	98502
		Base 463-6-27 Catalyst X-337 or X-354	98502
		Base 4500-PB-30D Catalyst 4500-C-30D Thinner 4500-S-30D	37810
		Base 02-GN-40 Catalyst 02-GN-40 Thinner IS-101 or MEK	33461
		Base 02-GN-40FD Catalyst 02-GN-40FD Thinner IS-101 or MEK	33461
		Base 666-2001 Curing Solution (676-9001)	33461

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
		Green Flow Coat Base 463-6-2 Catalyst C-305 Thinner TL 58	98502
		Base 515-706 Curing solution (910-012) Thinner 020X346	85570
		Yellow Flow Coat Base 191092 Curing Solution 8108148A (910-012) Thinner 6108189	85570
		Base 513-705 Curing Solution (910-012) Thinner (6108189) (910-025)	85570
		Base 463-6-5 Catalyst X-306 Thinner TL-52 Retarder TL 82	98502
		Green Spray (Rule 66) Base 1910091-66 (515-701) Catalyst 6108148A-66 Thinner (6108189) (910-025)	85570
		Base 515 706-66 (515X323) Catalyst (910-012-66) Thinner 6108189 (910-025)	85570
		Base 463-6-3-66 (463-6-11) Catalyst X-306-66 (X-315) Thinner TL-52-66 (TL65)	98502
		Base 463-3-36-66 Catalyst X-398-66	98502
		Base 02-GN-39 Catalyst 02-GN-39 Thinner: Methyl Cellusolve or MEK	33461

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
		Yellow Spray (Rule 66) Base 763-6-5-66 (463-8-12) Catalyst X-306-66 (X-315)	98502
		Base 463-6-35-66 (463-6-12) Catalyst X-397-66	98502
		Base 1910102-66(513-700) Curing Solution (6108148A--66) (910-707) Thinner 6108189 (910-025)	85570
		Base 513-705-66 (513-706) Curing Solution (910-012--66) (910-707) Thinner (6108189 (910-025)	85570
		Base 02-Y-28 Catalyst 02-Y-28 Thinner: Cellusolve	33461
		Finch System	98502
		Desoto System 1, 2, or 3	85570
		Bostik 1007	70707
	BMS 10-11, Type I, Class B	Green Base 515X341 Curing Solution (910X471) Thinner 020X331	88570
	BMS 10-79, Type I, Class A	Corrosion Preventive 513-731 Base 910-709 Curing Solution	85570
	BMS 10-79, Type II, Class A	Corrosion Preventive 513 X 329 Base 910 X 456 Curing Solution	85570
	BMS 10-79, Type III, Class A	Corrosion Preventive 515 X 336 Base 910 X 458 Curing Solution	85570
	BAC 5710, Type 51,	Polyurethane, DeSoto Hi-Temperature	85570

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Resin		Acrylic Casting PS-18 (Windshield Repair)	95696
		Acrylic Casting PS-30 (Windshield Repair)	95696
		Mat - 227 (Windshield Repair)	12035
Static Conditioner		Magna 28-C-1	02463
Surfacer		Magna 8-W-5	98795
Thinner		9954	76005

*No longer available

LUBRICANTS - MAINTENANCE PRACTICES

1. General
   A. This procedure contains a table of lubricants used during maintenance on airplanes. The table gives the material specification (if applicable), the material name and/or number, and the vendor code.

   TASK 20-30-04-992-001

2. Table - Lubricants
   A. General

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Antiseize Compound	BMS 3-28	Armite LP-AS-328	84180
		Ease-Off 990	87889
		Neverseez NS N16	15145
	MIL-T-5544	Thread Lube or Acheson GP460	IMQB7
		or GE SPEC A50TF201 Class A	Coml
		or GE C02-058	Coml
	MIL-M-7866	Molybdenum Disulphide Powder, Lubricating Grade	coml
	MIL-A-907	High Temperature:	
		Never-Seez	15145
		Kopr-Shield	07431
		"Dag" Dispersion #243	70079
		Lead Plate #250	84180
		Chesterton	80557
		Thread-Gard	00643
		Fel Pro C-661	73165
		Low Viscosity (Antiseize)	05972
		Antiseize Compound	05972
		GC-76	84180
		No-Lok	02905
		Kopr-Kote	07431
		SS-30	07431
		No. 550	07431
		No. 60 Lead Seal	07431
		Liquimoly NV	98113
		Micro Metals Compounds #77	37014
		Fel Pro C5-A	73165

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Damping Fluid, Silicone Based	VV-D-1078	Silicone DC 200	71984
Anti-Corrosion		Aeroshell 14 Royco 37	86961 07950
Corrosion Inhibiting Material	BMS 3-27 (Superceded by BMS3-38)	Mastinox 6856K International Celomar 75 Blvd Winston Churchill Le Havre, France	
Corrosion Inhibiting Material	BMS 3-38 Cor-Ban 27L (ZipChem ZC-027L)	ZipChem Products 400 Jarvis Drive Morgan Hills, CA 95037	
Corrosion Inhibiting	MIL-L-23398	Solid Film Lube: Molykote 3402-C Kal-Gard AD Lubri-Bond 220 Perma-Slik G Swif-Kits A5021 Sandstrom 238	 71984 0377B 85932
Grease		High Vacuum: Dow Corning (DC) 111 Fluorosilicone: Dow Corning Type FS-1292 Penetrox A	71984 71984 09922
	BMS 3-24	Airplane Ball and Roller Bearings, Wide Temperature Range: Aeroshell 16 Braycote 660	 54522
	BMS 3-33	General Purpose Airplane Grease: Aeroshell Grease 33	 54527

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
	MIL-PRF-23827 (Supersedes MIL-G-23827)	Instrument Gear and Actuator Screw: Metallic Soap Thickened (Type I): Aeroshell Grease 33 Royco 27 Clay Thickened (Type II): Aeroshell Grease No. 7	 54527 07950 54527
	MIL-G-21164	Molybdenum Disulphide: Lithium Thickened: Aero Shell Grease 33 Royco 64 Clay Thickened: Aero Shell Grease 17 Aero Shell Grease 33MS	
	MIL-G-81322	Airplane General Purpose, Wide Temperature Range: Mobilgrease 28 Rayco 22 Convoy 3224 322 Grease Aeroshell Grease 22C Arpolube 81322 Aeroshell Grease 22 Braycote 622 Chevron WT GN-22	coml 77988
	MIL-G-4343	Pneumatic System:	coml

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
		FS 1292 (Fluor - Silicone) Cosmolube 615 Rayco 43 Castrolease PS Aeroshell Grease 43C Misc 254 Krytox 240AC	71984
		Batco X8401-2 Grease, Polyalkylene Glycol-lithium	60226
Hydraulic Fluid		Castrol Aero 25 Castrol Aero 30 Aeroshell SSFK5591 Aeroshell LGFK5591 Castrol Aero 35 Castrol Aero 40 Lubrizol 1395	37995 37995 37995 37995 05238
	BMS 3-11 Type IV, Class 1	Fire Resistant: Skydrol LD4 Skydrol 5 Chevron Hyjet IV-A Plus	 76541 94548 94548
	Type IV, Class 2 Type V, Class 1, Grade B	Skydrol 500B4 Skydrol 5	76541 76541
Landing Gear Shock Strut Fluid Mixture	BMS 3-32 Type I	With Corrosion Inhibitor: Royco SSF Aero Shell SSF	 07950 K5591
	Type II	Without Corrosion Inhibitor: Castrolube 40 Rayco LGF Shell LGF Brayco SSF	 07950

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Hydraulic Fluid, Petroleum Base	MIL-H-5606	Petroleum Base:	
		PQ2890	92895
		PQ2863	92895
		PQ2903	92895
		PQ2905	92895
		PQ2950	92895
		PQ4140	92895
		PQ3808	92895
		Brayco 757B	98308
		Brayco 756C	98308
		Brayco 756D	98308
		Brayco 756E	98308
		Brayco 756F	98308
		Brayco Micronic 756ES	98308
		Castrol Hyspin A	01708
		Chevron Aviation (MFG)	07905
		Chevron Fluid D (PED 5225)	81230
		Mobil Aero HFT	57635
		Petrofluid 4606	86459
		Petrofluid 4607	86459
		Royco 756C (C730-4)	07950
		Royco 756D	07950
		DS-437	07950
		Aeroshell Fluid 41	K5591
		PED 3337	94548
		PED 3565	94548
		TL-5874	79630
		Stauffer Aero Hydroil 500	97854
		Hydraulic Fluid D (PED 5225)	81203
	MIL-H-6083	Petroleum Base, For Storage and Operation:	
		Brayco 783C	98303
		Brayco 783E	98303
		Hyspin P	01708
		Univis PJ42	29700
		Avrex 904	57635
		Petrotect 4066	86459
		Royco 783C	07950
Lubricant		Grease DC-33	71984
		Lubricant Grease DC-33 - Light Consistency	71984
		Bonding Gasket, Silicone: DC4	71984

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
		Assembly Lube, Hydraulic System:	
		MCS 352B	76541
		Molykote H Gear Guard	71984
		Liquid Moly NV	98113
		Acryloid HF-866	77902
		Landing Gear Shock Strut Additive:	
		Lubrizol 1395	05238
		Dry - Film Lubricant:	
		PL94	K6835
		Dry - Film Thixotropic, PL198	K6835
		Petroleum Jelly	
		Moroline	26045
		Extreme Pressure, Anti-Scoring	
		No. 3	11957
		Dry - Film, Colloidal Molybdenum Disulphide:	
		Achesons Dag No. 709	K6835 K2125 70079 50833
		Royco 11MS	07950
	BMS 3-8	Solid Film:	
		Lubeco M - 390	57678
		Electrofilm 5396	85932
		Spraymix Drielube No. 1A	06186
		Everlube 620	11770
		Drilube	9001
		Everlube	
	MIL-L-7866	PMC 9523 Molykote Type Z	94499
	VV-P-236	Petrolatum (Alt PMC 9609)	coml
	PMC 9609	Petrolatum	81205
		Oil - Light Machine	coml
		DC 111	71984

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
	Type II (P&W SB 238)	Nyco Turbine Oil 525-2A Aeroshell 500,555 Royco 500,555 Castrol 205,5000 Staufer Jet II Mobil Jet II RM139A RM147A RM246A RM247A RM249A RM254A RM270A	08438 86961 07950 K0132 97854 77988

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
	MIL-L-23699	Aircraft Turbine Engines, Synthetic Base	
		PQ6423	92895
		PQ6700	92895
		PQ3889	92895
		PQ3893	92895
		PQC-3788	92895
		PQ9598	92895
		HATCOL 3211	0842B
		HATCOL 3611	0842B
		HATCOL 1639	0842B
		HATCOL 1680	0842B
		Mobil Jet II	77988
		RM 139A	77988
		RM 147A	77988
		RM 246A	77988
		RM 247A	77988
		RM 249A	77988
		RM 254A	77988
		RM 270A	77988
		TURBONYCOIL 599	0843B
		Sto-5700	85239
		Royco 899(C-915)	07950
		Royco 899B(D-759-3)	07950
		Royco 899C(D-758)	07950
		Royco 899 HC	07950
		Royco 899E-1	07950
		Royco 899E-2	07950
		Brayco 899	98308
		Brayco 899G	98308
		Brayco 899M	98308
		Castrol 5000	K0132
		Engine Synthesized Turbine Lubricant (2952)	33358
		Engine Synthesized Turbine Lubricant (2949)	33358
		BPTO 25, 2197, 2380	29700
		Aeroshell Turbine Oil 500, 560	86961
		Stauffer Jet II (9624)	97854
		Stauffer STL (E7306)	97854
		Nyco 599A	0843B
		Nyco 599B	0843B

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
	MIL-L-7808J	Aircraft Turbine Engines, Synthetic Base	
		PQ4236	92895
		PQ4706	92895
		PQ8365	92895
		PQ9900	92895
		Brayco 880J	98308
		Aeroshell Turbine Oil 308	K5591
		Castrol 399	K0132
		BPTO 25, 2197, 2380	29700
		RM-272A	77988

STRIPPERS - MAINTENANCE PRACTICES

1. General
   A. This procedure contains a table of strippers used during maintenance on airplanes. The table gives the material specification (if applicable), the material name and/or number, and the vendor code.

   TASK 20-30-05-992-001

2. Table - Strippers
   A. General

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Cloth		Lint-Free, Clean, Wiping	Coml
Remover, Alkaline Removable Coating		TEC 243 or	25227
		TEC 243F (water base)	25227
Scraper		Plastic (See AMM 51-31-01/201)	Coml
Stripper, Inorganic		Chromic Acid	Coml
		Sodium Dichromate - Sulphuric Acid	Coml
Strippers, Organic		Cee Bee A-228-D	71361
		Fiber Resin E5-1	26348
	TT-M-268	Methyl Isobutyl Ketone	Coml
	TT-T548 or JAN-T-171, Grade A	Toluene	Coml
		Turco 800	61102
		Turco 5351	61102
	ASTM 845 or 846	Xylene	Coml

(continued)

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
		Pennwalt EZ Strip 19E	86460
	TT-E-776	Ethylene Glycol Monobutyl Ether (Butyl Cellosolve)	Coml
		Turco 5873	61102
		Cee Bee A-306B	71361
		Cee Bee R256B	71361

MISCELLANEOUS MATERIALS - MAINTENANCE PRACTICES

1. General
   A. This procedure contains a table of miscellaneous materials used during maintenance on airplanes. The table gives the material specification (if applicable), the material name and/or number, and the vendor code.

   TASK 20-30-07-202-002

2. Table - Miscellaneous Material
   A. General

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Abrasive		Scotchbrite Sheets	76381
		Paper - 100 grit or finer	coml
		40 to 100 grit	coml
Acid	MIL-A-13528	Hydrochloric	Coml
Agent		Del Chem X-769	86460
Aluminum Foil	BMS 8-289 Type 120/250/ 2/1100/025	Cycom AEL-200/1100	
Anti-Icing/ De-icing Fluid	MIL-A-8243 Type I & II	Anti-Icing and Defrosting	Coml
Anti-Icing/ De-icing Fluid	AMS 1424 Type I	Newtonian Fluids	Coml
Anti-Icing/ De-icing Fluid	ISO 11075 Type I	Newtonian Fluids	Coml
Anti-Icing/ De-icing Fluid	AEA Type I	Newtonian Fluids	Coml

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Anti-Icing/ De-icing Fluid	AMS 1428 Type II	(Non-Newtonian) Fluids	Coml
Anti-Icing/ De-icing Fluid	ISO 1178 Type II	(Non-Newtonian) Fluids	Coml
Anti-Icing/ De-icing Fluid	AEA Type II	(Non-Newtonian) Fluids	Coml
Antistatic (Windows)		Actival 139OM	07648
Brush		Soft Bristle Fiber	Coml
Brush		Hand Brush	Coml
Bubble Release	9971		76005
Catalyst	9989		76005
Cheesecloth	BMS 15-5	Class A (woven)	
		Shurwipe	86159
		Cheesecloth	97327
		Bleached	37666
		Gauze Sponges	97327
		Rymplecloth No. 301	97327
		Shurwipe 297-55, 298-10	19992
		Masslin No. 930	83582
		Keybac Liteweight	83582
Clay, Modeling			6E538

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Coating, Protective		Spraylat TR5157-1	87354
Coating, Protective ##		Ardrox 306-N (Alkaline Remover Ardrox 7050M)	23373
Compound	BMS 3-29	Corrosion Inhibiting Dinitrol AV30	OL040
Compound	BMS 3-23	Corrosion Inhibiting	
	Type I	Boeshield T-9 (Colorless)	ZO033
		Boeshield T-9HF (colorless)	45738
	Type II	Boeshield T-9 (colored)	ZO033
		Boeshield T-9HF (colored)	45738
		Dinitrol AV8	OL040
		Dinol International, Inc. P.O. Box 1065 Warren, MI 48090-1065	
Compound	BMS 3-26	Corrosion Inhibiting Dinitrol AV25B Dinitrol AV 25B-2 Dinitrol AV 100D	OL040
Compound	BMS 3-35	Corrosion Inhibiting Dinitrol AV15	OL040
Cord	MIL-C-5040, Type A	Nylon	Coml
Cotton		Flannel	Coml
Deodorant, Toilet Flushing		Turco Deodar	61102

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
		Jet Degerm	15108
		West-Sanitar	64807
		Monogram DG 19	29780
		Sani-Pak 2031M	18195
		Racasan Airline Powder	K1618
		Super-Sanitar	64807
		No. 101 Timson Aircraft Chemical Toilet Deodorant Unit Chemical Corp., 4161 Redwood Ave., Los Angeles, CA	
		Non Filter Clogging (N.F.C.) Aircraft Chemical Toilet Deodorant Lloyd George Assoc. 400S Burnside, No. 2E, Los Angeles, CA	
		Super Sanitex Selig Chemical Industries 840 Selig Dr. SW Atlanta, GA 30378	
		Elkee F-1 Cyclo Mfg. Co. P.O. Box 2038 Denver, CO 80201	
		Magnus Aviation Head-O-Matic, Alex Milne Assoc.	37733

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Leak Detection Compound, Oxygen System	MIL-L-25567	Snoop Leak Detector	18034
		Sherlock CG Type I	23316
Detector, Leak, Pressure Test		Leak-Tec 160X	03530
Disinfectant		Airwick Anti-Microbial Topical Gel	89044
		Acid - Citric,	Coml
		Calcium Hypochlorite (70%)	Coml
		Chlorine Dioxide (Stabilized 2% Solution)	Coml
		Liquid Sodium Hypochlorite (5%)	Coml
		Liquid Sodium Hypochlorite (10%)	Coml
		Lysol Brand	73820
Detector, Snoop Leak		MIL-L-25567	18034
Dyes, Red Dye		Automatic Red BSF	32063
Blue Dye		Automatic Blue SF	32063
Transfer Dye		Hyspot-107, Prussian Blue	98148
Etchant		TEC-361	25227
Fabric	BMS 8-143, Type 181	Glass, Resin Impregnated for Interior Decorative Laminate MXB 7203/7581	0892B

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
	BMS 8-7, Type I	Nylon, Vapor Permeable, Neoprene Coated NN 5102 CRP No. 2241 Neoprene Coated Fabric 687	 76381 07804 97376
	BMS 8-64	Flow Resistant	71562
Fastener Traction Material		E-Z Grip Friction Drops	81205
Filler, Static Conditioner		28-C-1	
Filter, Air		Fiberglass - Front Line Blue FG with Skin-Dry	01767
Foam	BMS 8-133, Type I, Grade 20, Form A	Urethane	28014
		Scott Filter Foam, Porosity Grade 45 PPI	3J310
Fuel Additive	MIL-I-27686	Anti-Icing PFA-55MB	 46934
Gauze			Coml
Laminate	BMS 8-98	Decorative Tedlar, Type IIA, Grade A, Class 1, Glass G	0888B 0889B 0890B
		Decorative Tedlar, Type IIA, Grade A, Class 1, Gloss M	0888B 0889B 0890B
		Decorative Tedlar, Type IIA, Grade B, Class 1.5, Gloss G	0888B 0889B 0890B

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
		Decorative Tedlar, Type IIB, Grade A, Class 1, Gloss M	0888B
		Decorative Tedlar, Type IIB, Grade A, Class 1, Gloss G	0888B
		Decorative Tedlar, Type III, Grade A, Class 1, Gloss S	18873
		Decorative Tedlar, Type III, Grade A, Class 2, Gloss M	18873
		Decorative Tedlar, Type III, Grade A, Class 2, Gloss L	18873
		Decorative Tedlar, Type III, Grade B, Class 2, Gloss L	18873
		Decorative Tedlar, Type III, Grade B, Class 4, Gloss L	18873
Laminate	BMS 8-254	Textured Decorative, Type I	01666 0891B
		Textured Decorative, Type II	13932
		Textured Decorative, Type III	13932
Liner, Cargo	BMS 8-262	Kevlar, Reinforced Thermoset	92666
Liner, Cargo	BMS 8-223	Glass fiber reinforced phenolic laminate, fire resistant	01413 39317
Maskant		Spraylat SC-1071	87354
Micromesh Kit		SN2	32834
Nitrogen		Liquid	Coml
Oxygen	MIL-O-27210, Type 1	Gaseous	Coml

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Paper	BMS 8-143, Type 100	Nomex MXM 7209- Resin Impregnated, for Interior Decorative Laminate	0892B
Paper	VV-P-272C	Plastic Coated	Coml
Parting Agent		Green, Strippable Vinyl Coating 4A-183 Boeing raw material code 5542000301	 49507 49507 49507
Parting Agent	BAC5000 PSD 6-187	Peelable Parting Agent AC962-73C	
Parting Agent	BAC5000 PSD 6-187	Peelable Parting Agent AZ 534-2B	
Parting Agent	BAC5000 PSD 6-187	Peelable Parting Agent AZ 634-2 Boeing raw material code 5542000302	
Parting Agent	BAC5000 PSD 6-187	Peelable Parting Agent Partall Coverall Film	
Parting Agent	BAC5000 PSD 6-187	Peelable Parting Agent Spraylat SC-1071H-1 Blue (ZR-5827)	
		Delchem X769	86460
		Green Strippable Vinyl Coating	17359
		598-5002 green strippable coating	17359
Putty		No. 4 Dual Purpose, Glazing	6E538
Rug	C-60	Epoxy Coat Tack Rag	1ST28
Remover Pad		Ardrox 275-G	 K6858

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Rubber grit Anti-skid Material	BAC 5705	Atlos P/N TP027+165 Atlos Rubber Co.	coml
Soap		Castile	Coml
Sponge, Cellulose		L-S-626 Synthetic (aircraft cleaning)	Coml
Sponge Rubber	BMS 1-60	Rubber Sponge	75345
Tape		Conductive (Aluminum Foil) Scotch No. 425	76381
		Scotch No. Y-427	76381
		Permacel No. P112	99742
		Fiberglass Owens Corning ECC-A	02866
		Fiberglass cloth, 3 inch wide, Style 116; BMS 9-3, Type C, Style 116	6M825 95746 12686
Tape	Fiberglass Tape	Style 1500, style 2964, style 7500	45255
		General 3M No. 213	76381
		3M No. 214	76381
		3M No. 418	76381
		Tuck 210	83334
		Gizzard Protex 20V	06929
		G565	71643
		Mystic 6223	32975

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
		Permacel No. 12, Stock 1.00 wide, Code 0422-001-4S	76381
		Permacel No. 20 (white)	99742
		Permacel No. 55 (3/4-inch wide)	99742
		Permacel No. 70	99742
		Permacel P-621	99742
Tape	BMS 8-256, Class 1, Grade 95	Graphite Fiber, Unidirectional, Non Self-Adhesive, Epoxy Resin-Impregnated, 350°F Cure	04621 04622 07314
		Masking	Coml
		Permacel No. 76	99742
		Mylar Permacel No. 92 (17 inches wide, 0.005 inch gage with interliner)	99742
		Pressure Sensitive	Coml
		Rubatex R326V Pressure Resistant	82942
		Vinyl Plastic Permacel 295	99742
Tapes for A/P Stored Outside		3M 471 White NITTO 224SPV	76381 99742
Tape, Insulation Blanket	BMS5-149	Type XI, Class 1 or 2, Grade C OT-49W	81205 23788

MATERIAL	SPECIFICATION	MATERIAL NAME AND/OR NUMBER	VENDOR CODE
Tape, Advanced Insulation Blanket	BMS5-157	Type I, Class 1, Grade B, Form 1 Composition MPVF OT-157	81205 23788
Tape - Doubleback	BMS 5-133, Type II, Class 2	Permacel P55-B (1-inch wide)	99742
Tape- Heat Resistant Adhesive			
		BMS5-146 (recommended) 3M N.474 3M 367-FR (optional)## Permacel P-29 Silver Permacel P-621 Permacel P-212HD	99742 76381
Tape- moisture resistant		PMC 4141 Mystik 5863	81205
Thread	V-T-295, Type II, Size E	Nylon	Coml
Wheel, Buffing		Cotton Flannel	6E538
Wrap, Tubular		SPI RAP 500015-2, Natural Nylon	Coml

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 80) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for general cleaning of metals as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-80-102-001

2. General Cleaning of Metal (Series 80)
   A. General
      (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01000, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

(1) In Table 201, find the applicable solvent.

General Cleaning of Metal (Series 80)
Table 201

Material Name	Material Bulk Code	Other Specifications
1,1,1-Trichloroethane	B00090	
Acetone	B00062	JIS-K-1503
Aerfluor 343		
BMS 11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Citra Safe	B00634	
Citra Safe, Deodorized		
d-Limonene		

General Cleaning of Metal (Series 80) Table 201		
Material Name	Material Bulk Code	Other Specifications
DeSo Clean 45	B00647	
EP-921		
Ethyl alcohol, denatured	B00068	
Ethyl-3-Ethoxy propionate (EEP)		
Extra Solv		
FCC-55		
Freon TES or Genesolve DES		
Freon TF or Genesolve D	B00143	
Glidsafe Prepsolv		
Isopropyl alcohol (IPA)	B00130	
MEK:1,1,1-Trichloroethane 1:1		
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		
Methyl ethyl ketone (MEK)	B00148	
Methyl isobutyl ketone (MIBK)	B00151	JIS-K-8903
Methyl propyl ketone (MPK)	B00666	
MIBK:MEK 3:2		
MIL-C-81302, Type I	B00143	
MOK or MOK*		

General Cleaning of Metal (Series 80) Table 201		
Material Name	Material Bulk Code	Other Specifications
P-D-680, Type I, II, or III	B00074	
Shopmaster RTU		
Toluene	B00094	
TT-N-95, Type II	B00083	
TT-T-291, Type I, II, or III	B00762	
Turco 4460 BK		
Turco 6226		
Turco 6709		
Wedco 3500		

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 81) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for general cleaning of all organic coatings as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-81-102-001

2. General Cleaning of All Organic Coatings (Series 81)
   A. General
      (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01001, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

(1) In Table 201, find the applicable solvent.

General Cleaning of All Organic Coatings (Series 81)
Table 201

Material Name	Material Bulk Code	Other Specifications
Aerfluor 343		
CDG-110		
CDG-211		
Ethyl alcohol, denatured	B00068	
Extra Solv		
Freon TES or Genesolve DES		
Freon TF or Genesolve D	B00143	
Isopropyl alcohol (IPA)	B00130	
MIL-C-81302, Type I	B00143	

General Cleaning of All Organic Coatings (Series 81) Table 201		
Material Name	Material Bulk Code	Other Specifications
P-D-680, Type I, II, or III	B00074	
Shopmaster RTU		
TT-N-95, Type II	B00083	
TT-T-291, Type I, II, or III	B00762	
Turco 6226		

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 82) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for general cleaning of solvent resistant organic coatings as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-82-102-001

2. General Cleaning of Solvent Resistant Organic Coatings (Series 82)
   A. General
      (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01002, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

(1) In Table 201, find the applicable solvent.

General Cleaning of Solvent Resistant Organic Coatings (Series 82) Table 201

Material Name	Material Bulk Code	Other Specifications
1,1,1-Trichloroethane	B00090	
Acetone	B00062	JIS-K-1503
Aerfluor 343		
BMS 11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Citra Safe	B00634	
Citra Safe, Deodorized		

General Cleaning of Solvent Resistant Organic Coatings (Series 82) Table 201		
Material Name	Material Bulk Code	Other Specifications
d-Limonene		
DeSo Clean 45	B00647	
EP-921		
Ethyl alcohol, denatured	B00068	
Ethyl-3-Ethoxy propionate (EEP)		
Extra Solv		
FCC-55		
Freon TES or Genesolve DES		
Freon TF or Genesolve D	B00143	
Glidsafe Prepsolv		
Isopropyl alcohol (IPA)	B00130	
MEK:1,1,1-Trichloroethane 1:1		
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		
Methyl ethyl ketone (MEK)	B00148	
Methyl isobutyl ketone (MIBK)	B00151	JIS-K-8903
Methyl propyl ketone (MPK)	B00666	
MIBK:MEK 3:2		
MIL-C-81302, Type I	B00143	

General Cleaning of Solvent Resistant Organic Coatings (Series 82) Table 201		
Material Name	Material Bulk Code	Other Specifications
M0K or M0K*		
P-D-680, Type I, II, or III	B00074	
Shopmaster RTU		
Toluene	B00094	
TT-N-95, Type II	B00083	
TT-T-291, Type I, II, or III	B00762	
Turco 4460 BK		
Turco 6226		
Turco 6709		
Wedco 3500		

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 83) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for general cleaning of composites as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-83-102-001

2. General Cleaning of Composites (Series 83)
   A. General
      (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01003, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

(1) In Table 201, find the applicable solvent.

General Cleaning of Composites (Series 83)
Table 201

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
Aerfluor 343		
BMS 11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Citra Safe	B00634	
Citra Safe, Deodorized		
d-Limonene		
Ethyl alcohol, denatured	B00068	

General Cleaning of Composites (Series 83) Table 201		
Material Name	Material Bulk Code	Other Specifications
FCC-55		
Glidsafe Prepsolv		
Isopropyl alcohol (IPA)	B00130	
MEK:1,1,1-Trichloroethane 1:1		
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		
Methyl ethyl ketone (MEK)	B00148	
Methyl propyl ketone (MPK)	B00666	
MIBK:MEK 3:2		
TT-N-95, Type II	B00083	
Turco 4460 BK		
Turco 6709		

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 84) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning of metal prior to painting as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-84-102-001

2. Final Cleaning of Metal Prior to Painting (Series 84)
   A. General
      (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01004, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

      (1) In Table 201, find the applicable solvent.

Final Cleaning of Metal Prior to Painting (Series 84)
Table 201

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
BMS 11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Citra Safe	B00634	
Citra Safe, Deodorized		
d-Limonene		
DeSo Clean 45	B00647	
FCC-55		

Final Cleaning of Metal Prior to Painting (Series 84) Table 201		
Material Name	Material Bulk Code	Other Specifications
Glidsafe Prepsolv		
Isopropyl alcohol (IPA)	B00130	
MEK:1,1,1-Trichloroethane 1:1		
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		
Methyl ethyl ketone (MEK)	B00148	
Methyl propyl ketone (MPK)	B00666	
MIBK:MEK 3:2		
MIL-C-81302, Type I	B00143	
Toluene	B00094	
Turco 4460 BK		
Turco 6709		

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 85) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning of all organic coatings prior to painting as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-85-102-001

2. Final Cleaning of All Organic Coatings Prior to Painting (Series 85)
   A. General
      (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01005, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

(1) In Table 201, find the applicable solvent.

Final Cleaning of All Organic Coatings Prior to Painting (Series 85) Table 201

Material Name	Material Bulk Code	Other Specifications
BMS 11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
FCC-55		
Isopropyl alcohol (IPA)	B00130	
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		
Methyl ethyl ketone (MEK)	B00148	

Final Cleaning of All Organic Coatings Prior to Painting (Series 85) Table 201		
Material Name	Material Bulk Code	Other Specifications
Methyl propyl ketone (MPK)	B00666	
MIBK:MEK 3:2		
MIL-C-81302, Type I	B00143	
Toluene	B00094	
Turco 4460 BK		
Turco 6709		

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 86) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning of solvent resistant coatings prior to painting as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-86-102-001

2. Final Cleaning of Solvent Resistant Coatings Prior to Painting (Series 86)
   A. General
      (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01006, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

(1) In Table 201, find the applicable solvent.

Final Cleaning of Solvent Resistant Organic Coatings Prior to Painting (Series 86)
Table 201

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
BMS 11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Citra Safe	B00634	
Citra Safe, Deodorized		
d-Limonene		
DeSo Clean 45	B00647	

Final Cleaning of Solvent Resistant Organic Coatings Prior to Painting (Series 86) Table 201		
Material Name	Material Bulk Code	Other Specifications
FCC-55		
Glidsafe Prepsolv		
Isopropyl alcohol (IPA)	B00130	
MEK:1,1,1-Trichloroethane 1:1		
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		
Methyl ethyl ketone (MEK)	B00148	
Methyl propyl ketone (MPK)	B00666	
MIBK:MEK 3:2		
MIL-C-81302, Type I	B00143	
Toluene	B00094	
Turco 4460 BK		
Turco 6709		

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 87) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning prior to painting composites as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-87-102-001

2. Final Cleaning Prior to Painting Composites (Series 87)
   A. General
      (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01007, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

      (1) In Table 201, find the applicable solvent.

Final Cleaning Prior to Painting Composites (Series 87)
Table 201

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
BMS 11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Citra Safe	B00634	
Citra Safe, Deodorized		
d-Limonene		
FCC-55		
Glidsafe Prepsolv		

Final Cleaning Prior to Painting Composites (Series 87) Table 201		
Material Name	Material Bulk Code	Other Specifications
MEK:1,1,1-Trichloroethane 1:1		
MEK:sec-Butyl alcohol 42:58 percent		
MEK:Toluene 1:1		
Methyl ethyl ketone (MEK)	B00148	
Methyl propyl ketone (MPK)		
MIBK:MEK 3:2		
Turco 4460 BK		
Turco 6709		

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 88) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning of metal prior to non-structural bonding as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-88-102-001

2. Final Cleaning of Metal Prior to Non-structural Bonding (Series 88)
   A. General
      (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01008, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

(1) In Table 201, find the applicable solvent.

Final Cleaning of Metal Prior to Non-structural Bonding (Series 88) Table 201

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
BMS 11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Ethyl alcohol, denatured	B00068	
FCC-55		
Isopropyl alcohol (IPA)	B00130	
MEK:1,1,1-Trichloroethane 1:1		

Final Cleaning of Metal Prior to Non-structural Bonding (Series 88) Table 201		
Material Name	Material Bulk Code	Other Specifications
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	
Methyl propyl ketone (MPK)	B00666	
MIBK:MEK 3:2		
MIL-C-81302, Type I	B00143	
Turco 6709		

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 89) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning of all organic coatings prior to non-structural bonding as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-89-102-001

2. Final Cleaning of All Organic Coatings Prior to Non-structural Bonding (Series 89)
   A. General
      (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01009, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

(1) In Table 201, find the applicable solvent.

Final Cleaning of All Organic Coatings Prior to Non-structural Bonding (Series 89)
Table 201

Material Name	Material Bulk Code	Other Specifications
CDG-110		
CDG-211		
Ethyl alcohol, denatured	B00068	
Isopropyl alcohol (IPA)	B00130	
MIL-C-81302, Type I	B00143	

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 90) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning of solvent resistant organic coatings prior to non-structural bonding as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-90-102-001

2. Final Cleaning of Solvent Resistant Organic Coatings Prior to Non-structural Bonding (Series 90)
   A. General
      (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01010, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

      S 162-002
      (1) In Table 201, find the applicable solvent.

Final Cleaning of Solvent Resistant Organic Coatings Prior to Non-structural Bonding (Series 90)
Table 201

Material Name	Material Bulk Code	Other Specifications
BMS 11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Ethyl alcohol, denatured	B00068	
FCC-55		
Isopropyl alcohol (IPA)	B00130	
MEK:1,1,1-Trichloroethane 1:1		

Final Cleaning of Solvent Resistant Organic Coatings Prior to Non-structural Bonding (Series 90) Table 201		
Material Name	Material Bulk Code	Other Specifications
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	
Methyl propyl ketone (MPK)	B00666	
MIBK:MEK 3:2		
MIL-C-81302, Type I	B00143	
Turco 6709		

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 91) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning of composites prior to non-structural bonding as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-91-102-001

2. Final Cleaning of Composites Prior to Non-structural Bonding (Series 91)
   A. General
      (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01011, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

(1) In Table 201, find the applicable solvent.

Final Cleaning of Composites Prior to Non-structural Bonding (Series 91)
Table 201

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
BMS 11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Ethyl alcohol, denatured	B00068	
FCC-55		
Isopropyl alcohol (IPA)	B00130	
MEK:1,1,1-Trichloroethane 1:1		

Final Cleaning of Composites Prior to Non-structural Bonding (Series 91) Table 201		
Material Name	Material Bulk Code	Other Specifications
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	
Methyl propyl ketone (MPK)	B00666	
MIBK:MEK 3:2		
Turco 6709		

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 92) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning prior to general sealing as given in BAC5000. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-92-102-001

2. Final Cleaning Prior to General Sealing (Series 92)
   A. General
      (1) This selection of solvents uses BAC5000 as a guide and may be used on all surfaces except unpainted composite laminated surfaces. This list of solvents has the Series Bulk Code of B01012, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

      S 162-002
      (1) In Table 201, find the applicable solvent.

Final Cleaning Prior to General Sealing (Series 92)
Table 201

Material Name	Material Bulk Code	Other Specifications
1,1,1-Trichloroethane	B00090	
Aliphatic Naphtha (for acrylic surfaces only)	B00083	TT-N-95 (TyII)
BMS 11-7	B00184	
Citra Safe	B00634	
Dowclene DC		
FCC-55		
MEK:sec-Butyl alcohol 42:58 percent		

Final Cleaning Prior to General Sealing (Series 92) Table 201		
Material Name	Material Bulk Code	Other Specifications
Methyl ethyl ketone (MEK)	B00148	ASTM D740 JIS-K-1524
Methyl propyl ketone (MPK)	B00666	

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 93) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning prior to fuel tank sealing as given in BAC5504. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-93-102-001

2. Final Cleaning Prior to Fuel Tank Sealing (Series 93)
   A. General
      (1) This selection of solvents uses BAC5504 as a guide. This list of solvents has the Series Bulk Code of B01013, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

      S 162-002
      (1) In Table 201, find the applicable solvent.

Final Cleaning Prior to Fuel Tank Sealing (Series 93)
Table 201

Material Name	Material Bulk Code	Other Specifications
1,1,1-Trichloroethane	B00090	O-T-620
BMS 11-7	B00184	
Dowclene EC		
FCC-55		
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 JIS-K-1524

Final Cleaning Prior to Fuel Tank Sealing (Series 93) Table 201		
Material Name	Material Bulk Code	Other Specifications
Methyl propyl ketone (MPK)	B00666	

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 94) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning prior to application of rain erosion resistant coating as given in BAC5880. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-94-102-001

2. Final Cleaning Prior to Application of Rain Erosion Resistant Coating (Series 94)
   A. General
      (1) This selection of solvents uses BAC5880 as a guide. This list of solvents has the Series Bulk Code of B01014, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

      (1) In Table 201, find the applicable solvent.

Final Cleaning Prior to Application of Rain Erosion Resistant Coating (Series 94)
Table 201

Material Name	Material Bulk Code	Other Specifications
Methyl ethyl ketone (MEK)	B00148	TT-M-261

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 95) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning prior to aerodynamic smoothing and fairing as given in BAC5030. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-95-102-001

2. Final Cleaning Prior to Aerodynamic Smoothing and Fairing (Series 95)
   A. General
      (1) This selection of solvents uses BAC5030 as a guide. This list of solvents has the Series Bulk Code of B01015, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

      (1) In Table 201, find the applicable solvent.

Final Cleaning Prior to Aerodynamic Smoothing and Fairing (Series 95) Table 201

Material Name	Material Bulk Code	Other Specifications
1,1,1-Trichloroethane	B00090	O-T-620
Aliphatic naphtha (for acrylic surfaces only)	B00083	TT-N-95, TyII
BMS 11-7	B00184	MIL-C-38736B
Citra Safe	B00634	
FCC-55		
Methyl ethyl ketone (MEK)	B00148	ASTM D740
Methyl propyl ketone (MPK)	B00666	

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 96) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning of oxygen components exposed to oxygen as given in BAC5402. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-96-102-001

2. Final Cleaning of Oxygen Components Exposed to Oxygen (Series 96)
   A. General
      (1) This selection of solvents uses BAC5402 as a guide. This list of solvents has the Series Bulk Code of B01016, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

      (1) In Table 201, find the applicable solvent.

Final Cleaning of Oxygen Components Exposed to Oxygen
(Series 96)
Table 201

Material Name	Material Bulk Code	Other Specifications
Freon TF	B00143	
Trichloroethylene	B00081	ASTM D 4080
Tetrachloroethylene	B00093	O-T-236

Final Cleaning of Oxygen Components Exposed to Oxygen (Series 96) Table 201		
Material Name	Material Bulk Code	Other Specifications
Isopropyl Alcohol	B00130	TT-I-735
HFE 7100	B50002	
HFE 71DE	B50003	
Vertrel XF	B50004	
Vertrel MCA	B50005	

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 97) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for final cleaning prior to structural bonding as given in BAC5514. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-97-102-001

2. Final Cleaning Prior to Structural Bonding (Series 97)
   A. General
      (1) This selection of solvents uses BAC5514 as a guide. This list of solvents has the Series Bulk Code of B01017, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

S 162-002

      (1) In Table 201, find the applicable solvent.

Final Cleaning Prior to Structural Bonding (Series 97)
Table 201

Material Name	Material Bulk Code	Other Specifications
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	ASTM D740
Methyl isobutyl ketone (MIBK)	B00151	ASTM D1153
Methyl propyl ketone (MPK)	B00666	
MIBK:MEK 3:2		
Sec-Butyl alcohol		ASTM D1007

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 98 & 98-1) - MAINTENANCE PRACTICES

1. General
   A. This subject contains a list of solvents for cleaning of specific polymerics as given in BAC5750. This subject gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-98-102-001

2. Cleaning of Specific Polymerics (Series 98)
   A. General
      (1) This selection of solvents uses BAC5750 as a guide. This list of solvents has the Series Bulk Code of B01018, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
      (2) The solvents in this list may be used for:
         (a) The general cleaning of:
            1) Polyester (Vibrin, Mylar, Dacron)
            2) Polytetrafluoroethylene (Teflon)
            3) Polyvinyl fluoride (Tedlar)
         (b) Or, the final cleaning of the following prior to painting:
            1) Polyester (Vibrin, Mylar, Dacron)
            2) Polytetrafluoroethylene (Teflon)
            3) Polyvinyl fluoride (Tedlar)
         (c) Or, the final cleaning of the following prior to non-structural bonding:
            1) Polyester (Vibrin, Mylar, Dacron)
            2) Polytetrafluoroethylene (Teflon)
            3) Polyvinyl fluoride (Tedlar)
   B. Procedure

      S 112-002
      (1) In Table 201, find the applicable solvent.

Cleaning of Specific Polymerics (Series 98)
Table 201

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
BMS 11-7	B00184	MIL-C-38736B

Cleaning of Specific Polymerics (Series 98) Table 201		
Material Name	Material Bulk Code	Other Specifications
CDG-110		
CDG-211		
Ethyl alcohol, denatured	B00068	
Ethyl-3-Ethoxy propionate (EEP)		
FCC-55		
Isopropyl alcohol (IPA)	B00130	
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	
Methyl isobutyl ketone (MIBK)	B00151	JIS-K-8903
Methyl propyl ketone (MPK)	B00666	
MOK or MOK*		
TT-N-95, Type II	B00083	
Turco 6709		

TASK 20-30-98-102-003

3. Cleaning of Phenolics or Nylon (Series 98-1)

A. General

(1) This selection of solvents uses BAC 5750 as a guide. This list of solvents has the Series Bulk Code of B01051, but this code is only for reference, to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.

B. Procedure

S 162-004

(1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Cleaning of Phenolics or Nylon (Series 98-1) Table 201		
Material Name	Material Bulk Code	Other Specifications
Acetone (Nylon only)	B00062	JIS-K-1503
CDG-110		
CDG-211		
Ethyl alcohol, denatured	B00068	
FCC-55		
Isopropyl alcohol (IPA)	B00130	
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	
Methyl Isobutyl Ketone (MIBK) (Nylon only)	B00151	JIS-K-8903
Methyl propyl ketone (MPK)	B00666	
Toluene (Nylon only)	B00084	
TT-N-95, Type II	B00083	
Turco 6709		

AIRPLANE STRUCTURE CLEANING SOLVENTS (SERIES 99) - MAINTENANCE PRACTICES

1. General
   A. This procedure contains a list of solvents for final cleaning of composites prior to structural bonding as given in BAC5578. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-99-912-001

2. Final Cleaning of Composites Prior to Structural Bonding (Series 99)
   A. General
      (1) This selection of solvents uses BAC5578 and D6-53900 as a guide. This list of solvents has the Series Bulk Code of B01019, but this code is only for reference to identify this complete group. In your orders to get the solvents of this list, you must identify each individual solvent by its name, bulk code, or other specification, as shown. Do not use the Series Bulk Code. Refer to the U-File for the applicable vendors.
   B. Procedure

      S 802-002
      (1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Final Cleaning of Composites Prior to Structural Bonding
Table 201

Material Name	Material Bulk Code	Other Specifications
1,1,1-Trichloroethane (Non-Metallic core only)	B00090	
Acetone	B00062	O-A-51
BMS 11-7 (non-Metallic core only)	B00184	
Isopropyl Alcohol (IPA) (Non-Metallic core only)	B00130	
MEK: Toluene 1:1		ASTM D 740 TT-T-548
Methyl Ethyl Ketone (MEK)	B00148	ASTM D 780

Final Cleaning of Composites Prior to Structural Bonding Table 201		
Material Name	Material Bulk Code	Other Specifications
Methyl Propyl Ketone (MPK) (High purity)	B00666	
Naphtha (Non-Metallic core only)	B00083	TT-N-95

STATIC GROUNDING - MAINTENANCE PRACTICES

1. General
   A. This procedure contains these tasks:
      (1) Static Ground procedure
      (2) Bonding procedure
      (3) Measure Airplane Electrical Resistance to Ground
   B. Grounding (Static Grounding) is the process of connecting one or more metal objects and ground conductors to ground electrodes (an electrical path to earth).

   C. Bonding is the process of connecting two or more metal objects together with a conductor.
   D. Static grounding is not necessary if the airplane is parked for a turnaround flight and no maintenance is to be done.
   E. During normal pressure refueling the airplane:
      (1) An electrical bond is necessary between the airplane and the refueling vehicle.
      (2) Static grounding is not necessary as long as the conductivity of the airplane and the parking site is adequate (AMM task Measure Airplane Electrical Resistance to Ground within this procedure).
         (a) The operator should ensure the adequacy of airplane and parking area conductivity and may need to establish local procedures in areas where inadequate parking site conductivity is seasonal or permanent.
         (b) Parking site conductivity may be inadequate on dry snow, dry sand or in areas of low moisture.
      (3) During over wing refueling.
      (4) When performing maintenance task using following devices:
         (a) Power Tools
         (b) Electrical Power Sources
         (c) Lights
         (d) Powered Instruments
   F. When static grounding is recommended in a detailed procedure, the airplane must be statically grounded to a common, approved, identified ground. Where a grid system is used, any number of individual grounds will provide a common ground, since all grounds are interconnected. If an area does not have a grid system, a single approved and identified ground must be used as the common ground for all grounding cables used.
   G. Stop ground servicing operations, external to the airplane, during electrical storms.
   H. Electrostatic Grounding - Parked Airplane
      (1) The airplane is normally electrostatically grounded through conductive tires (AMM task Measure Electrical Resistance to Ground within this procedure).

(2) Electrostatic Grounding - Parked Airplane
(3) The airplane is normally electrostatically grounded through conductive tires (AMM task Measure Electrical Resistance to Ground within this procedure). However, static grounding is necessary for:
(a) Airplanes with inadequate conductivity to ground through the tires.
(b) Airplanes on parking sites that have inadequate conductivity.
1) The operator should ensure the adequacy of airplane and parking area conductivity and may need to establish local procedures in areas where inadequate parking site conductivity is seasonal or permanent.
2) Parking site conductivity may be inadequate on dry snow, dry sand or in areas of low moisture.

I. Should operators elect not to follow this recommended procedure, they should develop alternate procedures or establish conditions adequately protecting the personnel and equipment involved. Local fire codes and customs may require alternative or additional procedures to those defined here.

TASK 20-41-00-862-009

2. Static Ground Procedure (Fig. 201)
A. Access
(1) Location Zones
711 Nose Landing Gear
731 Left Main Landing Gear
741 Right Main Landing Gear

B. Grounding Procedure:

S 422-020

WARNING: DO NOT CONNECT A HEADSET AND DO NOT TOUCH CONNECTIONS TO THE AIRPLANE DURING ATMOSPHERIC ELECTRICAL ACTIVITY OR IN STRONG ELECTROMAGNETIC FIELDS. LIGHTNING STRIKE AND HIGH DISCHARGE CURRENTS CAN CAUSE SEVERE INJURY.

WARNING: ALWAYS ATTACH THE GROUNDING CABLE TO THE GROUND CONNECTION FIRST. NEVER ATTACH THE CABLE TO THE AIRPLANE AND THEN TO THE GROUND CONNECTION.

WARNING: ALL WORK AROUND THE AIRPLANE MUST STOP WHEN LIGHTNING OCCURS AT A DISTANCE OF 6 MILES OR LESS. ALL PERSONNEL MUST GO IN A BUILDING OR THE AIRPLANE. LIGHTNING CAN CAUSE INJURY TO PERSONNEL.

CAUTION: ATTACH GROUNDING CABLES ONLY TO SPECIFIED POINTS ON THE AIRPLANE. INCORRECTLY ATTACHED GROUNDING CABLES CAN CAUSE SCRATCHES WHICH CAN CAUSE CORROSION AND CRACKS ON STRESSED PARTS. GROUND WIRES ATTACHED TO DOORS OR FAIRINGS MADE FROM COMPOSITE MATERIALS DO NOT PROVIDE A GROUND.

(1) Attach grounding cable to a static ground and to the airplane in the following sequence:
   (a) Connect the grounding cable to an approved, identified static ground point. These points may be located in the parking surface or in another fixed location.
   (b) Connect the grounding cable to approved grounding attach point on the airplane. These points are identified in Fig. 201.
      1) Connect the grounding cables to the jack pad during landing gear retraction tests or with the landing gear removed. The jack pad must be completely installed and the grounding stud on it must be unpainted and free from oil and grease.

S 022-011

(2) Before the airplane is moved, remove the ground cables from the approved grounding attach point on the airplane.

TASK 20-41-00-762-012

3. Bonding Procedure

A. Procedure:

S 422-021

WARNING: DO NOT CONNECT A HEADSET AND DO NOT TOUCH CONNECTIONS TO THE AIRPLANE DURING ATMOSPHERIC ELECTRICAL ACTIVITY OR IN STRONG ELECTROMAGNETIC FIELDS. LIGHTNING STRIKE AND HIGH DISCHARGE CURRENTS CAN CAUSE SEVERE INJURY.

CAUTION: ATTACH BONDING CABLES ONLY TO SPECIFIED POINTS ON THE AIRPLANE. INCORRECTLY ATTACHED BONDING CABLES CAN CAUSE SCRATCHES WHICH CAN CAUSE CORROSION AND CRACKS ON STRESSED PARTS. BOND WIRES ATTACH TO DOORS OR FAIRINGS MADE FROM COMPOSITE MATERIALS DO NOT PROVIDE A BOND.

(1) Connect a bonding cable to a recognized bonding or grounding point on the airplane and a recognized grounding or bonding point on the support equipment in use.

S 022-014

(2) Before the airplane is moved, remove the bonding cables from the airplane.

TASK 20-41-00-762-015

4. Measure Airplane Electrical Resistance to Ground

A. Equipment

(1) Multimeter - Model 27

B. Reference

(1) AMM 24-22-00/201, Supply Power Control

(2) AMM 24-41-02/201, External Power Receptacle

C. Prepare to Check

S 042-016

(1) Remove electrical power from the airplane (AMM 24-22-00/201).

S 042-022

(2) Remove or De-energize any External Powered devices.

S 762-027

(3) Do a continuity check from the neutral pin of the external power receptacle to the grounding stud (AMM 24-41-02/201).

S 042-023

(4) Disconnect airplane static ground cables if connected.

S 422-017

(5) Connect an ohmmeter between the recognized bonding/grounding point on the Primary Landing gear and on an identified ground point on the ramp or the surface of the ramp on which the airplane is parked.

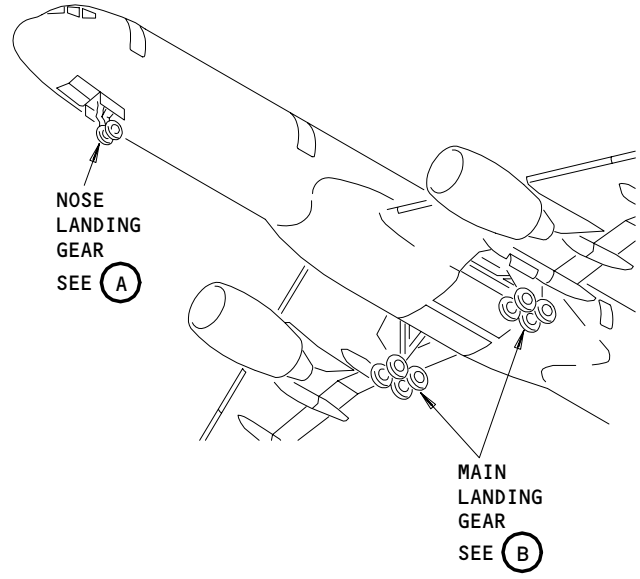
S 422-029
(6) Set the ohmmeter to the 50 Vdc range.

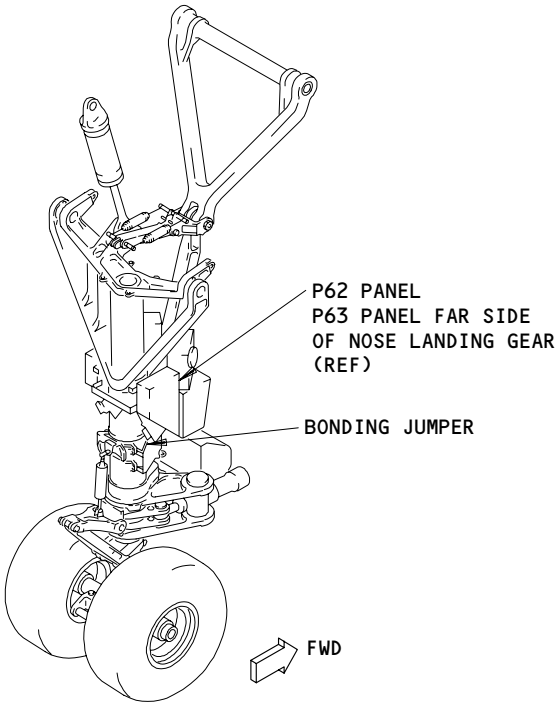
S 762-018
(7) Measure the resistance to ground and record in the maintenance log.
  (a) Make sure the resistance is less than 1.0 megohms.
    1) If the resistance to ground is greater than 1.0 megohms, do the following:
      a) Ensure the airplane is not parked over painted surfaces and that the tires provide sufficient conductivity.
      b) Repeat the measurement at other parking site locations where successful measurement have been made to verify sufficient airplane conductivity.

        NOTE: This will make sure the airplane has sufficient conductivty.
      c) Record the reading in the airplane logbook.
      d) Advise flight crews of subsequent flights that insufficient conductivity to ground is present through the tires to electrostatically ground this airplane on a parking surface. Static ground procedures may apply.

S 422-024
(8) Connect airplane static ground cables if required.

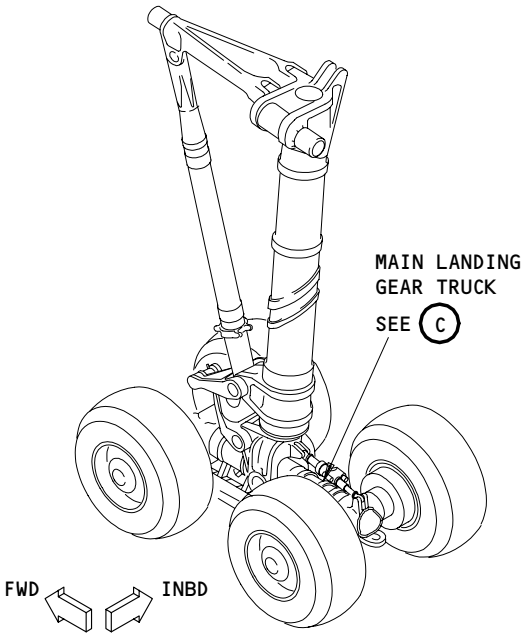
S 862-026
(9) Put the Airplane Back to Its Usual Condition





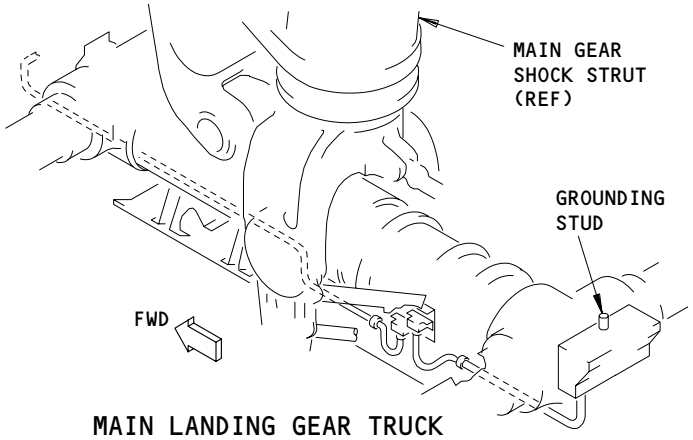
NOSE LANDING GEAR

A



MAIN LANDING GEAR

B



MAIN LANDING GEAR TRUCK

C

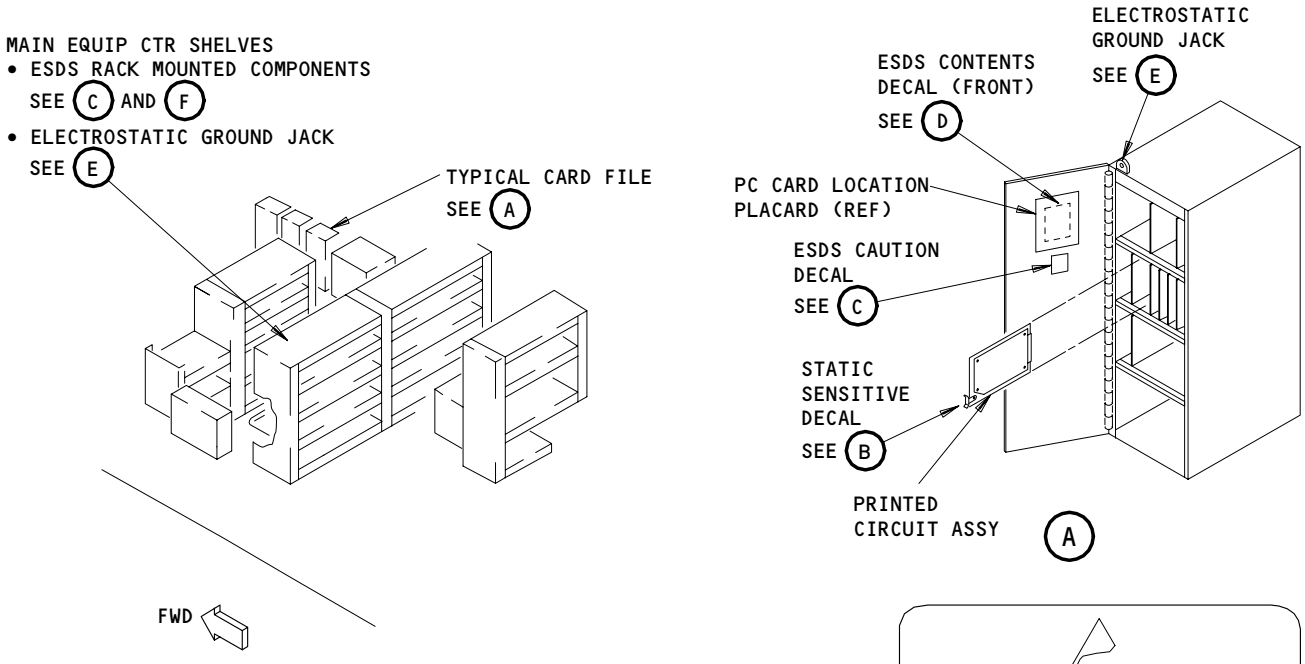
Static Grounding
Figure 201

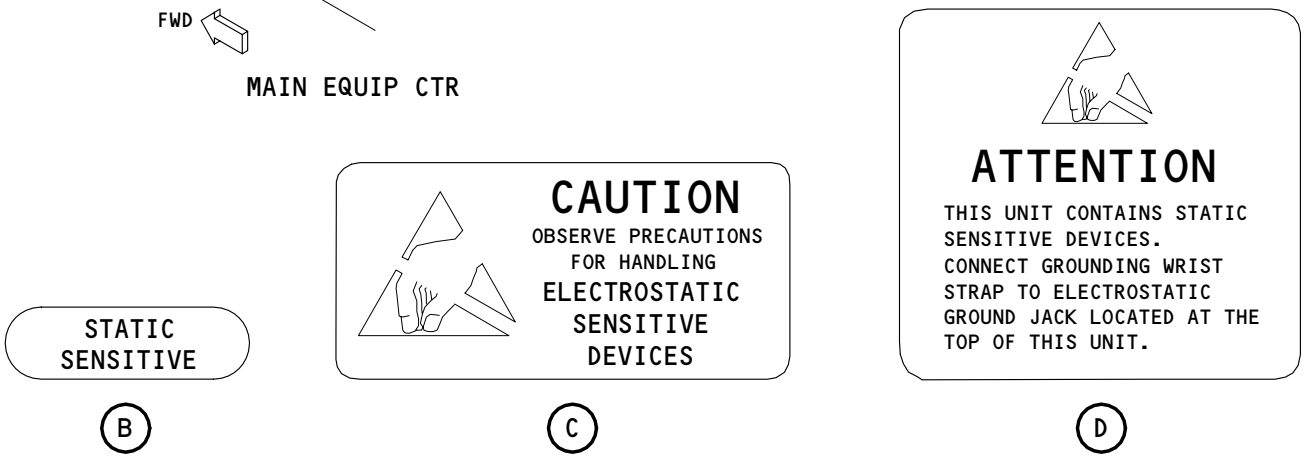
ELECTROSTATIC DISCHARGE SENSITIVE DEVICES - MAINTENANCE PRACTICES

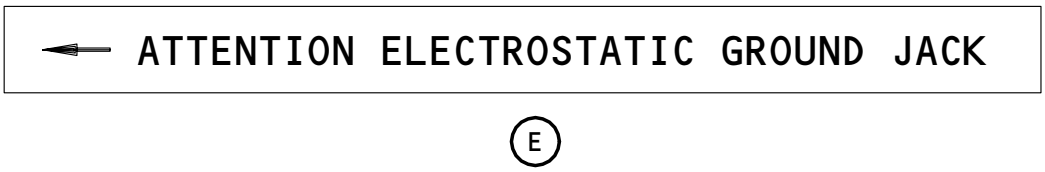
1. General (Fig. 201)
   A. Many electronic line replaceable units (referred to as LRUs) contain micro-circuits and other sensitive devices which can be damaged internally by electrostatic discharges. These LRUs are identified as Electrostatic Discharge Sensitive (referred to as ESDS). The placards installed on the ESDS LRUs show that you must be careful. The persons who remove, install, and move the ESDS LRUs must know about static electricity and the protection from static discharges that is necessary.
   B. Electrostatic charges can be caused by these: human bodies, hair, clothing, floors, equipment racks, and equipment units. An electrostatic discharge is electrostatic energy transmitted between substances of different electrical potentials. Electrostatic discharges from nylon clothing or human hair onto polyethylene or steel can damage ESDS components. Damage to the internal components of an ESDS LRU can cause failure with one static discharge. System properties can change with time because of many static discharges.
   C. The function of these procedures is to show the maintenance persons how to know and touch the ESDS LRUs. These procedures contain the precautions that are necessary to safely touch the units that are identified by the ESDS placard. Three types of decals are in used to identify the units with ESDS sensitive circuits. The military and commercial symbols are used on some units, while the international (JEDEC) symbol is used on most ESDS placard (Fig. 201). The ESDS printed circuit boards that are LRU's are identified with a "STATIC SENSITIVE" placard (Fig. 201).
   D. This procedure contains these tasks:
      (1) ESDS Printed Circuit Board Removal
      (2) ESDS Printed Circuit Board Installation
      (3) ESDS Metal Encased Unit Removal Handling
      (4) ESDS Metal Encased Unit Installation Handling

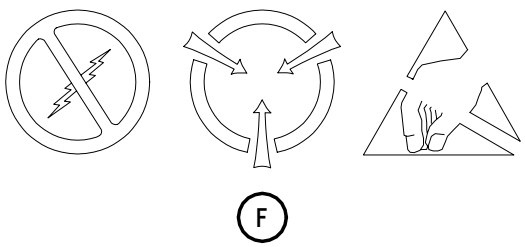
TASK 20-41-01-002-001

2. ESDS Printed Circuit Board Removal
   A. Equipment
      (1) Conductive Bags - 3M type 2100

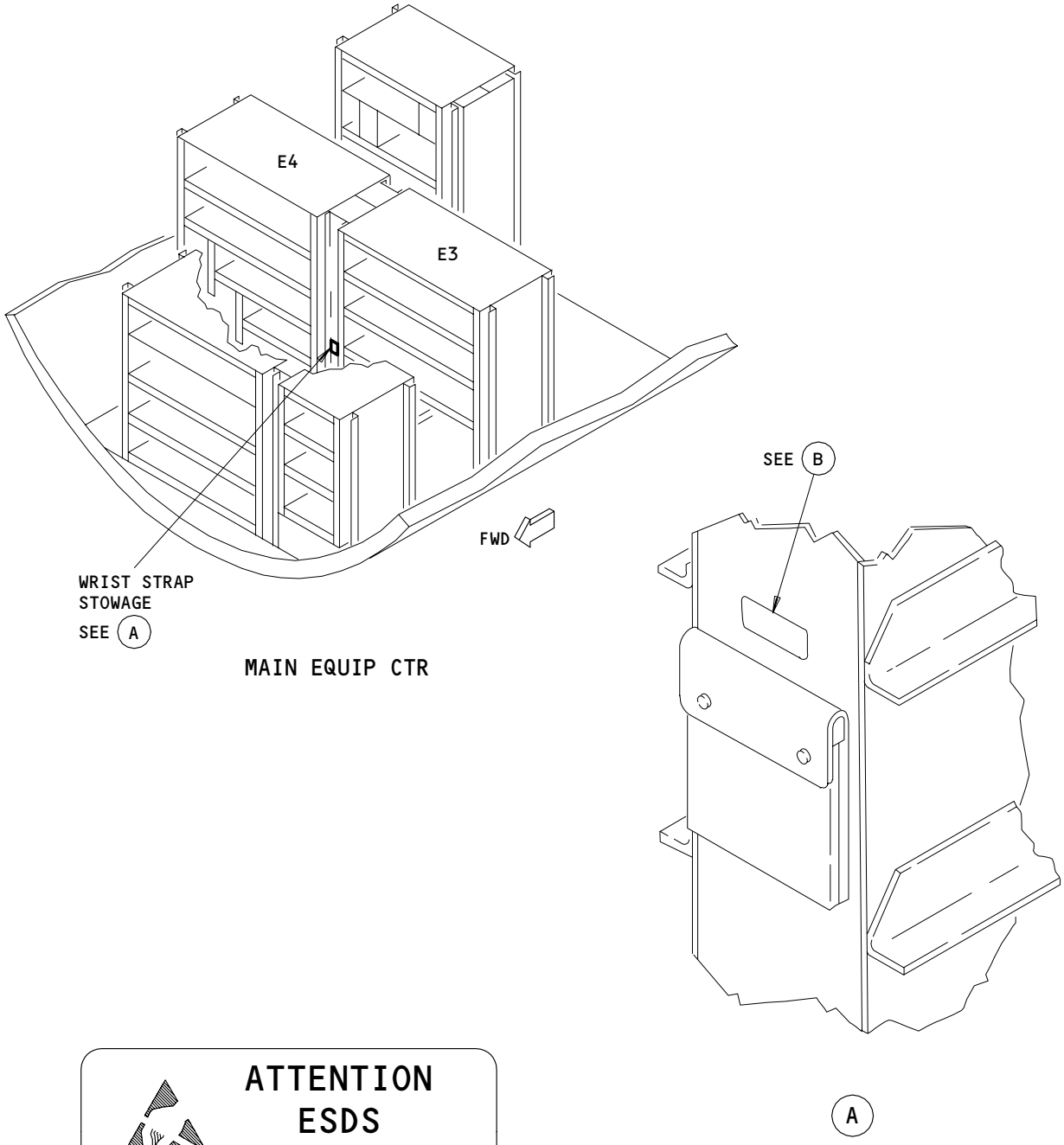








Static Sensitive Devices Identifiers
Figure 201



Onboard Wrist Strap Stowage
Figure 202

(2) Conductive Plastic Carrier - Electrical Insulation Suppliers PCC-700
(3) Ohmmeter
(4) Wrist Straps - 3M 2066, 2067, 2211, 2212, 2213, or 2214.
    (a) A wrist strap is kept on the plenum of the racks E3 and E4 in the main equipment center (Fig. 202).
(5) 100% Cotton Twine - Commercially Available
(6) ESDS Labels
    (a) JEDEC International Label - multi-source
    (b) 3M - No. 7102

B. Remove the Printed Circuit Boards with the STATIC SENSITIVE placards

NOTE: The placards on the outer area of the card files show the cards that contain the ESDS printed circuit boards that are LRU's.

S 862-039

CAUTION: MAKE SURE YOU KEEP CONTAMINATION OR UNWANTED MATERIAL AWAY FROM THE SENSITIVE DEVICE. CONTAMINATION OR UNWANTED MATERIAL NEAR THE SENSITIVE DEVICE CAN CAUSE A MALFUNCTION IN THE SENSITIVE DEVICE.

(1) Remove the system electrical power with the applicable Removal/Installation procedure.

S 862-037

WARNING: USE A WRIST STRAP WITH A MINIMUM GROUNDING LEAD RESISTANCE OF 250 KILOHMS AND A MAXIMUM OF 1.5 MEGOHMS. USE OF A LOW RESISTANCE WRIST STRAP CAN CAUSE INJURY TO PERSONS IF A HIGH VOLTAGE SOURCE IS TOUCHED.

(2) Do these steps to do a test of the wrist strap resistance:
    (a) Use an ohmmeter to make sure the wrist strap assembly has a minimum resistance of 250 kilohms and a maximum of 1.5 megohms.
    (b) Put the wrist strap on your wrist.
    (c) Use an ohmmeter to make sure the resistance is less than 10 megohm.

S 422-033

(3) Connect the wrist strap into the ELECTROSTATIC GROUND JACK of the card file.

S 862-005

CAUTION: THE GROUNDING LEAD ON THE WRIST STRAP MUST TOUCH THE SKIN TO GIVE THE PROTECTION THAT IS NECESSARY. FAILURE TO USE THE WRIST STRAP CORRECTLY CAN CAUSE DAMAGE TO THE ESDS PRINTED CIRCUIT BOARDS.

(4) Attach the wrist strap correctly on the person that will remove the printed circuit board.

S 012-006

(5) Open the access door on the card file.

S 032-007

(6) From the location decal, find the printed circuit board to be removed.

S 022-008

(7) Use the top and bottom (or left and right) extractors on the printed circuit board to remove it from the card file.

S 862-010

(8) Put the printed circuit board in the conductive bag or the container with the ESDS placard.

S 862-009

CAUTION: DO NOT USE STAPLES OR ADHESIVE TAPES TO CLOSE THE CONDUCTIVE BAGS. FAILURE TO CLOSE THE CONDUCTIVE BAGS CORRECTLY CAN CAUSE DAMAGE TO THE PRINTED CIRCUIT BOARD.

(9) Use an ESDS or a 100% cotton twine to close the conductive bag.

NOTE: The printed circuit boards in a conductive bag must be put in a rigid container to make sure the conductive bag stays in a satisfactory condition.

S 862-011

(10) Close the access door to the card file.

S 862-012

(11) Disconnect the wrist strap from the ELECTROSTATIC GROUND JACK.

TASK 20-41-01-402-013

3. ESDS Printed Circuit Boards Installation

A. Equipment

(1) Conductive Bags - 3M type 2100

(2) Conductive Plastic Carrier - Electrical Insulation Suppliers PCC-700
(3) Ohmmeter
(4) Wrist Straps - 3M 2066, 2067, 2211, 2212, 2213, or 2214.
    (a) A wrist strap is kept on the plenum of the racks E3 and E4 in the main equipment center (Fig. 202).
(5) 100% Cotton Twine - Commercially Available
(6) ESDS Labels
    (a) JEDEC International Label - multi-source
    (b) 3M - No. 7102

B. Install the Printed Circuit Boards with a STATIC SENSITIVE Placard

S 862-040

CAUTION: MAKE SURE YOU KEEP CONTAMINATION OR UNWANTED MATERIAL AWAY FROM THE SENSITIVE DEVICE. CONTAMINATION OR UNWANTED MATERIAL NEAR THE SENSITIVE DEVICE CAN CAUSE A MALFUNCTION IN THE SENSITIVE DEVICE.

(1) Remove the system electrical power with the applicable Removal/Installation procedure.

S 862-044

WARNING: USE A WRIST STRAP WITH A MINIMUM GROUNDING LEAD RESISTANCE OF 250 KILOHMS AND A MAXIMUM OF 1.5 MEGOHMS. USE OF A LOW RESISTANCE WRIST STRAP CAN CAUSE INJURY TO PERSONS IF A HIGH VOLTAGE SOURCE IS TOUCHED.

(2) Do these steps to do a test of the wrist strap resistance:
    (a) Use an ohmmeter to make sure the wrist strap assembly has a minimum resistance of 250 kilohms and a maximum of 1.5 megohms.
    (b) Put the wrist strap on your wrist.
    (c) Use an ohmmeter to make sure the resistance is less than 10 megohm.

S 422-034
(3) Connect the wrist strap into the ELECTROSTATIC GROUND JACK of the card file.

S 862-016

CAUTION: THE GROUNDING LEAD ON THE WRIST STRAP MUST TOUCH THE SKIN TO GIVE THE PROTECTION THAT IS NECESSARY. FAILURE TO USE THE WRIST STRAP CORRECTLY CAN CAUSE DAMAGE TO THE ESDS PRINTED CIRCUIT BOARDS.

(4) Attach the wrist strap correctly on the person that will remove the printed circuit board.

S 862-017

(5) Open the access door on the card file.

S 862-018

(6) From the location decal, find the printed circuit board to be installed.

S 862-019

(7) Remove the ESDS printed circuit board from the conductive bag or the carrier.

S 422-020

(8) With the top and bottom (or left and right) extractors, put the printed circuit board into the card file.

S 432-021

(9) Attach the printed circuit card with the extractors.

S 862-022

(10) Close the access door for the card file.

S 862-023

(11) Disconnect the wrist strap from the ELECTROSTATIC GROUND JACK.

TASK 20-41-01-002-024

4. ESDS Metal Encased Unit Removal Handling

A. General

(1) The metal encased units can be put on a rack, the airplane structure, or a control panel.

B. Equipment

(1) Wrist Straps - 3M 2066, 2067, 2211, 2212, 2213, or 2214.

(a) A wrist strap is kept on the plenum of the racks E3 and E4 in the main equipment center. (Fig. 202)

(2) Ohmmeter

(3) Conductive electrical dust caps and connector covers (Conductive Bag - Optional)

NOTE: Conductive dust caps and connector covers are black or grey in color.

(a) ITT Cannon - as applicable (stamped "CONDUCTIVE")

PART NUMBER	MARKING ON CAP	CONNECTOR
025-1155-001	BKAD1-A&B-R	BKAD1-A-R BKAD1-B-R
025-1156-001	BKAD1-C-R	BKAD1-C-R
025-1157-001	BKAD2&3-A&B-R	BKAD2-A-R BKAD2-B-R BKAD3-A-R BKAD3-B-R
025-1158-001	BKAD2&3-C-R	BKAD2-C-R BKAD3-C-R

(b) Souriau - as applicable

PART NUMBER	TYPE CONNECTOR	SHELL SIZE
8660-1404	Power	1
8660-1405	Signal	1
8660-1406	Power	2 & 3
8660-1407	Signal	2 & 3

(4) Anti-static dust caps, connector covers or conductive bags (alternate when conductive caps and covers not available)

(a) Plastic dust caps and connector covers that have an anti-static solution applied and they are dated.

C. Remove the Metal Encased Units with the ESDS Placards

S 862-041

CAUTION: MAKE SURE YOU KEEP CONTAMINATION OR UNWANTED MATERIAL AWAY FROM THE SENSITIVE DEVICE. CONTAMINATION OR UNWANTED MATERIAL NEAR THE SENSITIVE DEVICE CAN CAUSE A MALFUNCTION IN THE SENSITIVE DEVICE.

(1) Remove the system electrical power with the applicable Removal/Installation procedure.

S 762-046

WARNING: USE A WRIST STRAP WITH A MINIMUM GROUNDING LEAD RESISTANCE OF 250 KILOHMS AND A MAXIMUM OF 1.5 MEGOHMS.

(2) Do these steps to do a test of the wrist strap resistance:
(a) Use an ohmmeter to make sure the wrist strap assembly has a minimum resistance of 250 kilohms and a minimum of 1.5 megohms.

CAUTION: THE GROUNDING LEAD ON THE WRIST STRAP MUST TOUCH THE SKIN TO GIVE THE PROTECTION THAT IS NECESSARY. FAILURE TO USE THE WRIST STRAP CORRECTLY CAN CAUSE DAMGE TO THE ESDS METAL ENCASED UNIT.

(b) Connect the strap on the wrist of the person that will remove the device.
(c) Use an ohmmeter to make sure the resistance is less than 10 megohms.

S 422-047
(3) Connect the strap to an applicable electrostatic ground jack.

S 022-026

(4) Remove the unit with the ESDS placard from the equipment rack, the airframe, or the panel as shown in the applicable Removal/Installation procedure.

NOTE: Make sure you do not touch the pins in the electrical connector. Make sure a static sensitive placard is installed adjacent to the electrical connector(s).

This placard show that the unit can be damaged by an electrostatic discharge through the connector pins.

This static sensitive placard, or an equivalent, will be shown:

CAUTION ELECTROSTATIC SENSITIVE DEVICE. CONDUCTIVE CONNECTOR DUST COVER REQUIRED.

S 032-027

(5) Install a conductive dust cover with a static sensitive placard on the connectors, and standard dust covers or optional conductive bag on the connectors that do not have the placard.

NOTE: The conductive dust caps and the connector covers are black in color.

NOTE: The conductive dust caps and the connector covers from the installed unit can be used on the removed unit.

S 862-028

(6) Move the unit, as shown in the standard practices, with the conductive dust caps and connector covers installed.

S 482-048

(7) Remove the strap.

TASK 20-41-01-402-029

5. ESDS Metal Encased Unit Installation Handling

A. Equipment

(1) Wrist Straps - 3M 2066, 2067, 2211, 2212, 2213, or 2214.

(a) A wrist strap is kept on the plenum of the racks E3 and E4 in the main equipment center. (Fig. 202)

(2) Ohmmeter

(3) Conductive electrical dust caps and connector covers (Conductive Bag - Optional).

NOTE: Conductive dust caps and connector covers are black or grey in color.

(a) ITT Cannon - as applicable (stamped "CONDUCTIVE")

PART NUMBER	MARKING ON CAP	CONNECTOR
025-1155-001	BKAD1-A&B-R	BKAD1-A-R BKAD1-B-R
025-1156-001	BKAD1-C-R	BKAD1-C-R
025-1157-001	BKAD2&3-A&B-R	BKAD2-A-R BKAD2-B-R BKAD3-A-R BKAD3-B-R
025-1158-001	BKAD2&3-C-R	BKAD2-C-R BKAD3-C-R

(b) Souriau - as applicable

PART NUMBER	TYPE CONNECTOR	SHELL SIZE
8660-1404	Power	1
8660-1405	Signal	1
8660-1406	Power	2 & 3
8660-1407	Signal	2 & 3

(4) Anti-static dust caps, connector covers, or conductive bags (alternate when conductive caps and covers not available)
(a) Plastic dust caps and connector covers that have an anti-static solution applied and are dated.

B. Install the Metal Encased Units with ESDS Placards

S 862-042

CAUTION: MAKE SURE YOU KEEP CONTAMINATION OR UNWANTED MATERIAL AWAY FROM THE SENSITIVE DEVICE. CONTAMINATION OR UNWANTED MATERIAL NEAR THE SENSITIVE DEVICE CAN CAUSE A MALFUNCTION IN THE SENSITIVE DEVICE.

(1) Remove the system electrical power with the applicable Removal/Installation procedure.

S 762-049

WARNING: USE A WRIST STRAP WITH A MINIMUM GROUNDING LEAD RESISTANCE OF 250 KILOHMS AND A MAXIMUM OF 1.5 MEGOHMS. USE OF A LWO RESISTANCE WRIST STRAP CAN CAUSE INJURY TO PERSONS IF A HIGH VOLTAGE SOURCE IS TOUCHED.

(2) Do these steps to do a test of the wrist strap resistance:
(a) Use an ohmmeter to make sure the wrist strap assembly has a minimum resistance of 250 kilohms and a minimum of 1.5 megohms.

CAUTION: THE GROUNDING LEAD ON THE WRIST STRAP MUST TOUCH THE SKIN TO GIVE THE PROTECTION THAT IS NECESSARY. FAILURE TO USE THE WRIST STRAP CORRECTLY CAN CAUSE DAMAGE TO THE ESDS METAL ENCASED UNIT.

(b) Put the wrist strap on the person that will remove the device.
(c) Use an ohmmeter to make sure the resistance is less than 10 megohms.

S 432-031
(3) Remove all of the conductive dust caps, the connector covers , or conductive bags from the unit to be installed.

NOTE: Make sure you do not touch the electrical pins.

S 422-032
(4) Install the ESDS unit with the applicable Removal/Installation procedure.

S 842-050
(5) Remove the strap.

HIRF/LIGHTNING PROTECTION - FQIS WIRING AND BONDING - INSPECTION/CHECK

1. General
   A. This procedure contains tasks that inspect and check the bonding of the fuel quantity indicating system (FQIS) wiring shields at the fuel tank receptacles at the pressure seal connectors, and along the length of the wire bundle between those points.
   B. These tasks will also satisfy the Airworthiness Limitation Instructions as defined and required by SFAR 88 for lightning protection features that are part of the Fuel Quantity Indicating System, as defined in Section 9 of the MPD.
   C. These are the tasks in this procedure:
      (1) FQIS Wiring and Bonding - Inspection

          NOTE: This task checks the shielding and connector bonding of the Fuel Quantity Indicating System out-tank wire bundles at the spar penetrations.

      (2) FQIS Wiring and Bonding - Fault Isolation

          NOTE: This task is only used if you found the loop resistance measurement was out-of-range in the Inspection task.

TASK 20-55-54-286-001

2. FQIS Wiring and Bonding - Inspection
   A. General
      (1) ALI - Refer to this task: Airworthiness Limitation Precautions (AMM 20-00-00/201), for important information on Airworthiness Limitation Instructions (ALIs).
   B. Reference
      (1) AMM 20-56-02/201, HIRF/Lightning - Loop Resistance Measurement
      (2) AMM 20-56-03/201, HIRF/Lightning - Joint Resistance Measurement
   C. Equipment
      (1) 906-10246-2 or 906-10246-3 - Loop Resistance Tester (LRT).
   D. Access
      (1) Location Zones

221	Center Tank
300	Left Wing
400	Right Wing
122	Forward Cargo Compartment

(2) Access Panels

511BB	Access Panel
521CB	Access Panel
193EL	Access Door
621CB	Access Panel
611BB	Access Panel
611AB	Access Panel
621AB	Access Panel
194AR	Access Panel
122AZ	Forward Cargo Compartment Bulkhead Panel
821	Forward Cargo Door

E. Prepare for the Check

S 866-034

(1) Make copy of data sheets for recording the measured data.

NOTE: Use the correct data sheet for the airplane configuration.

S 016-025

(2) Open the forward cargo door, 821.

S 016-021

(3) Remove the forward cargo compartment bulkhead panel.

S 016-020

(4) Open the access panels.

(a) To inspect the FQIS connectors at the fuel tank spar penetrations, a man-lift and safety equipment will be required.

S 976-031

(5) Please submit copies of all data recorded while doing this procedure to the Boeing Company for engineering analysis. The data should be sent to the following addressee: "Boeing Commercial Airplane Group, Attention: Manager, Airline Support".

S 826-032

(6) To prepare the Loop Resistance Tester (LRT), 906-10246-2 or 906-10246-3, do this task: LRT Lid Standard Measurement (AMM 20-56-01/201).

NOTE: Once you do this task, it is not necessary to do this step again until you set the LRT to Off then On again.

(a) For instructions on how to do a loop resistance measurement, do this task: Loop Resistance Measurement (AMM 20-56-02/201).

F. FQIS Wiring and Bonding Connectors - Check

S 286-029

CAUTION: WHEN YOU USE THE LRT, BE CAREFUL WITH THE LOOP COUPLERS. THE LOOP COUPLERS CAN CAUSE DAMAGE TO THE GROUND WIRE INSTALLATION.

(1) Loop Resistance Measurement Procedure

(a) You will do the loop resistance test on the FQIS system. The FQIS system includes Hi-Z, Lo-Z, and Densitometer (for BF Goodrich only) wire bundles.

(b) The wire bundle connectors and wire bundles to be tested are listed in Tables below.

(c) Do a loop resistance measurement on the wire bundle for each connector (AMM 20-56-02/201):

1) Place the Drive and Sense couplers on the ground wire prior to the point where the shield pigtails break out to the ground stud.

NOTE: Where access is an issue, in that the drive and sense probes cannot be placed on the bundle prior to the grounds breaking out from the wire bundle, it is acceptable to place the drive and sense probes on the shield ground wires near the ground stud. Additionally it is acceptable to place the drive and sense couplers on the wire bundle at any part of the length of the wire bundle. Ensure only the subject wire bundle is under test.

2) For ground designator labeled as GD-LTG: do a Loop Test at the point on the bundle prior to the ground wire breaking out and going to ground. If this is not feasible due to space constraints the Loop Test can be completed on the ground wire at the ground stud.

NOTE: Some of the ground designations are generic and designated as GD-LTG. The proper ground stud is the ground stud where the wire bundle shields, and/or overbraid are physically terminated.

3) Record the measured shield resistance value.
4) If the loop resistance value measured is within the limits specified in the Data Sheet (Fig. 601), move to the next test point.
5) If the loop resistance value measured is not within the limits specified in the Data Sheet (Fig. 601), do this task: FQIS Wiring and Bonding - Fault Isolation.

(d) Perform a detailed inspection of each wire bundle connected to the tank end connectors listed in Tables along the entire bundle length, to include the shield termination points at each end of the wire bundle installation. Check for evidence of corrosion, chaffing, shielding degradation, or other damage to the outside wire bundle shield, or overbraid.

(e) If the connectors or wiring were found to be loose or broken, record that condition to the Data Sheet. Repair per Standard Wiring Practices Manual (SWPM 20-20-00).
1) Perform the loop resistance measurement on that wire bundle to verify the fault has been cleared.

(f) 757-200 BF GOODRICH AND WITHOUT INDIVIDUALLY SHIELDED WIRING ON THE DENSITOMETER WIRING FOR ENHANCED LIGHTNING PROTECTION; Use this table:

NOTE: Refer to the wire diagram for the Effectivity under test to determine which connector, ground or wire bundle is applicable for the airplane under test.

LOOP RESISTANCE TEST								
LOCATION	WIRE BUNDLE	CONNECTOR	WIRE BUNDLE (MILLIOHMS)		OVERBRAID TEST LOCATION (GROUND)	OVERBRAID (MILLIOHMS)		WIRING DIAGRAMS
			MIN	MAX		MIN	MAX	
Left Main Tank - Hi-Z	W4024	D42220P *[1]	215	506	N/A	N/A	N/A	28-41-21
Left Main Tank - Lo-Z	W4024	D41268P *[1]	119	282	N/A	N/A	N/A	28-41-21
Right Main Tank - Hi-Z	W4026	D42222P *[1]	243	572	N/A	N/A	N/A	28-41-31
Right Main Tank - Lo-Z	W4026	D41270P *[1]	137	326	N/A	N/A	N/A	28-41-31
Left Center Tank - Hi-Z	W4024	D42224P	77	183	N/A	N/A	N/A	28-41-41
Right Center Tank - Hi-Z	W4026	D42226P	85	200	N/A	N/A	N/A	28-41-41
Left Main Tank Densitometer Overbraid	W4020	Near Pressure Seal	N/A	N/A	N/A	3	48	28-41-21
Right Main & Center Tank Densitometer Overbraid	W4022	Near Pressure Seal	N/A	N/A	N/A	3	48	28-41-21

LOOP RESISTANCE TEST								
LOCATION	WIRE BUNDLE	CONNECTOR	WIRE BUNDLE (MILLIOHMS)		OVERBRAID TEST LOCATION (GROUND)	OVERBRAID (MILLIOHMS)		WIRING DIAGRAMS
			MIN	MAX		MIN	MAX	

*[1] If the value is not in limits, do the Special Troubleshooting Procedure in the FQIS Wiring and Bonding - Fault Isolation task below.

(g) 757-200 BF GOODRICH AND WITH INDIVIDUALLY SHIELDED WIRING ON THE DENSITOMETER WIRING FOR ENHANCED LIGHTNING PROTECTION; Use this table:

NOTE: Refer to the wire diagram for the Effectivity under test to determine which connector, ground or wire bundle is applicable for the airplane under test.

LOOP RESISTANCE TEST								
LOCATION	WIRE BUNDLE	CONNECTOR	WIRE BUNDLE (MILLIOHMS)		OVERBRAID TEST LOCATION (GROUND)	OVERBRAID (MILLIOHMS)		WIRING DIAGRAMS
			MIN	MAX		MIN	MAX	
Left Main Tank - Hi-Z	W4024	D42220P *[1]	206	486	N/A	N/A	N/A	28-41-21
Left Main Tank - Lo-Z	W4024	D41268P *[1]	121	280	N/A	N/A	N/A	28-41-21
Right Main Tank - Hi-Z	W4026	D42222P *[1]	258	608	N/A	N/A	N/A	28-41-31
Right Main Tank - Lo-Z	W4026	D41270P *[1]	137	336	N/A	N/A	N/A	28-41-31
Left Center Tank - Hi-Z and Lo-Z	W4024	D42224P	72	183	N/A	N/A	N/A	28-41-41
Right Center Tank - Hi-Z and Lo-Z	W4026	D42226P	95	234	N/A	N/A	N/A	28-41-41
Left Tank Densitometer Shield	W4020	D41272P	106	250	N/A	N/A	N/A	28-41-21
Right Main & Center Tank Densitometer Shield	W4022	D41276P	59	142	N/A	N/A	N/A	28-41-21

LOOP RESISTANCE TEST								
LOCATION	WIRE BUNDLE	CONNECTOR	WIRE BUNDLE (MILLIOHMS)		OVERBRAID TEST LOCATION (GROUND)	OVERBRAID (MILLIOHMS)		WIRING DIAGRAMS
			MIN	MAX		MIN	MAX	

*[1] If the value is not in limits, do the Special Troubleshooting Procedure in the FQIS Wiring and Bonding - Fault Isolation task below.

(h) 757-200 HONEYWELL POST SB 28-0015 AND PRE-SB-28-0020; Use this table:

NOTE: Refer to the wire diagram for the Effectivity under test to determine which connector, ground or wire bundle is applicable for the airplane under test.

LOOP RESISTANCE TEST								
LOCATION	WIRE BUNDLE	CONNECTOR	WIRE BUNDLE (MILLIOHMS)		OVERBRAID TEST LOCATION (GROUND)	OVERBRAID (MILLIOHMS)		WIRING DIAGRAMS
			MIN	MAX		MIN	MAX	
Right Main and Center Tank - Lo-Z Shield	W4218 or W4026	D41620P or D41270P	66	154	N/A	N/A	N/A	28-41-31
Right Main Tank - Hi-Z	W4218 or W4026	D42222P	504	1336	N/A	N/A	N/A	28-41-31
Right Main Tank - Lo-Z Shield	W3424 or W3486	D41196P or D41396P	42	100	N/A	N/A	N/A	28-41-31
Right Main Tank - Lo-Z Shield	W3462	D2814	1	40	N/A	N/A	N/A	28-41-31
Left Main and Center Tank - Lo-Z Shield	W4206 or W4024	D41636P or D41268P	55	130	N/A	N/A	N/A	28-41-21
Left Main Tank - Hi-Z	W4206 or W4024	D42220P	567	1186	N/A	N/A	N/A	28-41-21
Left Main Tank - Lo-Z Shield	W3342 or W3372	D41192P	40	101	N/A	N/A	N/A	28-41-21
Left Main Tank - Lo-Z Shield	W3326	D2788	1	40	N/A	N/A	N/A	28-41-21
Left Center Tank - Hi-Z	W4206 or W4024	D42224P	313	738	N/A	N/A	N/A	28-41-41
Right Center Tank - Hi-Z	W4218 or W4026	D42226P	385	908	N/A	N/A	N/A	28-41-41

(i) 757-200 HONEYWELL POST SB 28-0020;
Use this table:

NOTE: Refer to the wire diagram for the Effectivity under test to determine which connector, ground or wire bundle is applicable for the airplane under test.

LOOP RESISTANCE TEST								
LOCATION	WIRE BUNDLE	CONNECTOR	WIRE BUNDLE (MILLIOHMS)		OVERBRAID TEST LOCATION (GROUND)	OVERBRAID (MILLIOHMS)		WIRING DIAGRAMS
			MIN	MAX		MIN	MAX	
Right Main and Center Tank - Lo-Z Shield	W4218 or W4026	D41620P or D41270P	66	154	N/A	N/A	N/A	28-41-31
Right Main Tank - Hi-Z Shield	W4218 or W4026	D42222P	267	630	N/A	N/A	N/A	28-41-31
Right Main Tank - Lo-Z Shield	W3424 or W3486	D41196P or D41396P	42	100	N/A	N/A	N/A	28-41-31
Right Main Tank - Lo-Z Shield	W3462	D2814	1	40	N/A	N/A	N/A	28-41-31
Left Main and Center Tank - Lo-Z Shield	W4206 or W4024	D41636P or D41268P	55	130	N/A	N/A	N/A	28-41-21
Left Main Tank - Hi-Z Shield	W4206 or W4024	D42220P	221	522	N/A	N/A	N/A	28-41-21
Left Main Tank - Lo-Z Shield	W3342 or W3372	D41192P	40	101	N/A	N/A	N/A	28-41-21
Left Main Tank - Lo-Z Shield	W3326	D2788	1	40	N/A	N/A	N/A	28-41-21
Left Center Hi-Z Shield	W4206 or W4024	D42224P	147	348	N/A	N/A	N/A	28-41-41
Right Center Hi-Z Shield	W4218 or W4026	D42226P	169	398	N/A	N/A	N/A	28-41-41

(j) 757-200 HONEYWELL PRE SB 28-0015 AND PRE SB-28-0020;
Use this table:

NOTE: Refer to the wire diagram for the Effectivity under test to determine which connector, ground or wire bundle is applicable for the airplane under test.

LOOP RESISTANCE TEST								
LOCATION	WIRE BUNDLE	CONNECTOR	WIRE BUNDLE (MILLIOHMS)		OVERBRAID TEST LOCATION (GROUND)	OVERBRAID (MILLIOHMS)		WIRING DIAGRAMS
			MIN	MAX		MIN	MAX	
Right Main and Center Tank - Lo-Z Shield	W4218 or W4026	D41620P or D41270P	66	154	N/A	N/A	N/A	28-41-31
Right Main Tank - Hi-Z Shield	W4218 or W4026	D42222P	364	854	N/A	N/A	N/A	28-41-31
Right Main Tank - Hi-Z Shield	W3424 or W3486	D41398P or D42334P or D41396P	187	446	N/A	N/A	N/A	28-41-31
Right Main Tank - Hi-Z Shield	W3426	D41396J or D2818	31	74	N/A	N/A	N/A	28-41-31
Right Main Tank - Lo-Z Shield	W3424 or W3486	D41196P or D41396P	42	100	N/A	N/A	N/A	28-41-31
Right Main Tank - Lo-Z Shield	W3462	D2814	1	40	N/A	N/A	N/A	28-41-31
Left Main and Center Tank - Lo-Z Shield	W4206 or W4024	D41636P or D41268P	55	130	N/A	N/A	N/A	28-41-21
Left Main Tank - Hi-Z Shield	W4206	D42220P	307	724	N/A	N/A	N/A	28-41-21
Left Main Tank - Hi-Z Shield	W3424	D41398P or D42312P or D41194P	188	444	N/A	N/A	N/A	28-41-21
Left Main Tank - Hi-Z Shield	W3326	D40304P or D41392J or D2792	34	82	N/A	N/A	N/A	28-41-21

LOOP RESISTANCE TEST								
LOCATION	WIRE BUNDLE	CONNECTOR	WIRE BUNDLE (MILLIOHMS)		OVERBRAID TEST LOCATION (GROUND)	OVERBRAID (MILLIOHMS)		WIRING DIAGRAMS
			MIN	MAX		MIN	MAX	
Left Main Tank - Lo-Z Shield	W3342 or W3372	D41192P	40	101	N/A	N/A	N/A	28-41-21
Left Main Tank - Lo-Z Shield	W3326	D2788	1	40	N/A	N/A	N/A	28-41-21
Left Center Hi-Z Shield	W4206 or W4024	D42224P	329	776	N/A	N/A	N/A	28-41-41
Right Center Hi-Z Shield	W4218 or W4026	D42226P	385	906	N/A	N/A	N/A	28-41-41

(k) 757-200 GOODRICH CONVERTED FROM HONEYWELL SYSTEM;
Use this table:

NOTE: Refer to the wire diagram for the Effectivity under test to determine which connector, ground or wire bundle is applicable for the airplane under test.

LOOP RESISTANCE TEST								
LOCATION	WIRE BUNDLE	CONNECTOR	WIRE BUNDLE (MILLIOHMS)		OVERBRAID TEST LOCATION (GROUND)	OVERBRAID (MILLIOHMS)		WIRING DIAGRAMS
			MIN	MAX		MIN	MAX	
Right Main and Center Tank - Lo-Z Shield	W4218 or W4026	D41620P or D41270P	66	162	N/A	N/A	N/A	28-41-31
Right Main Tank - Hi-Z Shield	W4218 or W4026	D42222P	267	630	N/A	N/A	N/A	28-41-31
Right Main Tank - Lo-Z Shield	W3424 or W3486	D41196P or D41396P	35	82	N/A	N/A	N/A	28-41-31
Right Main Tank - Lo-Z Shield	W3462	D2814	1	40	N/A	N/A	N/A	28-41-31
Left Main and Center Tank - Lo-Z Shield	W4206 or W4024	D41636P or D41268P	55	130	N/A	N/A	N/A	28-41-21
Left Main Tank - Hi-Z Shield	W4206 or W4024	D42220P	221	522	N/A	N/A	N/A	28-41-21
Left Main Tank - Lo-Z Shield	W3342 or W3372	D41192P	40	102	N/A	N/A	N/A	28-41-21
Left Main Tank - Lo-Z Shield	W3326	D2788	1	40	N/A	N/A	N/A	28-41-21
Left Center Hi-Z Shield	W4206 or W4024	D42224P	147	348	N/A	N/A	N/A	28-41-41
Right Center Hi-Z Shield	W4218 or W4026	D42226P	169	398	N/A	N/A	N/A	28-41-41

LOOP RESISTANCE TEST								
LOCATION	WIRE BUNDLE	CONNECTOR	WIRE BUNDLE (MILLIOHMS)		OVERBRAID TEST LOCATION (GROUND)	OVERBRAID (MILLIOHMS)		WIRING DIAGRAMS
			MIN	MAX		MIN	MAX	
Left Main Tank Densitometer Overbraid	W4020	Near Pressure Seal	N/A	N/A	GD-LTNG	3	48	28-41-21
Right Main and Center Tank Densitometer Overbraid	W4022	Near Pressure Seal	N/A	N/A	GD-LTNG	3	48	28-41-21

G. Put the Airplane Back to its Usual Condition

S 846-014
(1) If any FQIS wire bundles were disturbed during the accomplishment of this procedure, then do this task: Fuel Quantity Indicating System (FQIS) - Operational Check(28-41-00).

S 416-015
(2) Close the Access Panels opened during inspection.

S 416-022
(3) Install the forward cargo compartment bulkhead panel.

S 416-023
(4) Close the forward cargo door, 821.

PLANE:	
DATE:	
TECHNICIAN:	

BUNDLE NUMBER	CONNECTOR NUMBER	MEASURED RESISTANCE VALUE (mΩ)	WIRE BUNDLE MIN/MAX VALUE (mΩ)	PASS FAIL	OVERBRAID LOCATION	MEASURED OVERBRAID VALUE (MΩ)	OVERBRAID MIN/MAX VALUE (mΩ)	PASS FAIL	RETEST MEASURED VALUE/COMMENTS
W4024	D42220P		215/506		N/A		N/A		
W4024	D41268P		119/282		N/A		N/A		
W4026	D42222P		243/572		N/A		N/A		
W4026	D41270P		137/326		N/A		N/A		
W4024	D42224P		77/186		N/A		N/A		
W4026	D42226P		85/200		N/A		N/A		
W4020	Near Pressure Seal		N/A		GD - LTNG		3/48		
W4022	Near Pressure Seal		N/A		GD - LTNG		3/48		

757-200 BF Goodrich Without Individually Shielded Wiring On The Desitometer Wiring For Enhanced Lightning Protection

HIRF/Lightning Protection
(Data Sheet)
Figure 601 (Sheet 1)

PLANE:	
DATE:	
TECHNICIAN:	

BUNDLE NUMBER	CONNECTOR NUMBER	MEASURED RESISTANCE VALUE (mΩ)	WIRE BUNDLE MIN/MAX VALUE (mΩ)	PASS FAIL	OVERBRAID LOCATION	MEASURED OVERBRAID VALUE (MΩ)	OVERBRAID MIN/MAX VALUE (mΩ)	PASS FAIL	RETEST MEASURED VALUE/COMMENTS
W4024	D42220P		206/486		N/A		N/A		
W4024	D41268P		121/280		N/A		N/A		
W4026	D42222P		258/608		N/A		N/A		
W4026	D41270P		137/336		N/A		N/A		
W4024	D42224P		72/183		N/A		N/A		
W4026	D42226P		95/234		N/A		N/A		
W4020	D41272P		106/250		N/A		N/A		
W4022	D41276P		59/142		N/A		N/A		

757-200 BF Goodrich With Individually Shielded Wiring On The Desitometer Wiring For Enhanced Lightning Protection

HIRF/Lightning Protection
(Data Sheet)
Figure 601 (Sheet 2)

PLANE:	
DATE:	
TECHNICIAN:	

BUNDLE NUMBER	CONNECTOR NUMBER	MEASURED RESISTANCE VALUE (mΩ)	WIRE BUNDLE MIN/MAX VALUE (mΩ)	PASS FAIL	OVERBRAID LOCATION	MEASURED OVERBRAID VALUE (MΩ)	OVERBRAID MIN/MAX VALUE (mΩ)	PASS FAIL	RETEST MEASURED VALUE/COMMENTS
W4218 or W4026	D41620P or D41270P		66/154		N/A		N/A		
W4218 or W4026	D42222P		504/1336		N/A		N/A		
W3424 or W3486	D41196P or D41396P		42/100		N/A		N/A		
W3462	D2814		1/40		N/A		N/A		
W4206 or W4024	D41636P or D41268P		55/130		N/A		N/A		
W4206 or W4024	D42220P		567/1186		N/A		N/A		
W3342 or W3372	D41192P		40/101		N/A		N/A		
W3326	D2788		1/40		N/A		N/A		
W4206 or W4024	D42224P		313/738		N/A		N/A		
W4218 or W4026	D42226P		385/908		N/A		N/A		

757-200 Honeywell Post-SB 28-0015 and Pre-SB 28-0020

HIRF/Lightning Protection
(Data Sheet)
Figure 601 (Sheet 3)

PLANE:	
DATE:	
TECHNICIAN:	

BUNDLE NUMBER	CONNECTOR NUMBER	MEASURED RESISTANCE VALUE (mΩ)	WIRE BUNDLE MIN/MAX VALUE (mΩ)	PASS FAIL	OVERBRAID LOCATION	MEASURED OVERBRAID VALUE (MΩ)	OVERBRAID MIN/MAX VALUE (mΩ)	PASS FAIL	RETEST MEASURED VALUE/COMMENTS
W4218 or W4026	D41620P or D41270P		66/154		N/A		N/A		
W4218 or W4026	D42222P		267/630		N/A		N/A		
W3424 or W3486	D41196P or D41396P		42/100		N/A		N/A		
W3462	D2814		1/40		N/A		N/A		
W4206 or W4024	D41636P or D41268P		55/130		N/A		N/A		
W4206 or W4024	D42220P		221/522		N/A		N/A		
W3342 or W3372	D41192P		40/101		N/A		N/A		
W3326	D2788		1/40		N/A		N/A		
W4206 or W4024	D42224P		147/348		N/A		N/A		
W4218 or W4026	D42226P		169/398		N/A		N/A		

757-200 Honeywell Post-SB 28-0020

HIRF/Lightning Protection
(Data Sheet)
Figure 601 (Sheet 4)

PLANE:	
DATE:	
TECHNICIAN:	

BUNDLE NUMBER	CONNECTOR NUMBER	MEASURED RESISTANCE VALUE (mΩ)	WIRE BUNDLE MIN/MAX VALUE (mΩ)	PASS FAIL	OVERBRAID LOCATION	MEASURED OVERBRAID VALUE (MΩ)	OVERBRAID MIN/MAX VALUE (mΩ)	PASS FAIL	RETEST MEASURED VALUE/COMMENTS
W4218 or W4026	D41620P or D41270P		66/154		N/A		N/A		
W4218 or W4026	D42222P		364/854		N/A		N/A		
W3424 or W3486	D41398P or D42334P or D41396P		187/446		N/A		N/A		
W3426	D41396J or D2818		31/74		N/A		N/A		
W3424 or W3486	D41196P or D41396P		42/100		N/A		N/A		
W3462	D2814		1/40		N/A		N/A		
W4206 or W4024	D41636P or D41268P		55/130		N/A		N/A		
W4206	D42220P		307/724		N/A		N/A		
W3424	D41398P or D42312P or D41194P		188/444		N/A		N/A		
W3326	D40304P or D41392JP or D2792		34/82		N/A		N/A		
W3342 or W3372	D41192P		40/101		N/A		N/A		
W3326	D2788		1/40		N/A		N/A		
W4206 or W4024	D42224P		329/776		N/A		N/A		
W4218 or W4026	D42226P		385/906		N/A		N/A		

757-200 Honeywell Pre-SB 28-0015 and Pre-SB 28-0020

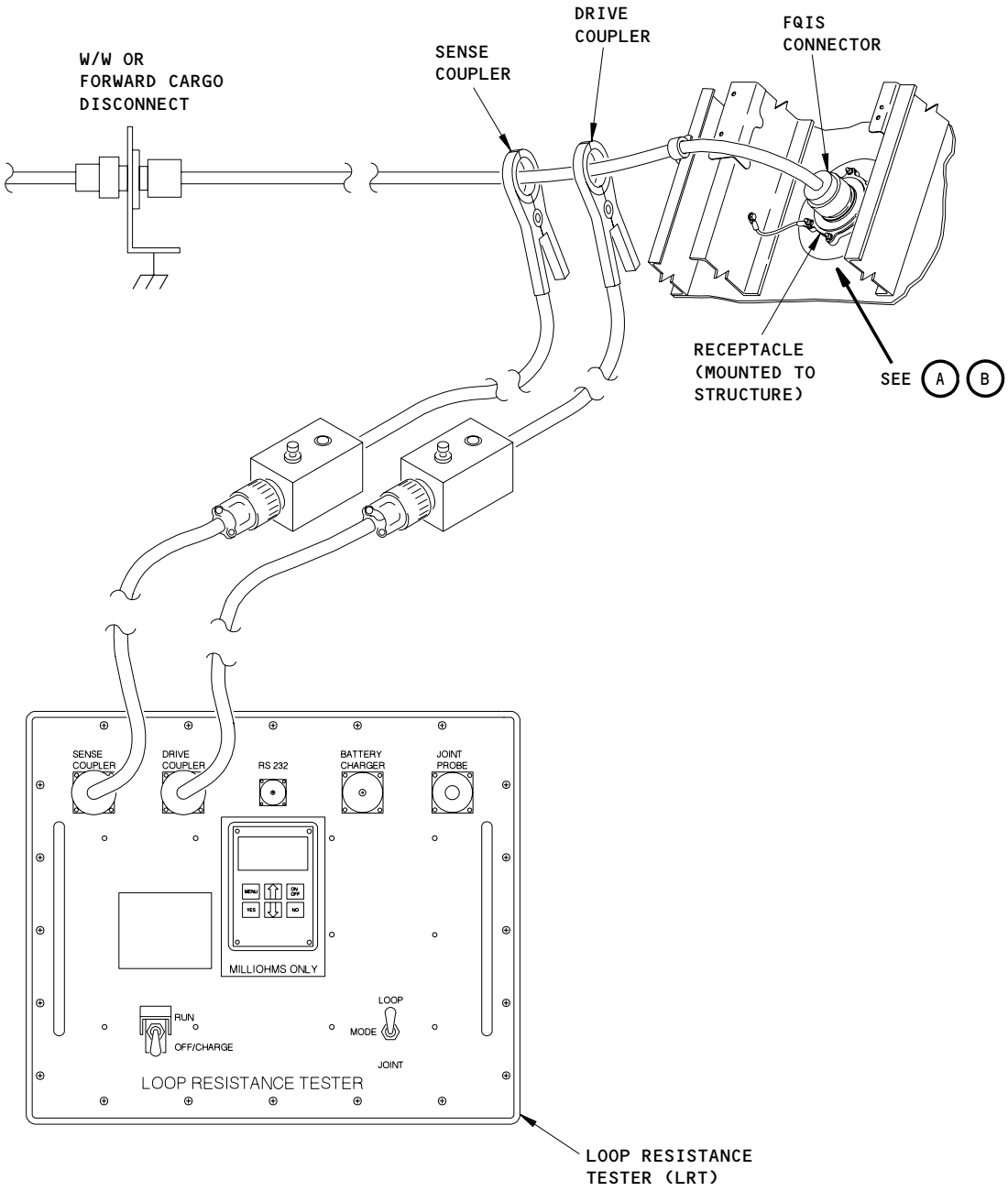
HIRF/Lightning Protection
(Data Sheet)
Figure 601 (Sheet 5)

PLANE:	
DATE:	
TECHNICIAN:	

BUNDLE NUMBER	CONNECTOR NUMBER	MEASURED RESISTANCE VALUE (mΩ)	WIRE BUNDLE MIN/MAX VALUE (mΩ)	PASS FAIL	OVERBRAID LOCATION	MEASURED OVERBRAID VALUE (MΩ)	OVERBRAID MIN/MAX VALUE (mΩ)	PASS FAIL	RETEST MEASURED VALUE/COMMENTS
W4218 or W4026	D41620P or D41270P		66/162		N/A		N/A		
W4218 or W4026	D42222P		267/630		N/A		N/A		
W3424 or W3486	D41196P or D41396P		35/82		N/A		N/A		
W3462	D2814		1/40		N/A		N/A		
W4206 or W4024	D41636P or D41268P		55/130		N/A		N/A		
W4206 or W4024	D42220P		221/522		N/A		N/A		
W3342 or W3372	D41192P		40/102		N/A		N/A		
W3326	D2788		1/40		N/A		N/A		
W4206 or W4024	D42224P		147/348		N/A		N/A		
W4218 or W4026	D42226P		169/398		N/A		N/A		
W4020	Near Pressure Seal		N/A		GD - LTNG		3/48		
W4022	Near Pressure Seal		N/A		GD - LTNG		3/48		

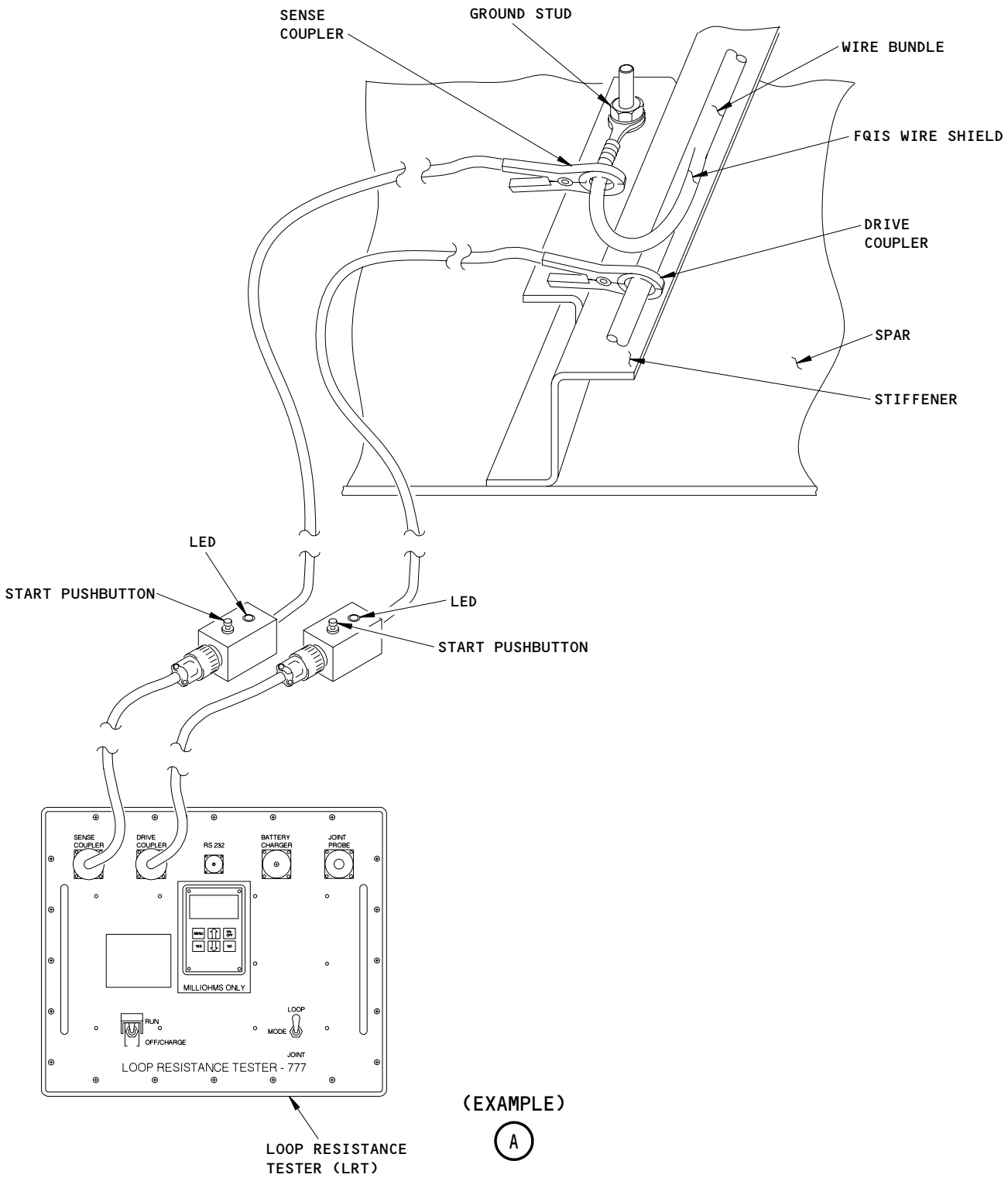
757-200 BF Goodrich Converted from Honeywell System

HIRF/Lightning Protection
(Data Sheet)
Figure 601 (Sheet 6)

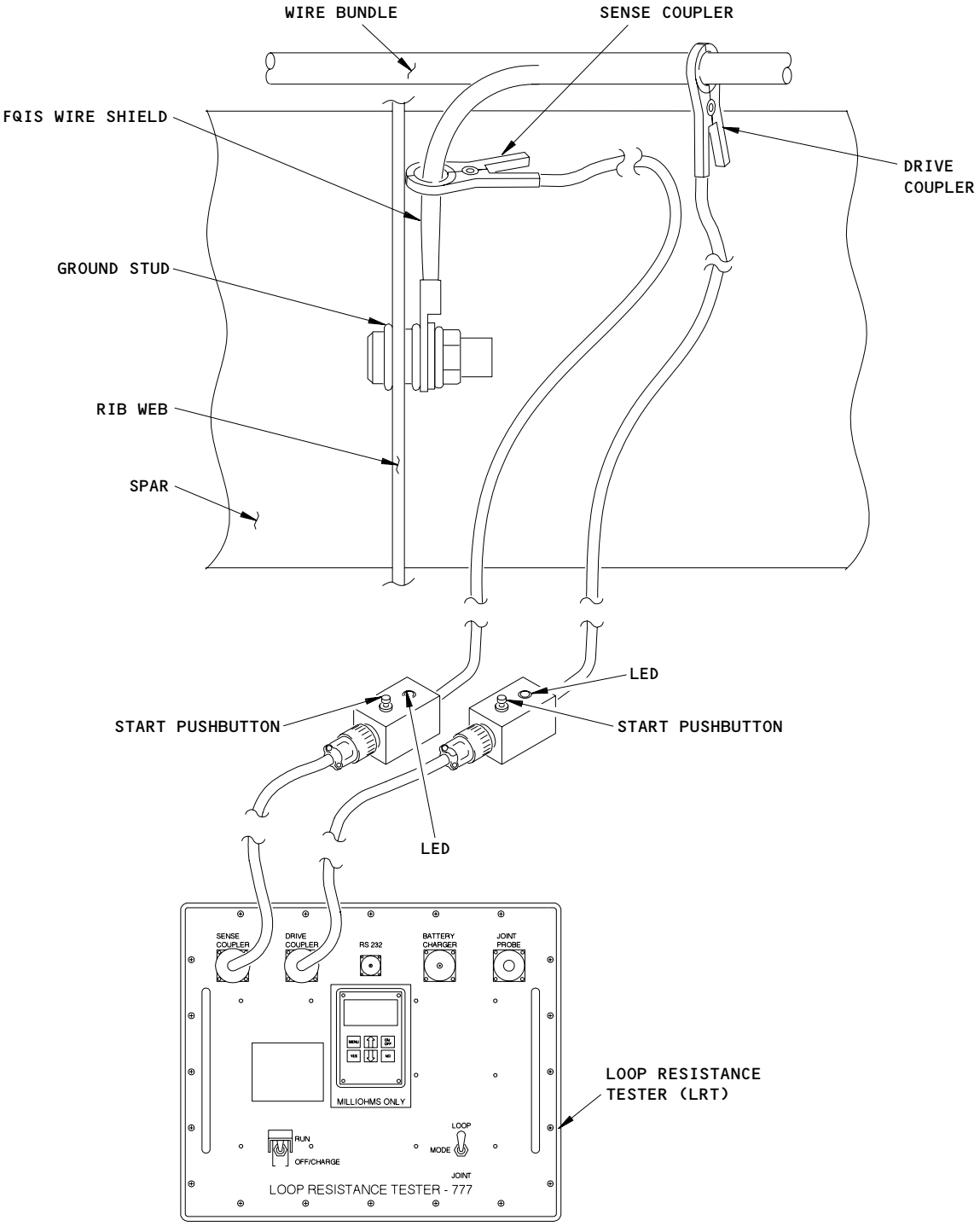


FQIS TEST CONNECTIONS

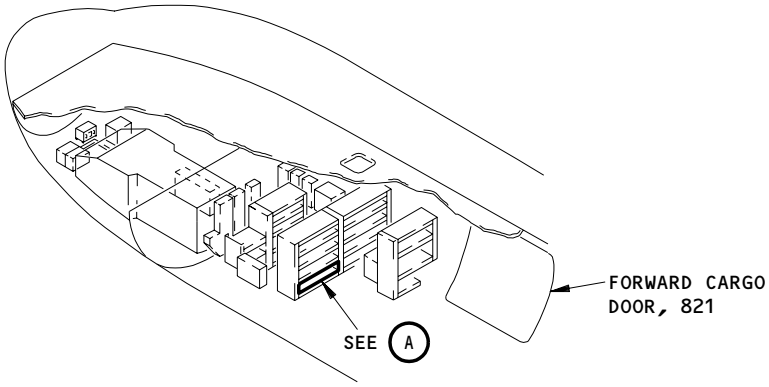
High Intensity Radiated Fields (HIRF) Inspection (Test Connections)
Figure 602 (Sheet 1)



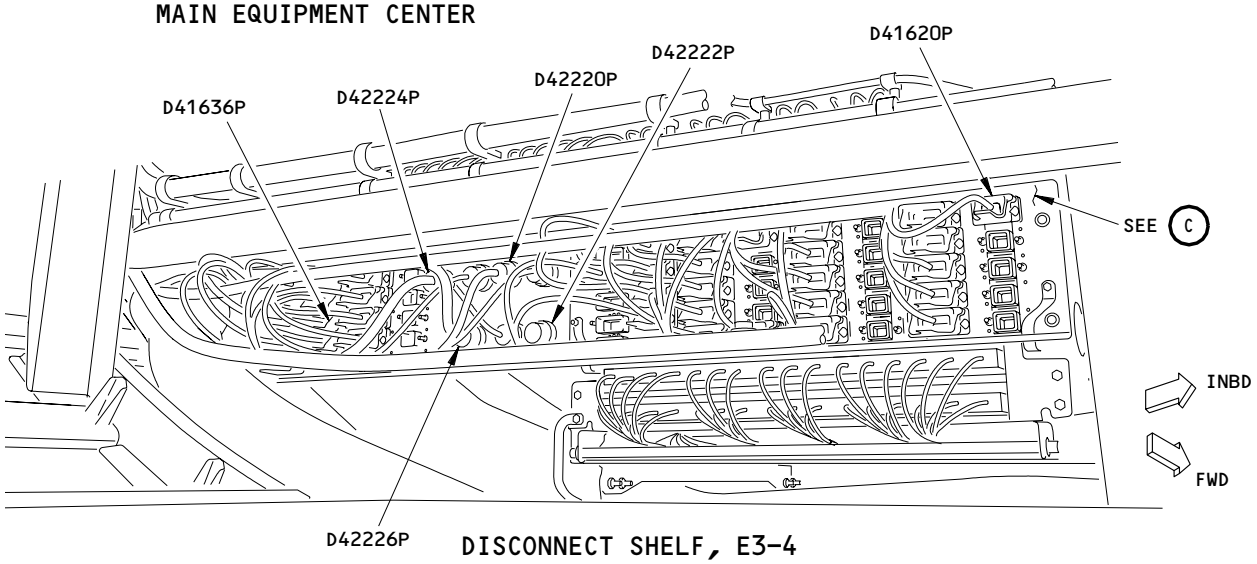
Typical Test Setup – Loop Resistance Test – Left Wing Main Tank Front Spar At Outboard Spar Station (Example)
Figure 602 (Sheet 2)



Typical Test Setup – Loop Resistance Test – Right Wing Main Tank Front Spar At Outboard Spar Station (Example)
Figure 602 (Sheet 3)

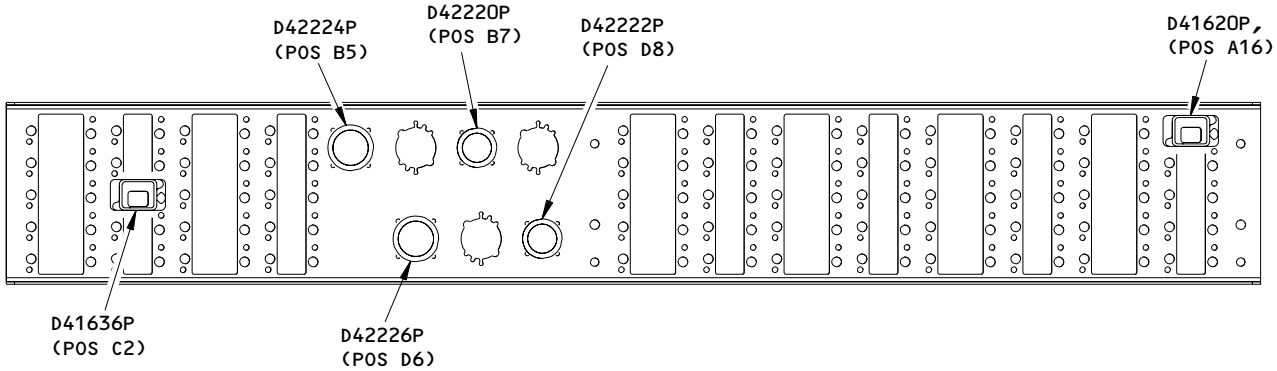


MAIN EQUIPMENT CENTER



DISCONNECT SHELF, E3-4

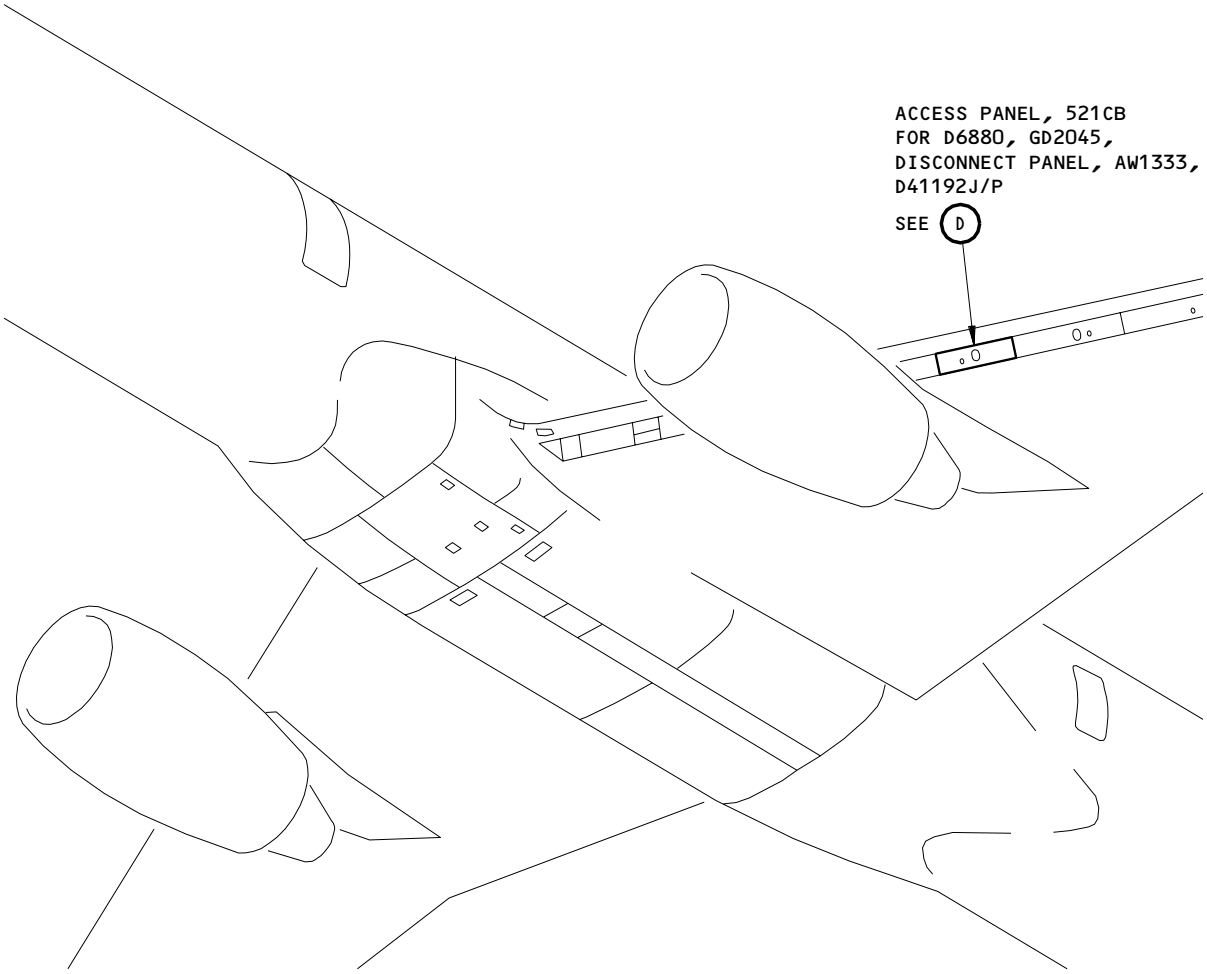
B



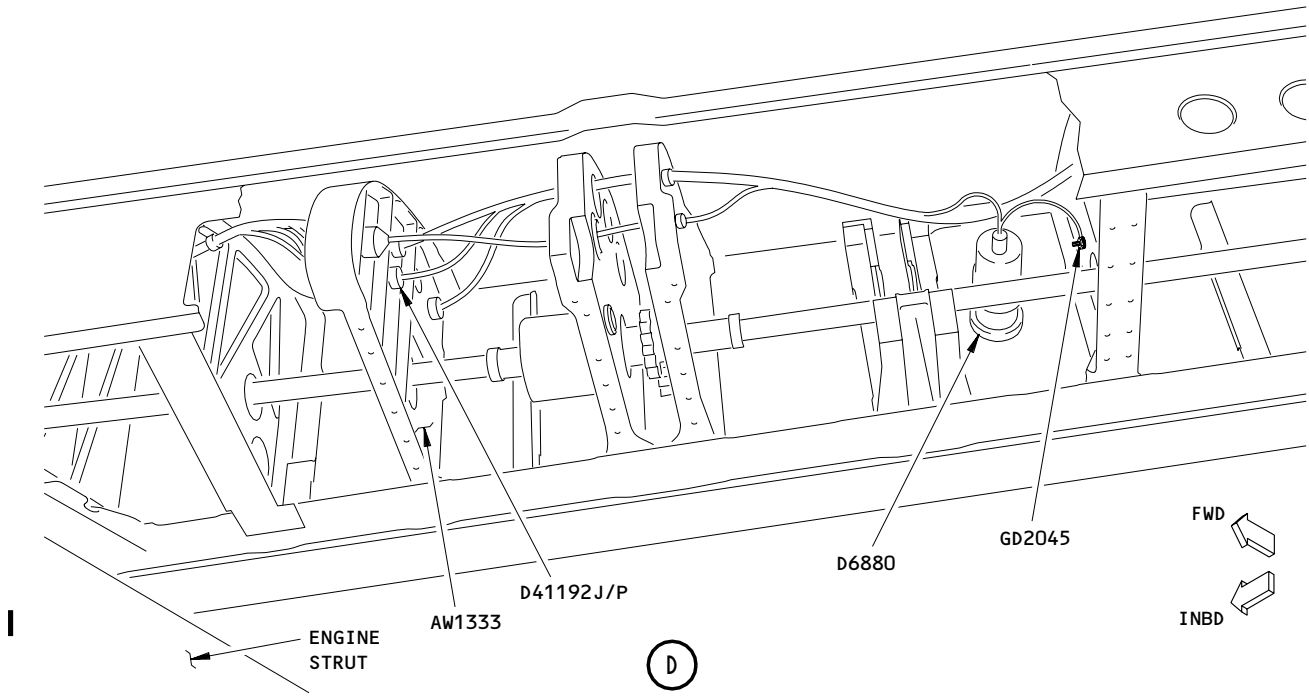
DISCONNECT PANEL, E3-4

C

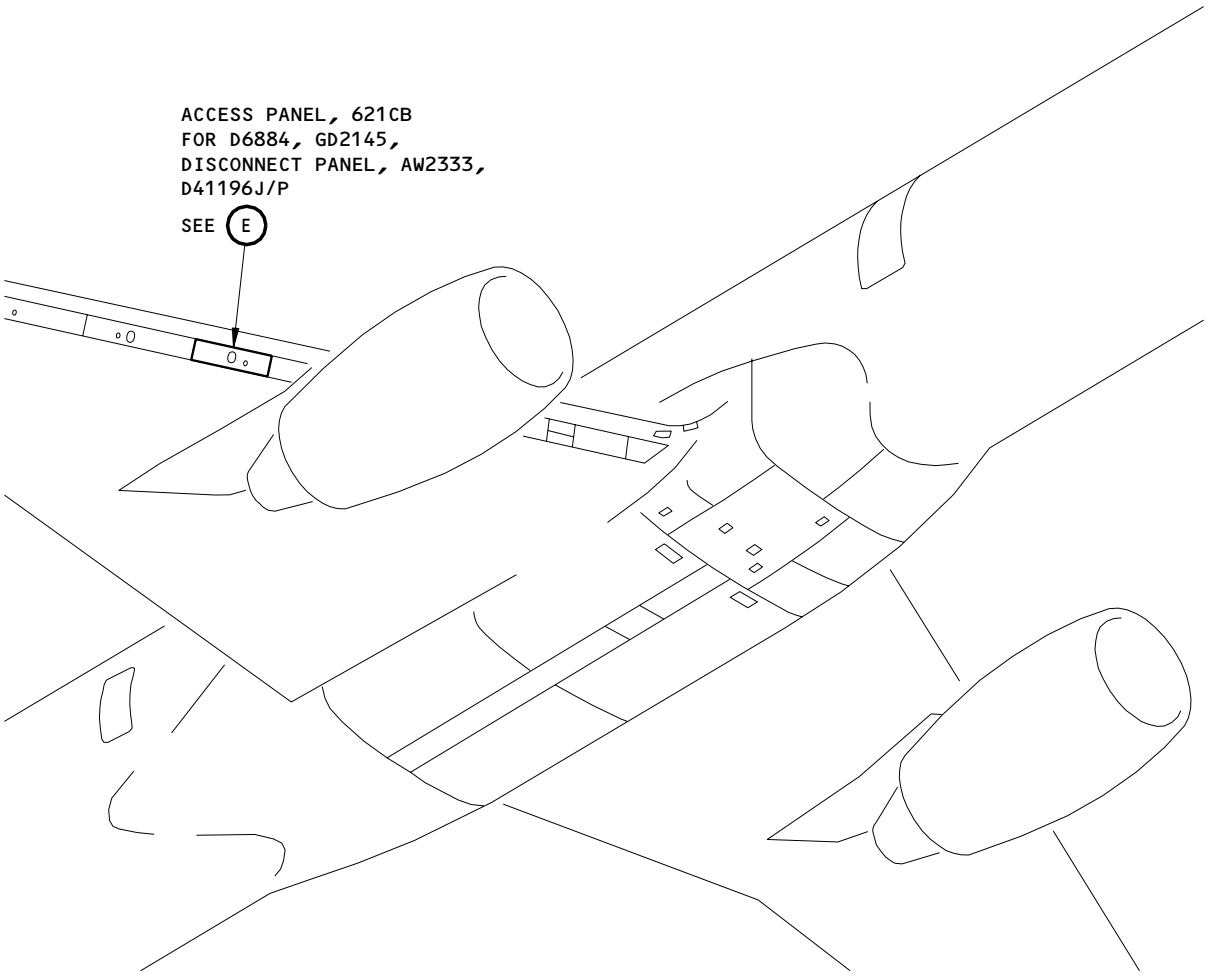
HIRF/Lightning Protection
(Connector and Ground Locations)
Figure 603 (Sheet 1)



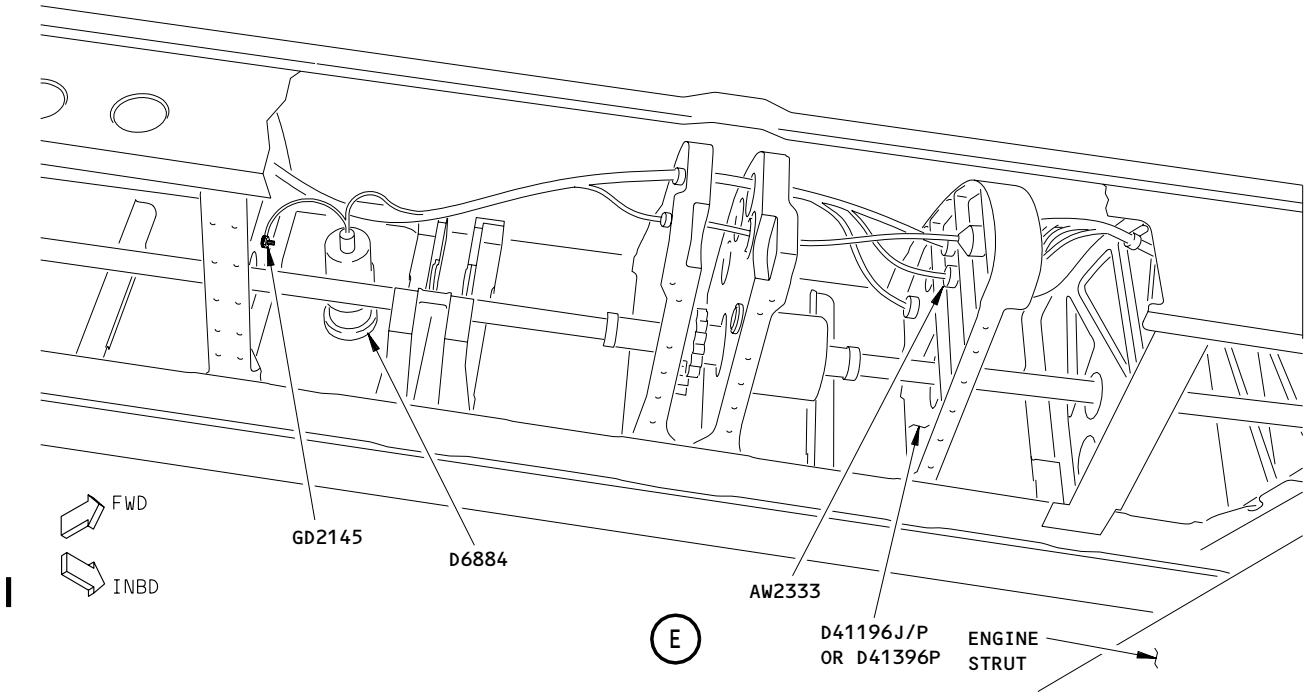
HIRF/Lightning Protection
(Connector and Ground Locations)
Figure 603 (Sheet 2)



HIRF/Lightning Protection
(Connector and Ground Locations)
Figure 603 (Sheet 3)



HIRF/Lightning Protection
(Connector and Ground Locations)
Figure 603 (Sheet 4)



HIRF/Lightning Protection
(Connector and Ground Locations)
Figure 603 (Sheet 5)

TASK 20-55-54-286-026

3. FQIS Wiring and Bonding - Fault Isolation

A. References

(1) AMM 20-56-01 201 LRT Lid Standard Measurement
(2) AMM 20-56-02/201, Loop Resistance Measurement
(3) AMM 20-56-03/201, Joint Resistance Measurement
(4) SWPM Chapter 20, Standard Wiring Practices Manual

B. Equipment

(1) 906-10246-2 or 906-10246-3 - Loop Resistance Tester (LRT).

C. Access

(1) Access Panels

3378	Left Feed Thru Panel
3478	Right Feed Thru Panel
511BB	Access Panel
521CB	Access Panel
193EL	Access Door
621CB	Access Panel
611BB	Access Panel
611AB	Access Panel
621AB	Access Panel
194AR	Access Panel
122AZ	Forward Cargo Compartment Bulkhead Panel
821	Forward Cargo Door

D. Special Troubleshooting Procedure

S 816-033

(1) Do these steps if one of these connectors is not in the limits:
- Wire bundle W4024 and connectors D42220P & D41268P
- Wire Bundle W4026 and connectors D42222P & D41270P

(a) Do the loop resistance measurement on the applicable wire bundle listed in table below.

1) If the measured loop resistance values are in limits listed, then go to the Troubleshooting Procedure below.

2) If the measured resistance value is not in the limit listed, then do the Join Resistance Measurement Test for the failed connector in the Troubleshooting Procedure below.

(b) 757-200 BF GOODRICH AND WITH INDIVIDUALLY SHIELDED WIRING ON THE DENSITOMETER WIRING FOR ENHANCED LIGHTNING PROTECTION; Use this table:

SPECIAL TROUBLESHOOTING								
LOCATION	WIRE BUNDLE	CONNECTOR	WIRE BUNDLE (MILLIOHMS)		OVERBRAID TEST LOCATION (GROUND)	OVERBRAID (MILLIOHMS)		WIRING DIAGRAMS
			MIN	MAX		MIN	MAX	
Left Main Tank - Hi-Z and Lo-Z	W4024	D6880-gnd wires only	77	182	N/A	N/A	N/A	28-41-21
Right Main Tank - Hi-Z and Lo-Z	W4026	D6884-gnd wires only	87	206	N/A	N/A	N/A	28-41-31

(c) 757-200 BF GOODRICH AND WITH INDIVIDUALLY SHIELDED WIRING ON THE DENSITOMETER WIRING FOR ENHANCED LIGHTNING PROTECTION; Use this table:

SPECIAL TROUBLESHOOTING								
LOCATION	WIRE BUNDLE	CONNECTOR	WIRE BUNDLE (MILLIOHMS)		OVERBRAID TEST LOCATION (GROUND)	OVERBRAID (MILLIOHMS)		WIRING DIAGRAMS
			MIN	MAX		MIN	MAX	
Left Main Tank - Hi-Z and Lo-Z	W4024	D6880-gnd wires only	74	176	N/A	N/A	N/A	28-41-21
Right Main Tank - Hi-Z and Lo-Z	W4026	D6884-gnd wires only	87	216	N/A	N/A	N/A	28-41-31

E. Troubleshooting Procedure

S 816-027

(1) To isolate a fault associated with the loop resistance measurement of the FQIS system wire bundles, do these steps:

(a) If the wire bundle shield resistance is LESS than the minimum value shown in the Data Sheet then check the operation of the LRT. To check the LRT operation, do this task: LRT Lid Standard Measurement(AMM 20-56-02).

1) If no problem is found with the LRT, then do a detailed visual inspection along the entire length of the wire bundle being measured. Inspect the shield along its entire length, looking for either shorting or chafing conditions along the bundle. Look for any physical damage or conditions that could cause the out-of-range resistance reading, and repair or replace as required

NOTE: An example might be an area where bundle insulation degraded and a portion of the shield is exposed and making contact with structure at an intermediate point in the bundle length. Another might be some metallic object penetrating the insulation and making contact between the shield and structure.

2) If a problem was found and is repaired, retest this bundle.

3) If no defects are found with the wire bundle, then record the below-minimum resistance reading for submission to Boeing and continue with the next wire bundle in the table.

(b) If the loop resistance value measured is more than the maximum resistance specified in the Data Sheet then do a Joint Resistance Measurement (AMM 20-56-03/201).

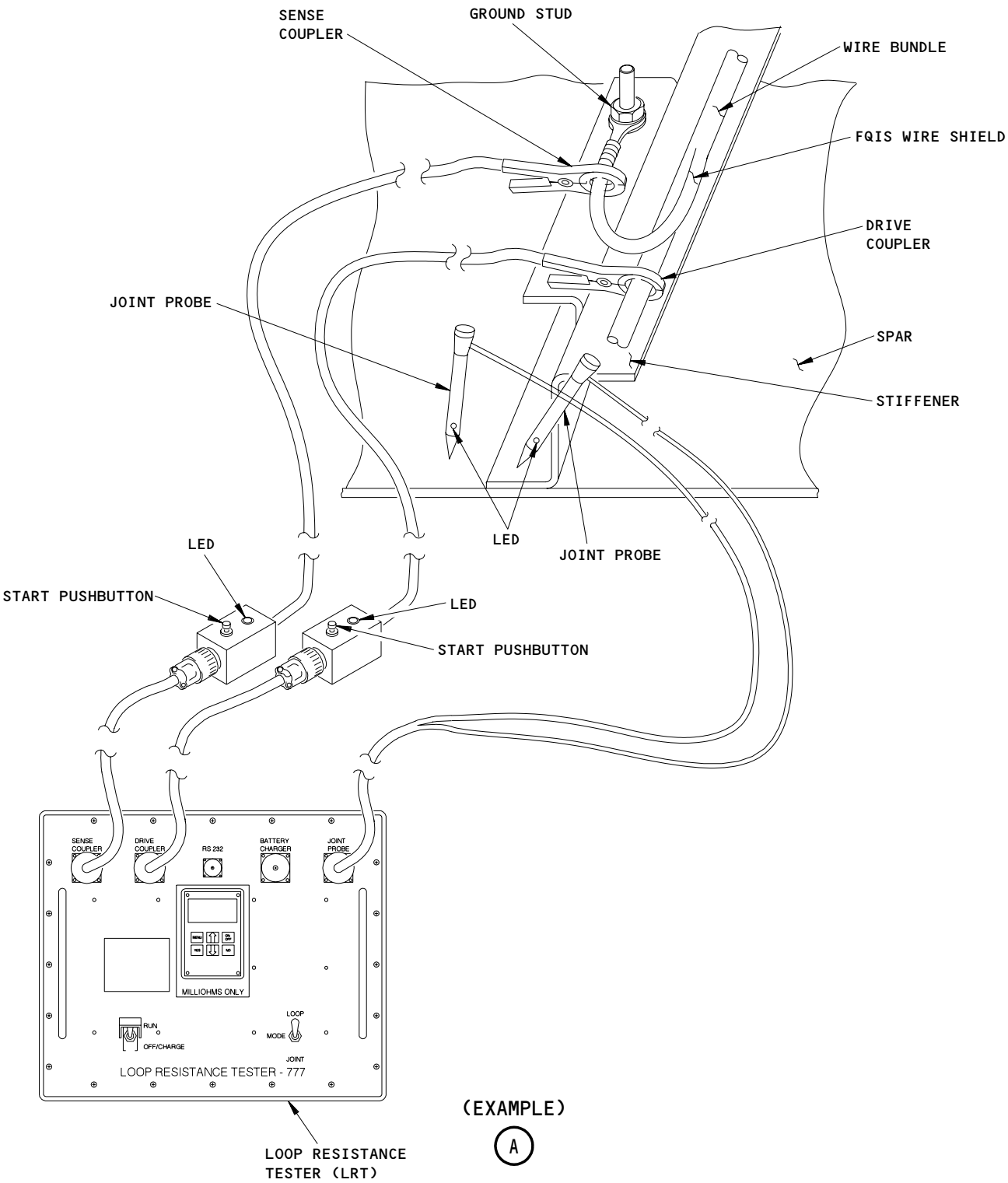
S 286-028

(2) Do the Joint Resistance Measurement test:

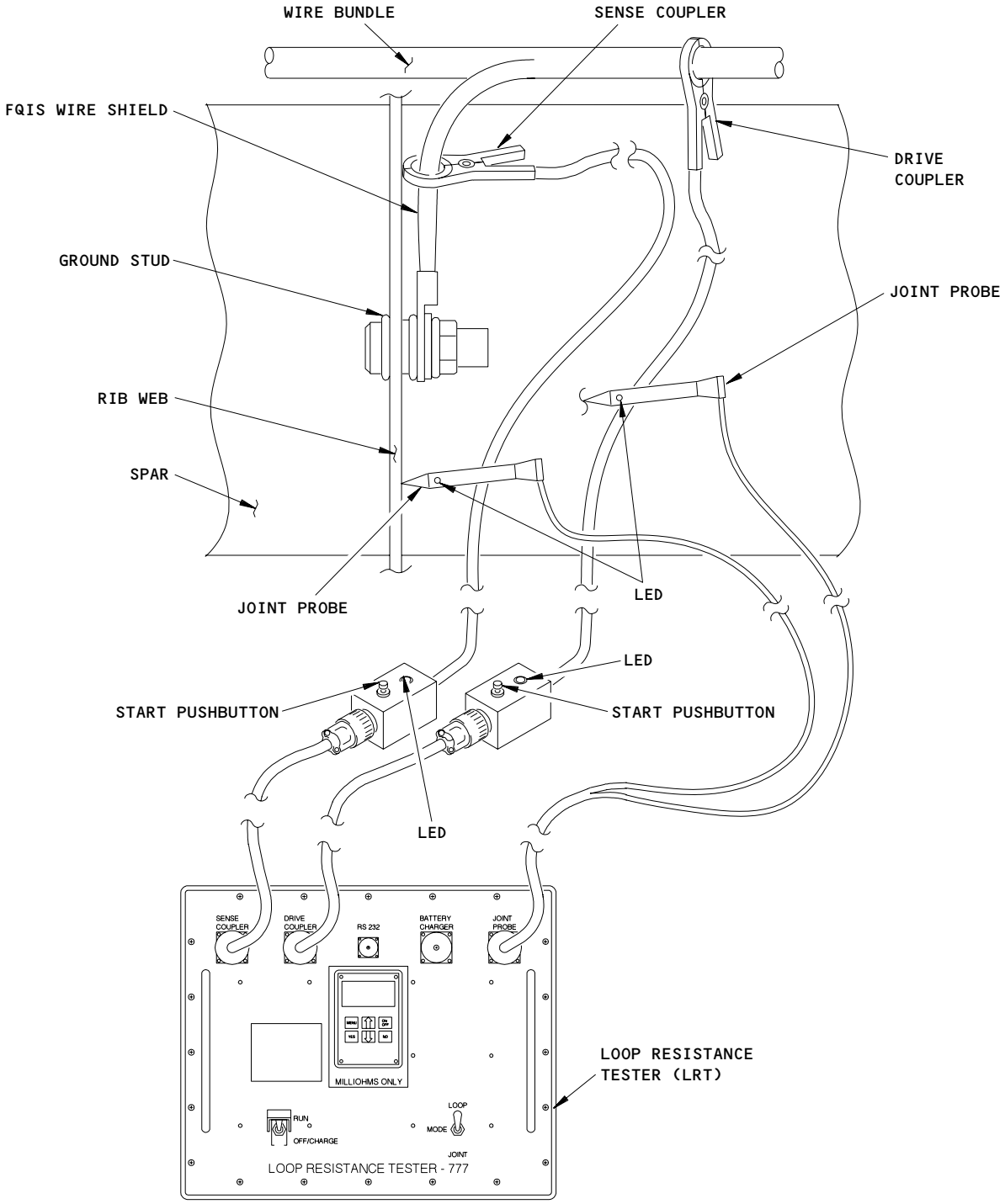
(a) Record the measured values to Data sheet (Fig. 605) below.

(b) Do a Joint Resistance measurement (AMM 20-56-03/201) on the connector at the point where the loop measurement was taken. Perform a ground terminal or connector to primary structure measurement.

1) If the measured value is more than the value on the Data Sheet, find the problem and repair the wire bundle connectors and shield grounding (SWPM 20-20-00).
2) If the measured value is within the range then do a measurement from a ground terminal or connector to primary structure at the opposite end of the wire bundle tested above.
3) If fault is identified repair the wire bundle connectors and shield grounding, in accordance with the Standard Wiring Practices Manual connection (SWPM 20-22-00).
4) If the measurement of both end of the wire bundles are less than the specified value in the Table (20-56-03) and if the loop resistance value is still above the maximum allowable value, then the wire bundle shield terminations may be faulty and require repair in accordance with (SWPM 20-22-00).
5) If the wire bundle shield termination did not require repair, then the wire bundle or overbraid will need to be repaired or replaced in accordance with (SWPM 20-20-00).
6) Do a FQIS wire bundle inspection procedure again after a you repair or replace a wire bundle.



Typical Test Setup – Joint Resistance Test – Right Wing Main Tank Front Spar At Outboard Spar Station (Example)
Figure 604 (Sheet 1)



(EXAMPLE)

B

Typical Test Setup – Joint Resistance Test – Right Wing Main Tank Front Spar At Outboard Spar Station (Example)
Figure 604 (Sheet 2)

PLANE:	
DATE:	
TECHNICIAN:	

BUNDLE NUMBER	CONNECTOR NUMBER	MEASURES JOINT RESISTANCE VALUE (mΩ)	PASS FAIL	RETEST MEASURED VALUE/COMMENTS
W4024	D42220P			
W4024	D41268P			
W4024	D6880 – gnd wires only			
W4026	D42222P			
W4026	D41270P			
W4026	D6884 – gnd wires only			
W4024	D42224P			
W4026	D42226P			
W4020	Near Pressure Seal			
W4022	Near Pressure Seal			

757-200 BF Goodrich Without Individually Shielded Wiring On The Desitometer Wiring For Enhanced Lightning Protection

HIRF/Lightning Protection
(Data Sheet)
Figure 605 (Sheet 1)

PLANE:	
DATE:	
TECHNICIAN:	

BUNDLE NUMBER	CONNECTOR NUMBER	MEASURES JOINT RESISTANCE VALUE (mΩ)	PASS FAIL	RETEST MEASURED VALUE/COMMENTS
W4024	D42220P			
W4024	D41268P			
W4024	D6880 – gnd wires only			
W4026	D42222P			
W4026	D41270P			
W4026	D6884 – gnd wires only			
W4024	D42224P			
W4026	D42226P			
W4020	D41272P			
W4022	D41276P			

757-200 BF Goodrich With Individually Shielded Wiring On The Desitometer Wiring For Enhanced Lightning Protection

HIRF/Lightning Protection
(Data Sheet)
Figure 605 (Sheet 2)

1730989

PLANE:	
DATE:	
TECHNICIAN:	

BUNDLE NUMBER	CONNECTOR NUMBER	MEASURES JOINT RESISTANCE VALUE (mΩ)	PASS FAIL	RETEST MEASURED VALUE/COMMENTS
W4218 or W4026	D41620P or D41270P			
W4218 or W4026	D42222P			
W3424 or W3486	D41196P or D41396P			
W3462	D2814			
W4206 or W4024	D41636P or D41268P			
W4206 or W4024	D42220P			
W3342 or W3372	D41192P			
W3326	D2788			
W4206 or W4024	D42224P			
W4218 or W4026	D42226P			

757-200 Honeywell Post-SB 28-0015 and Pre-SB 28-0020

HIRF/Lightning Protection
(Data Sheet)
Figure 605 (Sheet 3)

PLANE:	
DATE:	
TECHNICIAN:	

BUNDLE NUMBER	CONNECTOR NUMBER	MEASURES JOINT RESISTANCE VALUE (mΩ)	PASS FAIL	RETEST MEASURED VALUE/COMMENTS
W4218 or W4026	D41620P or D41270P			
W4218 or W4026	D42222P			
W3424 or W3486	D41196P or D41396P			
W3462	D2814			
W4206 or W4024	D41636P or D41268P			
W4206 or W4024	D42220P			
W3342 or W3372	D41192P			
W3326	D2788			
W4206 or W4024	D42224P			
W4218 or W4026	D42226P			

757-200 Honeywell Post-SB 28-0010 and Post-SB 28-0020

HIRF/Lightning Protection
(Data Sheet)
Figure 605 (Sheet 4)

PLANE:	
DATE:	
TECHNICIAN:	

BUNDLE NUMBER	CONNECTOR NUMBER	MEASURES JOINT RESISTANCE VALUE (mΩ)	PASS FAIL	RETEST MEASURED VALUE/COMMENTS
W4218 or W4026	D41620P or D41270P			
W4218 or W4026	D42222P			
W3424 or W3486	D41398P or D42334P or D41396P			
W3426	D41396J or D2818			
W3424 or W3486	D41196P or D41396P			
W3462	D2814			
W4206 or W4024	D41636P or D41268P			
W4206	D4220P			
W3424	D41398P or D42312P or D41194P			
W3326	D40304P or D41392JP or D2792			
W3342 or W3372	D41192P			
W3326	D2788			
W4206 or W4024	D42224P			
W4218 or W4026	D42226P			

757-200 Honeywell Pre-SB 28-0015 and Pre-SB 28-0020

HIRF/Lightning Protection
(Data Sheet)
Figure 605 (Sheet 5)

PLANE:	
DATE:	
TECHNICIAN:	

BUNDLE NUMBER	CONNECTOR NUMBER	MEASURES JOINT RESISTANCE VALUE (mΩ)	PASS FAIL	RETEST MEASURED VALUE/COMMENTS
W4218 or W4026	D41620P or D41270P			
W4218 or W4026	D42222P			
W3424 or W3486	D41196P or D41396P			
W3462	D2814			
W4206 or W4024	D41636P or D41268P			
W4206 or W4024	D42220P			
W3342 or W3372	D41192P			
W3326	D2788			
W4206 or W4024	D42224P			
W4218 or W4026	D42226P			
W4020	Near Pressure Seal			
W4022	Near Pressure Seal			

757-200 BF Goodrich Converted from Honeywell System

HIRF/Lightning Protection
(Data Sheet)
Figure 605 (Sheet 6)

1731264

HIRF/LIGHTNING - LOOP RESISTANCE TESTER (LRT) - MAINTENANCE PRACTICES

1. General
   A. The Loop Resistance Tester (LRT) is a specialized piece of test equipment which is used to make non-intrusive wire bundle and coax cable shield resistance measurements. The LRT can also be used to make resistance measurements across a built-up joint or individual electrical connections/joints.
      (1) This task contains the procedure for performing a Lid Standard Measurement with the LRT. The Lid Standard Measurement is a check of the Loop Resistance Tester (LRT) that should be performed whenever the LRT does not appear to be operating correctly. Measurement of the standard resistances on the LRT storage lid provides a quick indication of proper LRT operation. The Lid Standard Measurement consists of the following two parts:
         (a) Loop Mode, which makes a check of the loop resistance measurement function.
         (b) Joint Mode, which makes a check of the joint resistance measurement function.

TASK 20-56-01-822-001

2. LRT Lid Standard Measurement
   A. Procedure

      S 752-002

      (1) Loop Mode
         (a) The various components of the LRT are illustrated in Fig. 201.
         (b) Open the LRT assembly and slide the lid aside to separate it from the base.
         (c) Open the lid and remove the Sense/Drive couplers and the Joint Probe assembly.
         (d) Connect the blue-coded Sense coupler cable to the blue-coded Sense Coupler connector on the LRT.
         (e) Connect the red-coded Drive coupler cable to the red-coded Drive Coupler connector on the LRT.
         (f) Connect the Joint Probe assembly to the Joint Probe connector on the LRT.
         (g) Lift the safety cover and set the RUN-OFF/CHARGE switch to the RUN position.
         (h) Set the MODE switch to the LOOP position.

(i) Push and hold the ON/OFF pushbutton switch on the BITE module until "Testing Hardware" shows on the BITE display, then release the ON/OFF switch. A four-character symbol will move around the BITE display during the hardware self-test.

NOTE: To conserve the battery, the LRT will automatically power down after 10 minutes of inactivity. To re-apply power, do the above steps again.

(j) When the "Press Start" indication shows on the BITE display, make sure the LED on each Sense/Drive coupler control box is red.

(k) Connect the Sense/Drive couplers to the cutout in the Reference Standard, built into the storage lid of the LRT.
1) Position the couplers at each end of the cutout, near the Sense/Drive coupler alignment marks (Fig. 201).

(l) Begin the Lid Standard Test by pushing the START pushbutton switch on either of the Sense/Drive coupler control boxes.

(m) Make sure the LED on each of the Sense/Drive coupler control boxes is green.
1) If either LED is red and a "DRV Coup is Open" or "SNS Coup Is Open" message shows on the BITE display, then the couplers should be checked for proper connection.
a) Gently squeeze and release the coupler handles to improve the connection of the couplers to the Lid Standard. If adjusting the couplers does not change the LEDs to green, replace the LRT.
b) If "Press Start" shows on the BITE display, then push the START pushbutton on either of the Sense/Drive coupler control boxes and begin the Lid Standard Test again.
2) If either LED is red and a "DRV Coup Is Open" or "SNS Coup Is Open" message does not show on the BITE display, replace the LRT.
3) If the LED on one or both couplers flashes red, then re-connect the couplers to the lid after the "Press Start" message shows on the BITE display.
a) Push the START pushbutton on either of the Sense/Drive coupler control boxes and begin the Lid Standard Test again.
4) If the message "UNSTABLE" shows on the BITE display and does not clear, set the MODE switch to the JOINT position.
a) When the message "CONNECT PROBES" shows on the BITE display, set the MODE switch back to the LOOP position.

b) Push the START pushbutton on either of the Sense/Drive coupler control boxes and begin the Lid Standard Test again.
c) If the "UNSTABLE" message continues to show, replace the LRT.

(n) When the Sense/Drive coupler control box LEDs flash green, note the measured resistance value which shows on the BITE display.
1) Make sure the displayed resistance value is 0.5 - 1.0 milliohm.
2) If the displayed resistance value is not 0.5 - 1.0 milliohm, replace the LRT.

S 752-003

(2) Joint Mode
(a) With the Sense/Drive couplers still connected to the Lid Reference Standard, change the MODE switch to the JOINT position.
(b) Make sure the Joint Probe LEDs are red (Fig. 201).
(c) Place the tip of one Joint Probe on the first Joint Probe reference mark on the Lid Reference Standard (Fig. 201).
(d) Place the tip of the other Joint Probe on the second Joint Probe reference mark.

NOTE: The LRT will start the Joint Test when the LEDs on both Joint Probes are green.

(e) When the LED on either Joint Probe flashes green, the measurement shows, in milliohms, on the bottom line of the BITE display.

NOTE: The loop resistance from the previous loop measurement is displayed on the top line of the BITE display during a joint mode measurement.

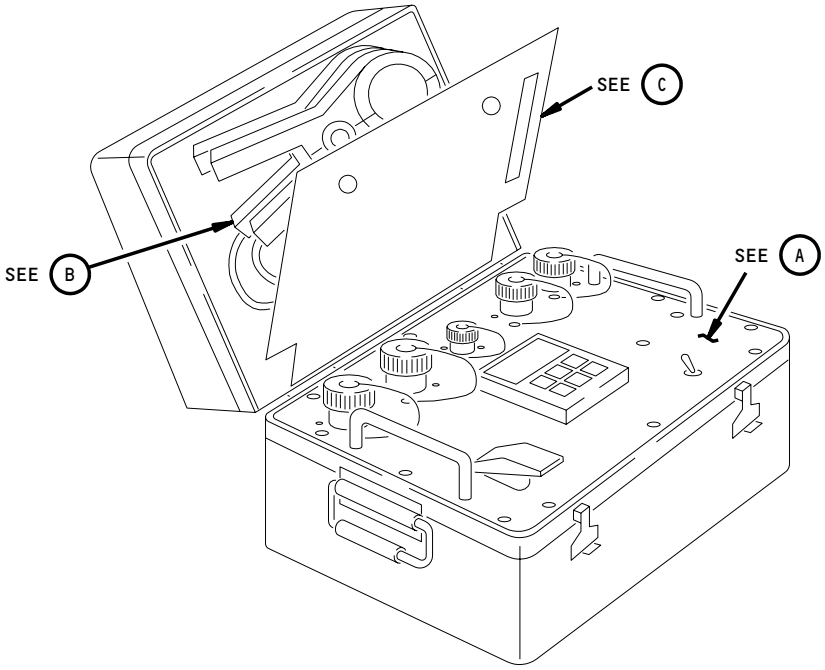
(f) Note the joint resistance value.
(g) Keep the first Joint Probe in place on the first Joint Probe reference mark and move the second Joint Probe to the next Joint Probe reference mark.
(h) Repeat the above steps until a resistance value has been measured for each Joint Probe reference mark, 2 through 6.

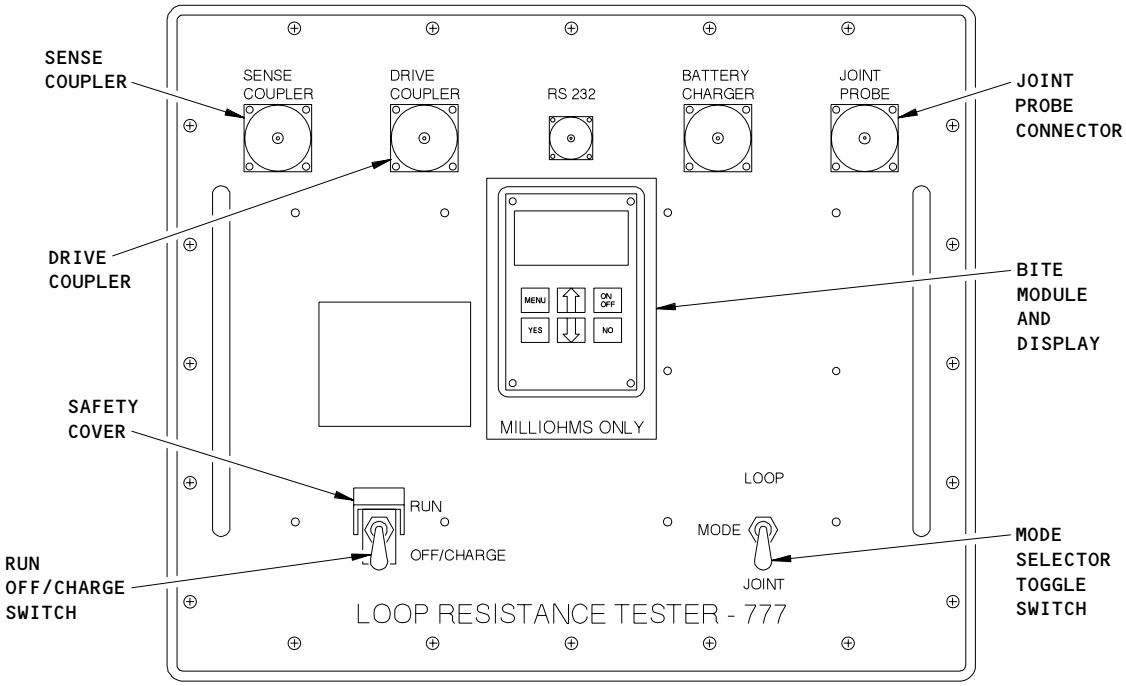
(i) Compare the measured resistance values with the acceptable resistance values listed below:

TABLE 201	
MEASUREMENT POINTS (REFERENCED TO FIRST JOINT PROBE MARK)	RESISTANCE MEASUREMENT ACCEPTABLE VALUES
Second Joint Probe Reference Mark	0.01 - 0.06 milliohms
Third Joint Probe Reference Mark	0.04 - 0.11 milliohms
Fourth Joint Probe Reference Mark	0.07 - 0.16 milliohms
Fifth Joint Probe Reference Mark	0.10 - 0.21 milliohms
Sixth Joint Probe Reference Mark	0.12 - 0.26 milliohms

1) If all five resistance measurements taken above are within the range of Acceptable Values from Table 201, then this task is complete and the LRT is operational.
2) If any of the five resistance measurements taken above are outside the range of Acceptable Values from Table 201, then replace the LRT.

(j) Change the MODE switch to LOOP.
(k) Disconnect the Sense/Drive couplers from the Lid Reference Standard.
(l) This completes the LRT Lid Standard Measurement.





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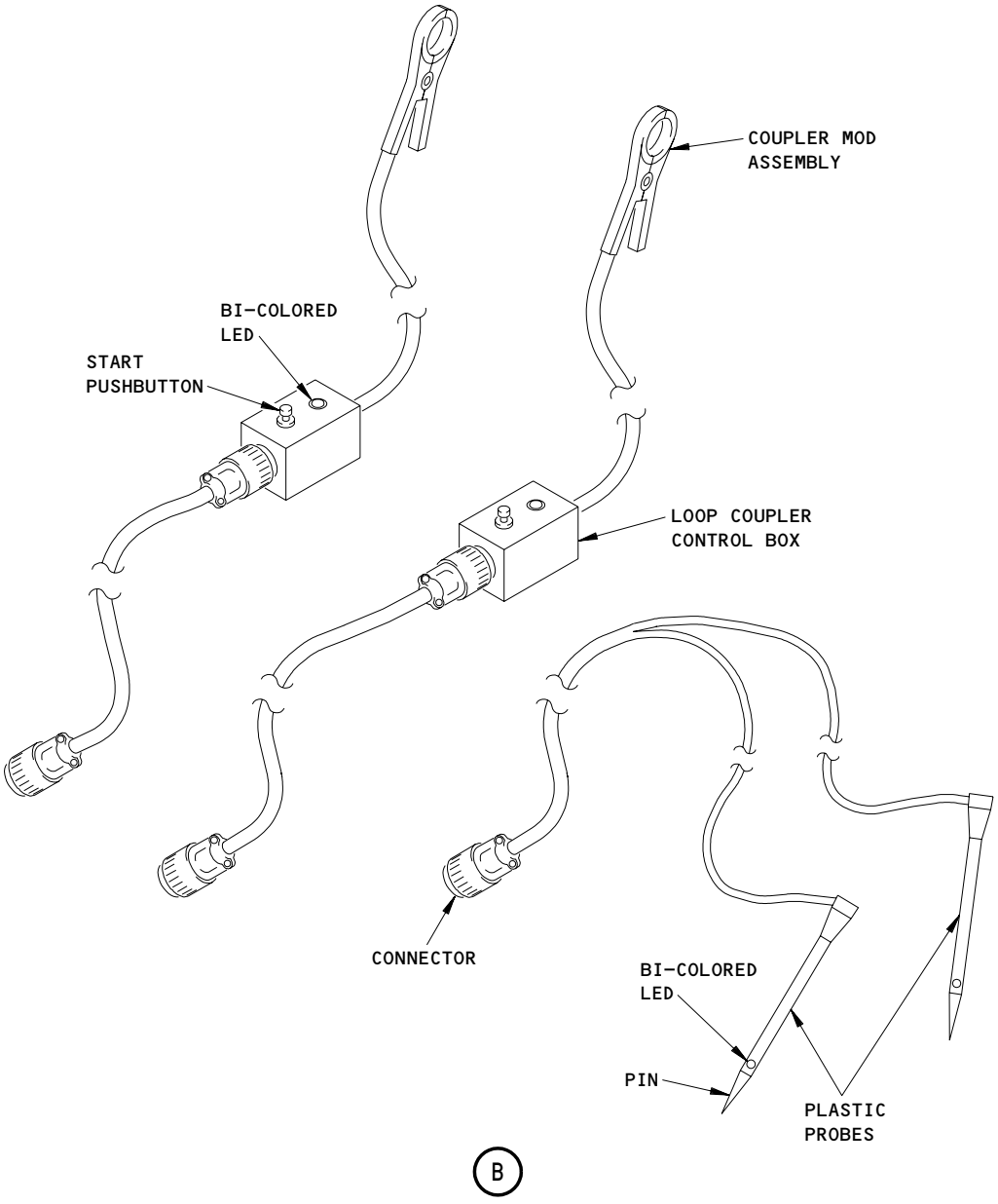
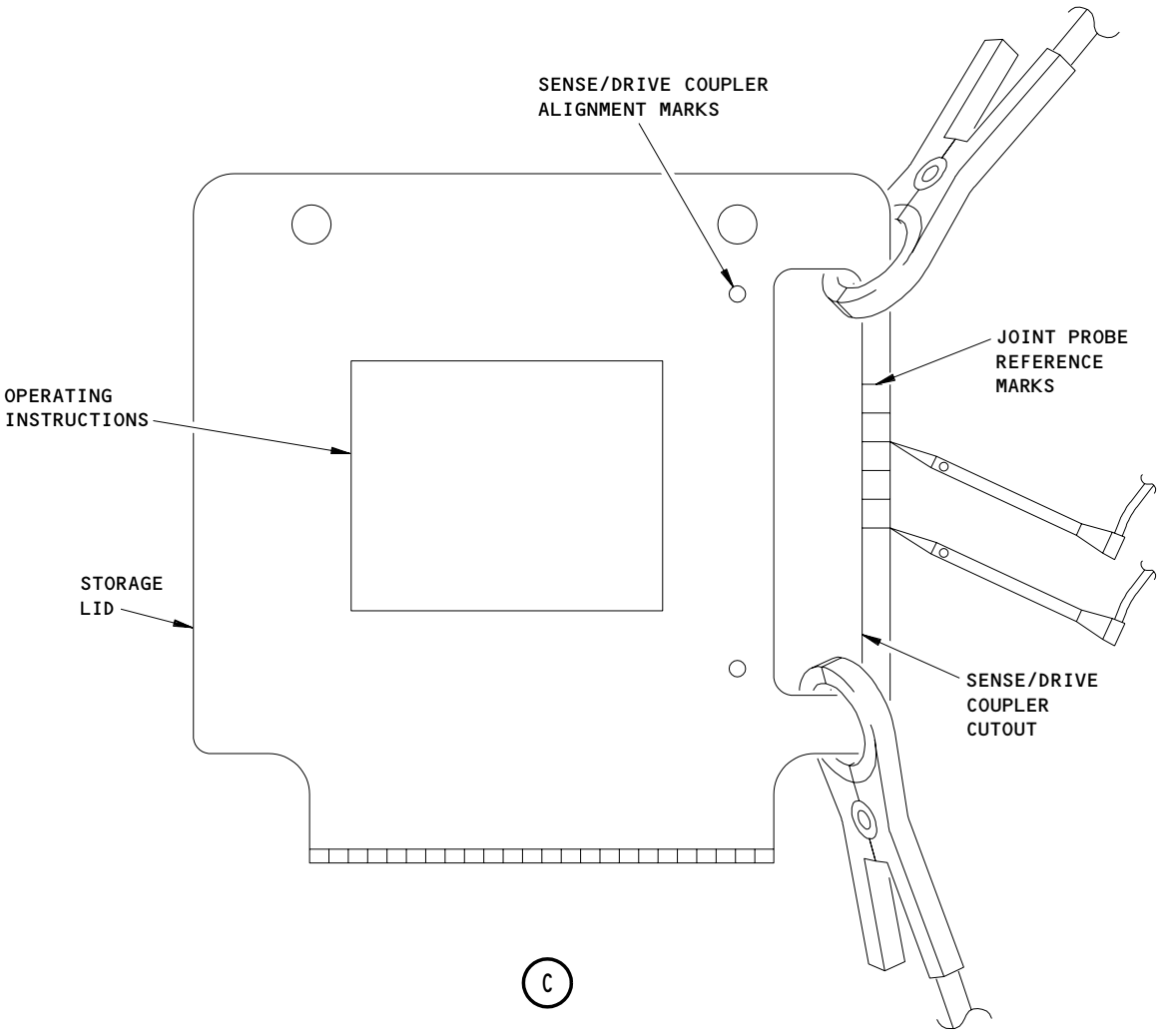
High Intensity Radiated Fields (HIRF) Inspection
Loop Resistance Tester Maintenance Practices
Figure 201 (Sheet 1)



High Intensity Radiated Fields (HIRF) Inspection
Loop Resistance Tester Maintenance Practices
Figure 201 (Sheet 2)



High Intensity Radiated Fields (HIRF) Inspection
Loop Resistance Tester Maintenance Practices
Figure 201 (Sheet 3)

HIRF/LIGHTNING - LOOP RESISTANCE MEASUREMENT - MAINTENANCE PRACTICES

1. General
   A. The comments and instructions contained herein apply to the Loop Resistance Tester (LRT), Boeing P/N 906-10246-2 or greater.
   B. The LRT is used to make non-intrusive wire bundle and coax cable shield resistance measurements by inductively coupling a low voltage into the shield and measuring the current flowing through the shield. The LRT can also be used to make resistance measurements across a built-up joint or individual electrical connections/joints after an electrical loop is first established.
   C. This procedure does the Loop Resistance Measurement task.
      (1) The Loop Resistance Measurement Task contains instructions on how to use the LRT to measure the shield resistance of a wire bundle or coaxial cable. The shield must be electrically connected to airplane structure at both ends in order to form an electrical loop for current to flow. In certain cases, a ground return jumper cable must be used to provide a ground return path because the wire bundle is not specifically connected to airplane structure at one end.

TASK 20-56-02-762-001

2. Loop Resistance Measurement
   A. References
      (1) AMM 20-56-01/201, LRT Lid Standard Measurement
      (2) AMM 20-56-03/201, Joint Resistance Measurement
   B. Preliminary

      S 752-002

      (1) Prepare the LRT for use (Fig. 201).
         (a) Open the LRT assembly and slide the lid aside to remove it from the base.
         (b) Open the lid and remove the Sense/Drive couplers and the joint probe assembly.
         (c) Connect the blue-coded Sense coupler cable to the blue-coded Sense Coupler connector on the LRT.
         (d) Connect the red-coded Drive coupler cable to the red-coded Drive Coupler connector on the LRT.
         (e) Connect the Joint Probe assembly to the Joint Probe connector on the LRT.
         (f) Lift the safety cover and set the RUN-OFF/CHARGE switch to the RUN position.
         (g) Set the LRT MODE switch to the LOOP position.

(h) Push and hold the ON/OFF pushbutton switch on the BITE module until "Testing Hardware" shows on the BITE display, then release the ON/OFF switch. A four-character symbol will move around the BITE display during the hardware self-test.

NOTE: To conserve the battery, the LRT will automatically power down after 10 minutes of inactivity. To re-apply power, do the above steps again.

(i) When the "Press Start" indication shows on the BITE display, make sure the LED on each Sense/Drive coupler control box is red.

C. Procedure

S 752-003

(1) Connect the couplers.

(a) For a normal Loop Resistance Measurement (Fig. 202):

1) Clamp both of the LRT couplers around the wire bundle to be measured.

a) If there are ground wires, such as shield pigtail connections, at the point of measurement on the measured bundle, make sure that such wiring is NOT included within either coupler for this Loop Resistance measurement.

b) Make sure there is at least 4 inches separation between the two couplers. If such separation is impossible to maintain, use the Mu-Metal shields (P/N 906-10249-9) provided with the LRT to obtain the necessary isolation.

NOTE: In the case of multiple wire bundles going to/from a connector, make sure the coupler is only around the desired bundle. This may require removing (and replacing) wire ties to separate the bundles enough for coupler connection.

(b) For a Modified Loop Resistance Measurement using a ground jumper (Fig. 203):

1) Clamp the Drive coupler around the ground return jumper cable.

2) Clamp the Sense coupler around the bundle to be tested.

NOTE: Where practical, a minimum separation of 4 inches between the couplers should be maintained.

a) If there are ground wires, such as shield pigtail connections, at the point of measurement on the bundle, make sure that such wiring is NOT included within the Sense coupler.

(c) For a Modified Loop Resistance Measurement using one or more shield ground wires as a return (Fig. 203):

1) Make sure that all the shield ground wires connected to the ground stud are within the closed jaws of the coupler for this kind of measurement.

S 752-004

(2) Initiate a Loop Resistance Measurement by pushing the START pushbutton on either of the Sense/Drive Coupler Control boxes, causing the LEDs on both boxes to turn green.

(a) When the LEDs flash green, note the loop resistance value shown on the LRT BITE display.

(b) This completes the Loop Resistance Measurement.

S 752-005

(3) If you are unable to complete the Loop Resistance Measurement, do the following fault isolation steps:

(a) If either LED is red and a "DRV Coup Is Open" or "SNS Coup Is Open" message shows on the BITE display, then the couplers should be checked for proper connection.

1) Gently squeeze and release the coupler handles to improve the connection of the couplers around the wire bundle being measured.

a) If adjusting the couplers does not change the LEDs to green, replace the LRT.

2) If "Press Start" shows on the BITE display, then push the START pushbutton on either of the Sense/Drive coupler control boxes and begin the Loop Resistance Measurement again.

(b) If either LED is red and a "DRV Coup Is Open" or "SNS Coup Is Open" message does not show on the BITE display, replace the LRT.

(c) If the LED on one or both couplers flashes red, then re-connect the couplers to the wire bundle being measured after the "Press Start" message shows on the BITE display.

1) Push the START pushbutton on either coupler control box and begin the Loop Resistance Measurement again.

(d) If the message "UNSTABLE" is displayed and does not clear, set the MODE switch to the JOINT position.

1) When the message "Connect Probes" shows on the BITE display, set the MODE switch back to the LOOP position.

2) When the "Press Start" message appears, push the Start pushbutton on either of the coupler control boxes and begin the Loop Resistance Measurement again.
3) If this fails to clear the "UNSTABLE" message, then there is a problem with the wire bundle being measured or with the LRT.

NOTE: The "UNSTABLE" message is caused by the LRT detecting a varying resistance. This varying resistance can be caused by a loose connection, a corroded or intermittent electrical joint, a faulty Transorb adapter, or a faulty LRT.

a) Make sure the LRT is operating correctly (AMM 20-56-01/201).
b) If the LRT is operating correctly, then the wire bundle or a connection/joint is faulty and must be repaired or replaced before continuing the measurement. Check each electrical connection in the circuit being measured to isolate the faulty connection/joint. Check the electrical joint (AMM 20-56-03/201).

(e) If the BITE display shows "Joint V TooBig" (Dash-2 LRT only), "Loop I TooBig" or "Loop V TooBig", then stray currents may be circulating through the shield of the wire bundle being measured.
1) If power is applied to any of the equipment attached to this bundle, remove power from the equipment.
2) Any on-board electrical equipment that does not need to be ON should be turned OFF.
3) Make sure no other sources of current or voltage are connected on or near the bundle being tested.
4) In extreme cases, all power may need to be removed from the airplane.

S 752-006

(4) For a Dash-2 LRT, the following BITE display messages may also appear:
(a) Joint TooSmall:
1) This indication is displayed when the Joint Value is too small compared to the Loop Value to give an accurate Joint reading. This condition exceeds the operating capabilities of the LRT.

(b) LNoise V TooBig:

1) This indication is displayed when excessive noise voltage on the wire bundle shield interferes with the LRTs ability to read accurately during Loop Mode. Stray signals on the wire shield may be produced by motors, electronic equipment, or adjacent electronic circuits. This condition can be alleviated by de-energizing equipment in the vicinity of the circuit being tested.

(c) LNoise I TooBig:

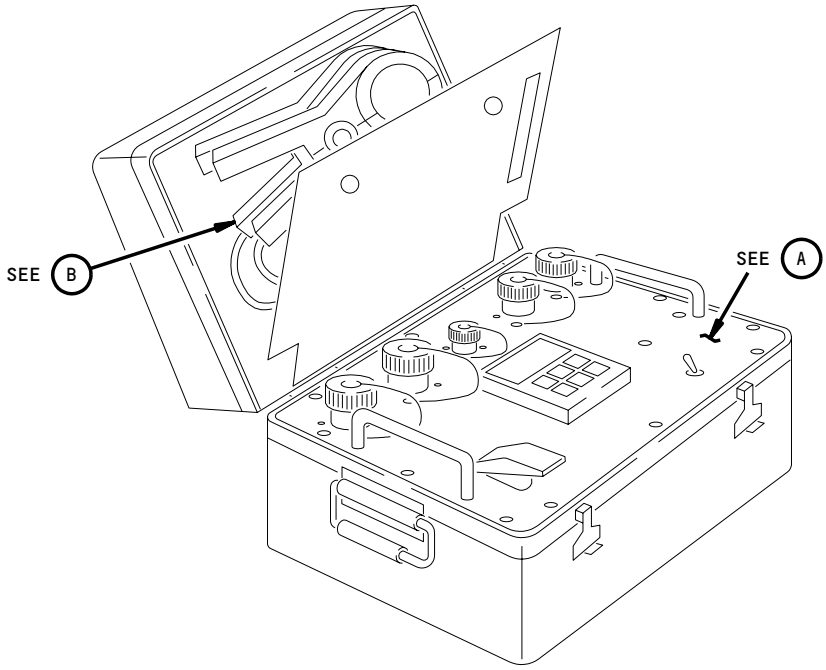
1) This indication is displayed when excessive noise current on the wire bundle shield interferes with the LRTs ability to read accurately during Loop Mode. Stray signals on the wire shield may be produced by motors, electronic equipment, or adjacent electronic circuits. This condition can be alleviated by de-energizing equipment in the vicinity of the circuit being tested.

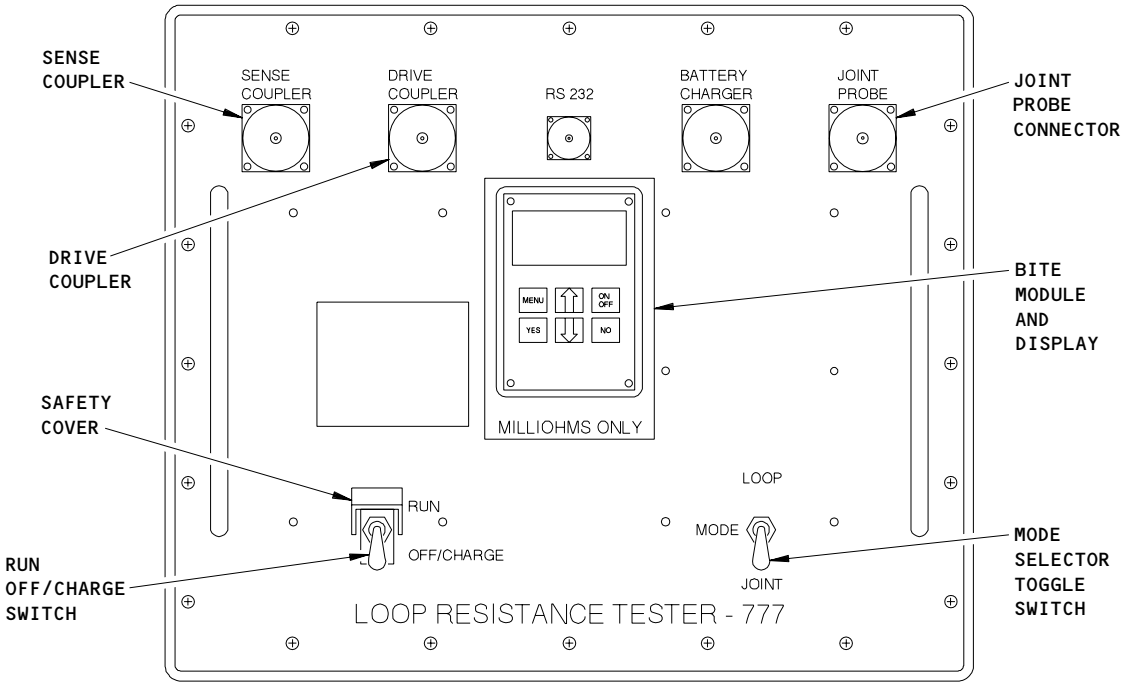
(d) JNoise V TooBig:

1) This indication is displayed when excessive noise voltage on the wire bundle shield interferes with the LRTs ability to read accurately during Joint Mode. Stray signals on the wire shield may be produced by motors, electronic equipment, or adjacent electronic circuits. This condition can be alleviated by de-energizing equipment in the vicinity of the circuit being tested.

(e) JNoise I TooBig:

1) This indication is displayed when excessive noise current on the wire bundle shield interferes with the LRTs ability to read accurately during Joint Mode. Stray signals on the wire shield may be produced by motors, electronic equipment, or adjacent electronic circuits. This condition can be alleviated by de-energizing equipment in the vicinity of the circuit being tested.





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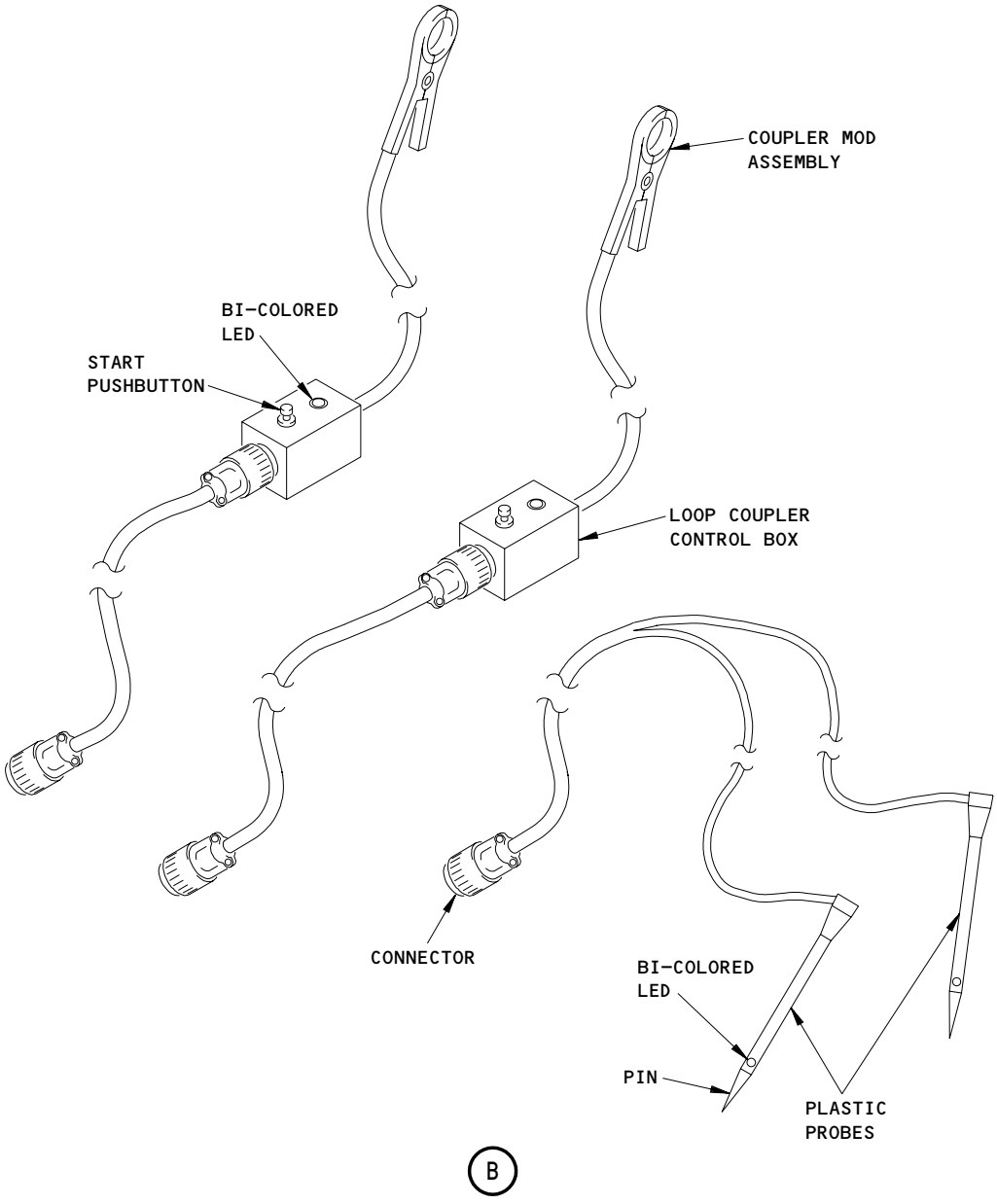
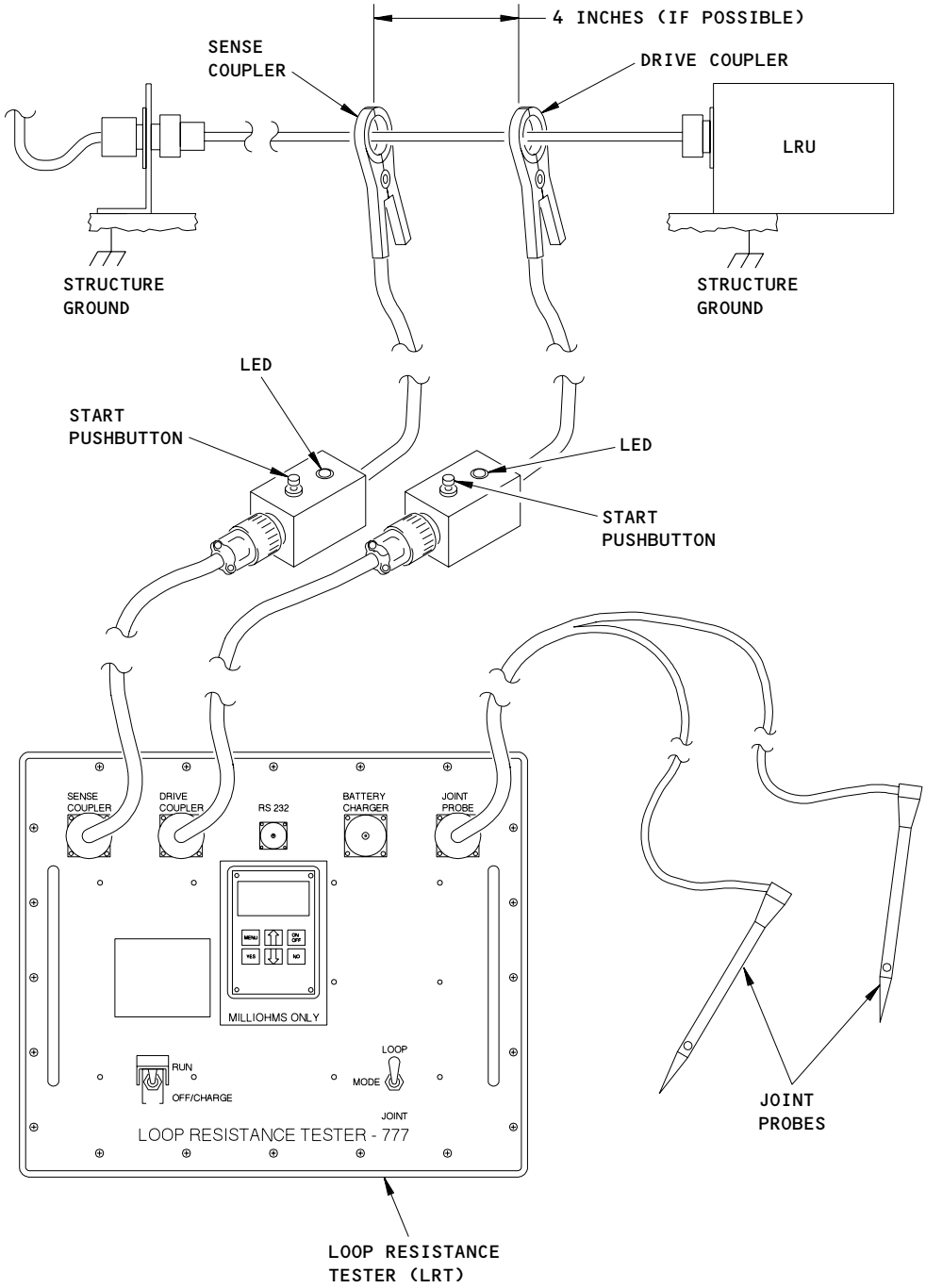
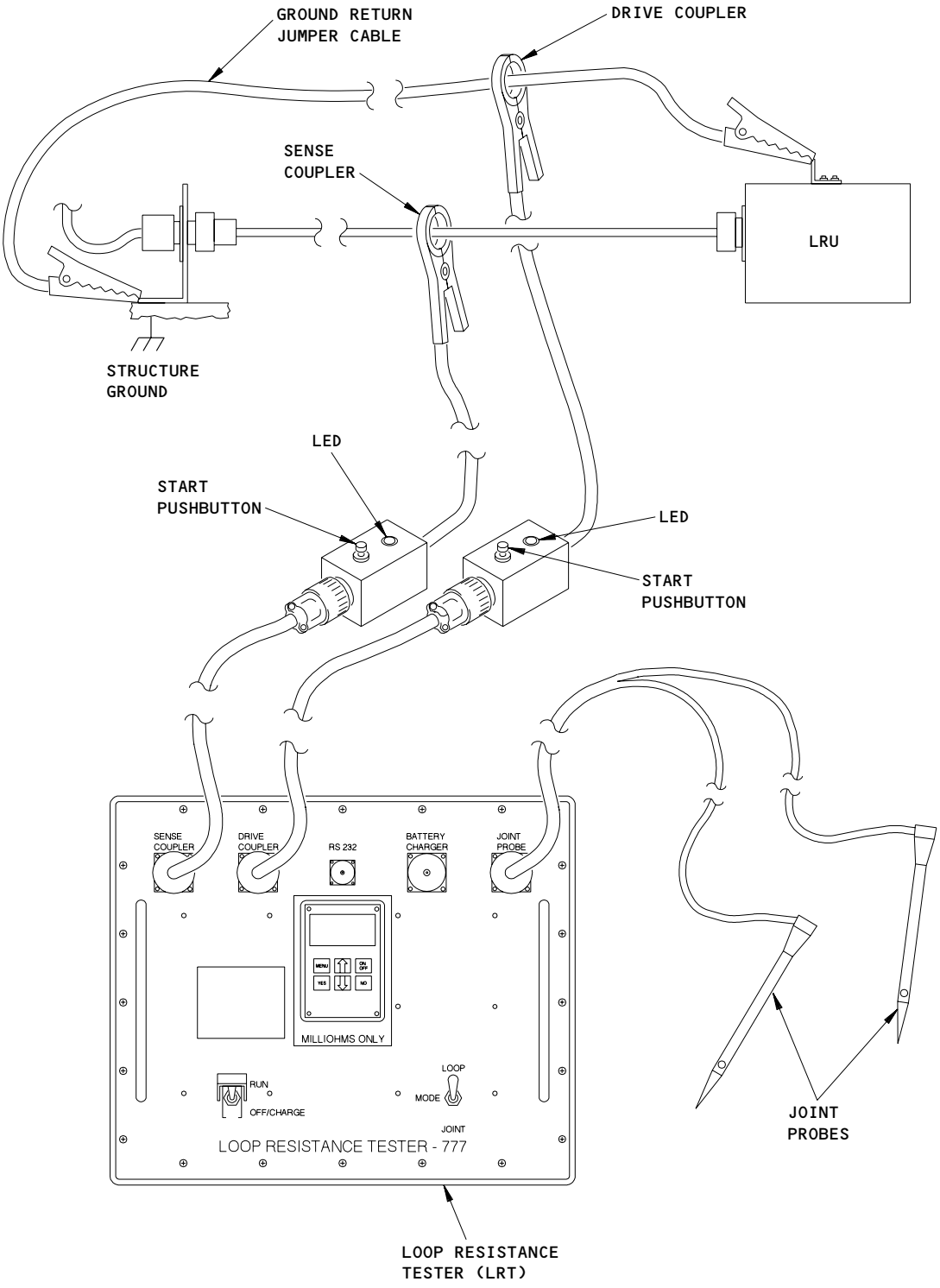
High Intensity Radiated Fields (HIRF) Inspection
Loop Resistance Tester Maintenance Practices
Figure 201 (Sheet 1)



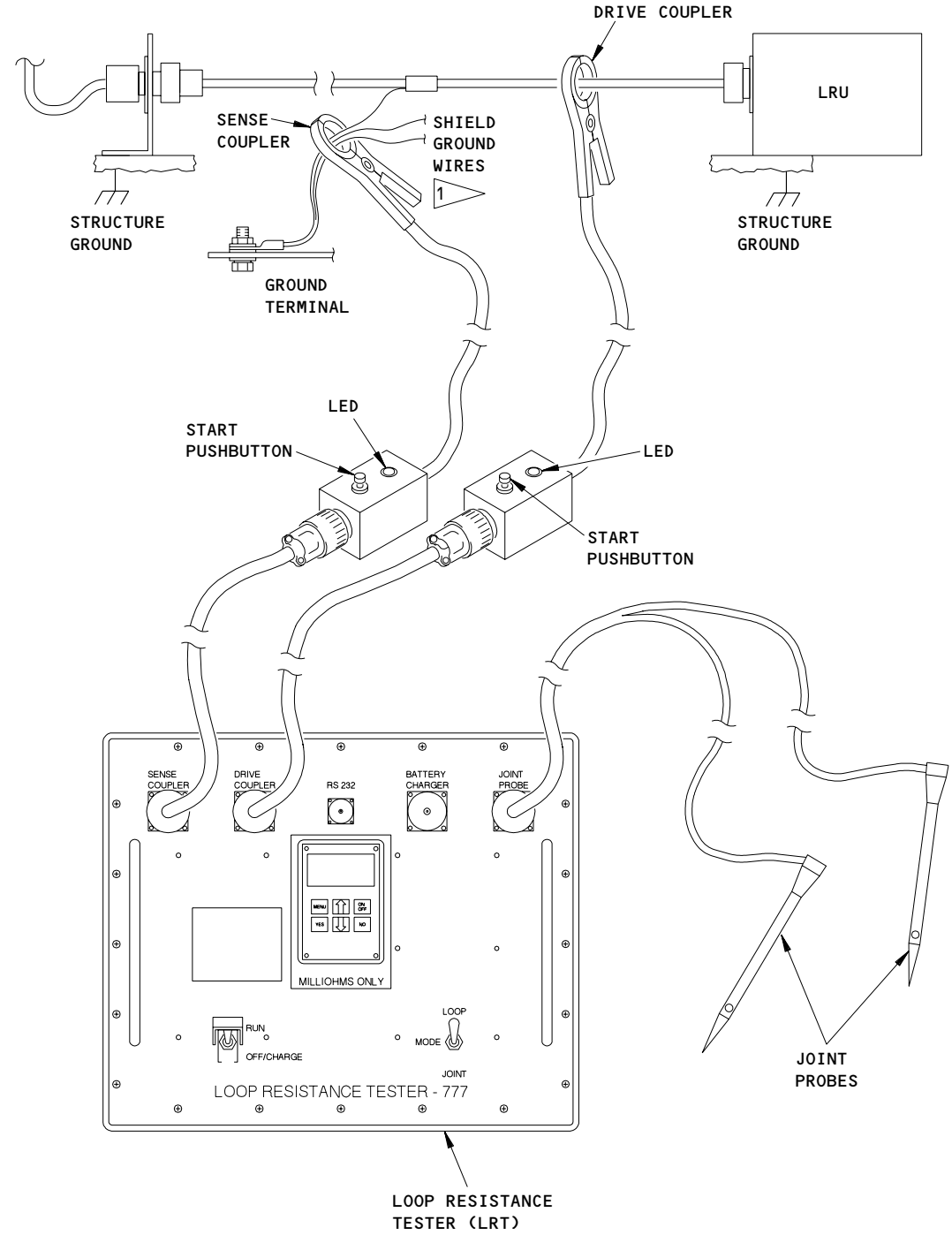
High Intensity Radiated Fields (HIRF) Inspection
Loop Resistance Tester Maintenance Practices
Figure 201 (Sheet 2)



Typical Loop Resistance Tester (LRT)
Hookup for Loop Resistance Measurement
Figure 202



Typical Loop Resistance Tester (LRT) Hookup
for Modified Loop Resistance Measurement
Figure 203 (Sheet 1)



1 ALL SHIELD GROUND WIRES CONNECTED TO GROUND TERMINAL WITHIN COUPLER

Typical Loop Resistance Tester (LRT) Hookup Using Shield Ground Wires for Loop Resistance Measurement
Figure 203 (Sheet 2)

HIRF/LIGHTNING - JOINT RESISTANCE MEASUREMENT - MAINTENANCE PRACTICES

1. General
   A. This task contains instructions on how to use the Loop Resistance Tester (LRT) to measure the resistance across a built-up joint or individual electrical connections/joints.
      (1) The direct contact voltage and current measurement capabilities of the LRT Joint Probes are used to perform a Joint Resistance Measurement.
      (2) The connections/joints to be measured must be contained within the shielding system being measured in the Loop Resistance Mode (the loop current must flow through these joints/connections).
   B. In some cases, the current path to structure may include a subassembly. An example would be one of the connectors mounted to an FSEU Gearbox. In such a case, the bonding of the subassembly-to-structure may also need to be measured. If an out-of-spec joint reading is found, refer to the AMM chapter associated with that particular subsystem for component bonding requirements.

TASK 20-56-03-762-001

2. Joint Resistance Measurement
   A. References
      (1) AMM 20-56-01/201, LRT Lid Standard Measurement
      (2) AMM 20-56-02/201, Loop Resistance Measurement
      (3) SWPM 20-20-00, Standard Wiring Practices Manual
      (4) SWPM 20-25-11, Standard Wiring Practices Manual
   B. Procedure

      S 752-002

      (1) To establish an electrical current flow in the wire bundle, joints/connections and bonding straps being measured, do a Loop Resistance Measurement (AMM 20-56-02/201) before starting the Joint Resistance Measurement.

      NOTE: Before a Joint Resistance Measurement can be performed, a Loop Measurement must have been completed on the wire bundle associated with the joint being measured. If this is a modified loop formed with a ground return jumper cable, then the LRT Sense/Drive couplers must be connected as shown for a modified loop resistance measurement. The LRT continues to monitor the loop resistance of the wire bundle while the joint measurement is being made. If the loop resistance changed by too large an amount, the LEDs on both joint probes will blink red and the message "REDO LOOP" will appear on the BITE display. This message cannot be erased without switching the LRT back to the loop mode and doing a loop resistance measurement again.

S 752-003
(2) Set the Mode Selector switch on the LRT to the joint position.

S 752-004
(3) Make sure the LEDs on both Joint Probes are red.

S 752-005
(4) Connect one joint probe to one side of a complex joint buildup (structure, LRU, receptacle, bracket, or connector backshell for example) within 1 inch of the joint being measured (Fig. 201 or 202).

NOTE: A joint may have several electrical connections. For example, a connector mounted on a bracket which is mounted to structure can provide five connections between the bundle shield and "ground". The shield is (1) connected to the connector backshell which is (2) connected to the connector itself which (3) connects to the receptacle which (4) is mounted on the bracket which is (5) connected to structure.

S 752-006
(5) Connect the second joint probe to the other side of the joint being measured, within 1 inch of the joint/connector.

NOTE: The LRT will start the Joint Resistance Measurement when the LEDs on both Joint Probes are green. The LEDs change from red to green when electrical continuity is established between the probes. It may be necessary to wiggle the probes in order to make electrical contact through surface coatings.

(a) If the Joint Probes appear to be making good electrical contact and the Joint Probe LEDs do not change to green and no error messages are displayed on the LRT, then, do LRT Lid Standard Measurement (AMM 20-56-01/201).

(b) If the BITE display shows "Joint V TooBig", then stray currents may be circulating through the shield of the wire bundle being measured.
1) If power is applied to any of the equipment attached to this bundle, remove power from the equipment.
2) Any on-board electrical equipment that does not need to be ON should be turned OFF.
3) Make sure no other sources of current or voltage are connected on or near the bundle being tested.
4) In extreme cases, all power may need to be removed from the airplane.

S 752-007
(6) When the LEDs on the probes flash green, record the resistance value of this joint from the bottom line of the BITE display.
(a) The following resistance values (Table 201) are maximum joint resistance values for common electrical connections/joints.

TABLE 201

TYPE OF JOINT	MAXIMUM ALLOWABLE RESISTANCE (ALUMINUM CONNECTORS) IN MILLIOHMS	MAXIMUM ALLOWABLE RESISTANCE (STAINLESS/STEEL) IN MILLIOHMS
Backshell-To-Receptacle	2.5	5.0
Backshell-To-Plug Body	2.5	5.0
Plug-To-Receptacle	5.0	12.5
Receptacle-To-Bracket	2.5	5.0
Bracket-To-Bond Strap	1.0	1.0
Bond Strap-To-Structure	1.0	1.0
Bracket-To-Structure	1.0	1.0
Ground Stud-To-Structure	1.0	1.0
Riveted Bracket-To-Structure	1.0	1.0
Other Fay Surface Bonds	1.0	1.0

(b) To calculate the maximum allowable resistance for a built-up joint, do the following:
   1) Determine what type of electrical connections/joints and how many of each are contained within the built-up joint.
   2) Find the maximum allowable resistance for each type of electrical connection/joint (Table 201) contained within the built-up joint.
   3) Sum the individual maximum allowable resistances for each electrical connection/joint contained within the built-up joint. This sum is the calculated maximum allowable resistance for the built-up joint.

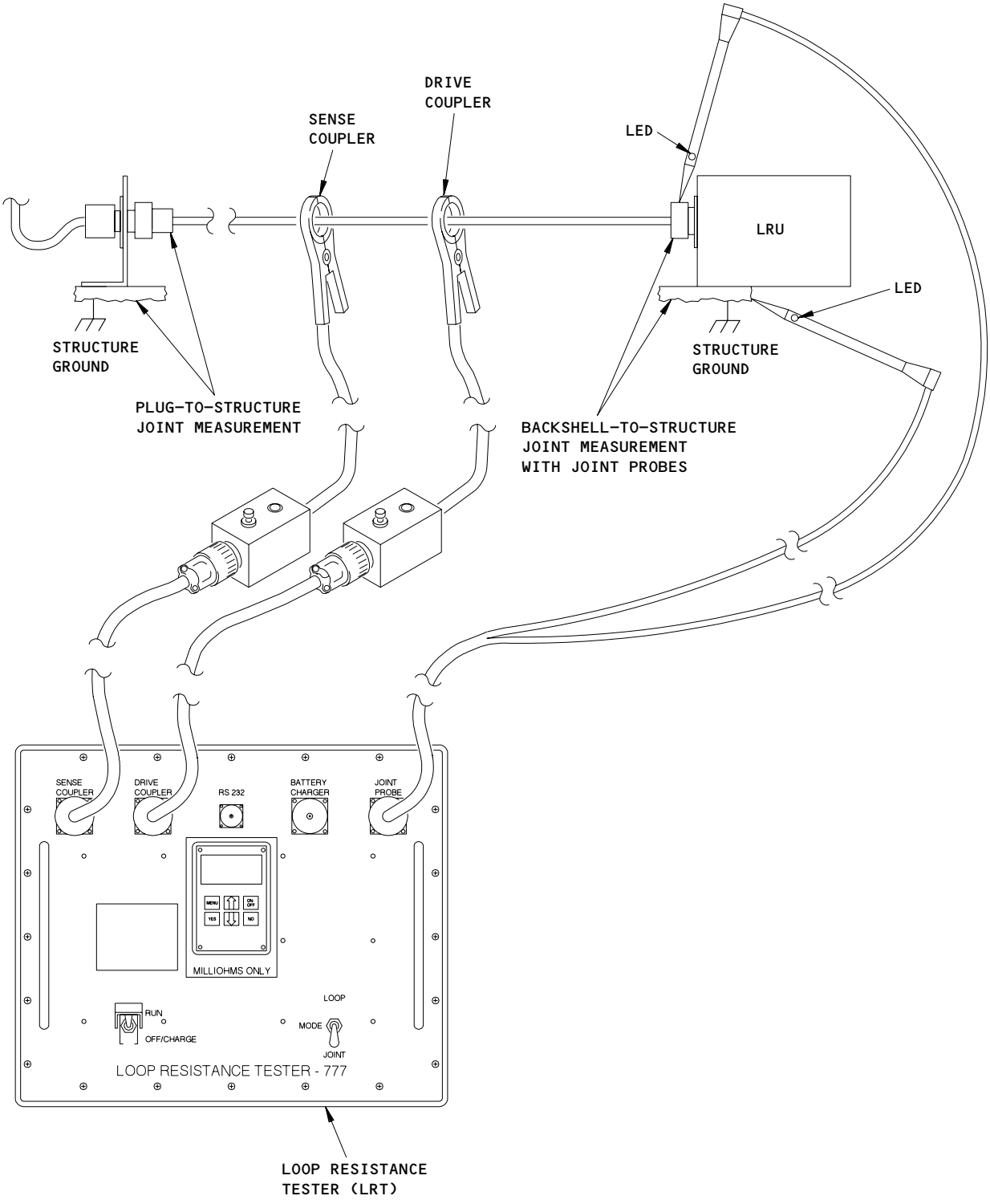
(c) If the measured built-up joint resistance is higher than the calculated maximum allowable resistance, then do a joint resistance measurement across each individual connection/joint to isolate the specific high resistance connection/joint.
   1) If an individual connection/joint resistance exceeds the maximum allowable resistance (Table 201) for that type of connection/joint, then repair the faulty connection/joint.

      NOTE: Loose connectors and backshells or pigtails can cause an out-of-tolerance resistance reading.

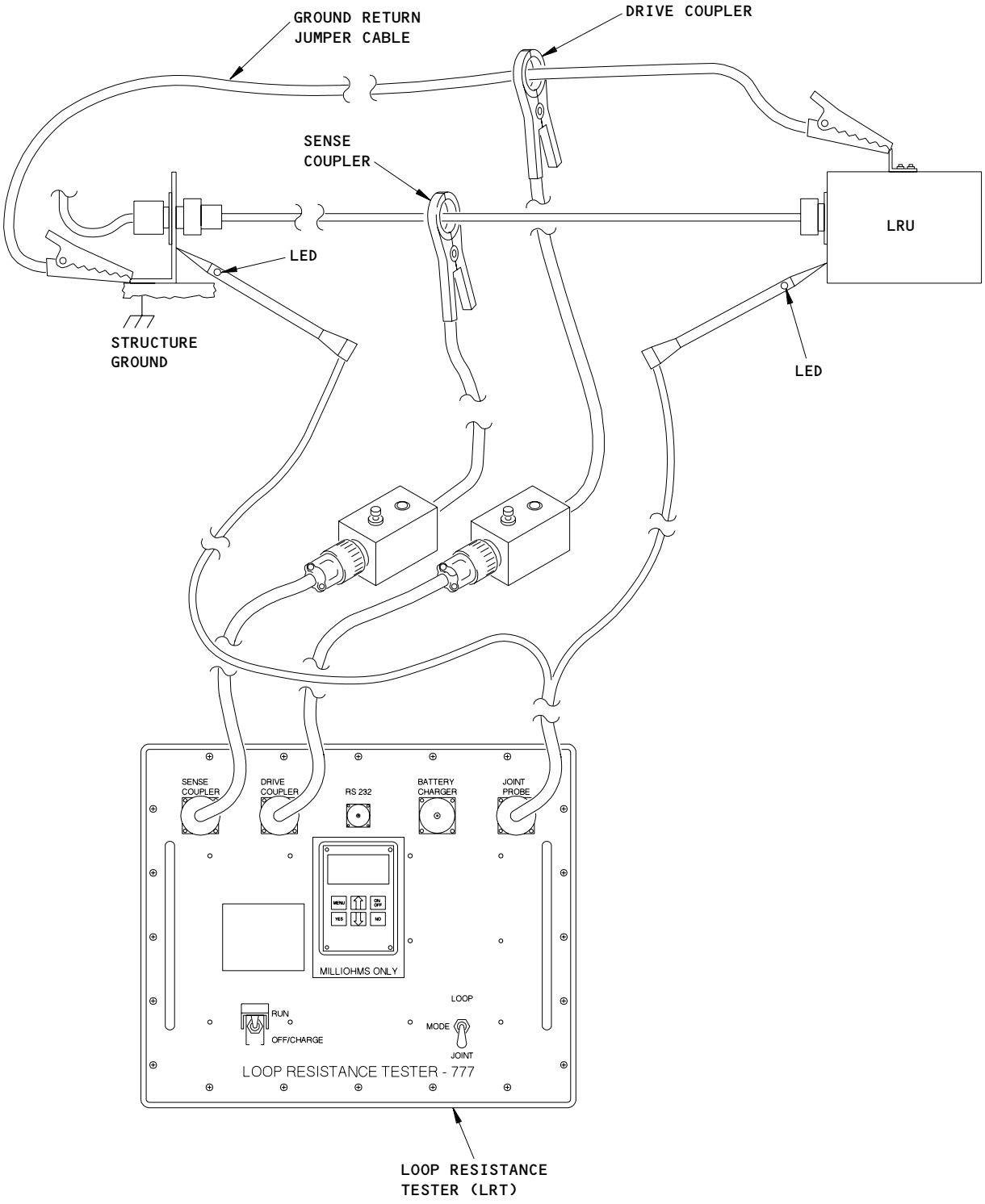
      a) Do the following SWPM 20-20-00 or SWPM 20-25-11.
   2) After you complete the joint repair, repeat the Joint Buildup Resistance Measurement to verify the repair.

(d) If the measured joint resistance is less than the calculated maximum allowable resistance for the built-up joint, then do the Joint Buildup Resistance Measurement on the next joint in the wire bundle.

(e) If all of the built-up joints/connections for a particular wire bundle have been measured and joint resistances are less than the calculated maximum allowable resistance for the built-up joints, then the Joint Buildup Resistance Measurement Task is complete.



Typical Loop Resistance Tester (LRT) Hookup for Joint Buildup Test
Figure 201



Typical Loop Resistance Tester (LRT) Hookup for Modified Joint Buildup Test
Figure 202

CIRCUIT BREAKER RESET - MAINTENANCE PRACTICES

TASK 20-60-01-862-001

1. Circuit Breaker Reset

A. General

(1) This procedure is for on-the-ground maintenance.

(2) Circuit breakers open when there is an electrical overload in the airplane system. A circuit breaker that opens because of an electrical overload is known as a "tripped" circuit breaker.

(3) If there are currently specific instructions for the reset of a tripped circuit breaker in maintenance and troubleshooting procedures, follow those instructions.

(4) A defective circuit breaker can cause the circuit breaker to open. Make sure that the circuit breaker is serviceable.

(5) Use your judgement and airline policy to reset a tripped circuit breaker.

(6) Monitor the airplane to see if a tripped circuit breaker occurs again on subsequent flights.

(7) Do not reset a tripped circuit breaker until you know the cause for the tripped circuit breaker and that the circuit breaker can be safely reset. Fires have occurred in which the tripped circuit breakers were reset without an examination of the cause.

(8) Use this procedure to reset a tripped circuit breaker:

(a) If you know that the circuit breaker is serviceable.

(b) If this procedure is in agreement with your airline policy.

(c) If you cannot determine the cause for the tripped circuit breaker.

(d) If you cannot determine whether it is safe to reset the circuit breaker.

B. References

(1) AMM (applicable procedure)

(2) SWPM (applicable procedure)

(3) WDM (applicable diagram)

C. Procedure

S 862-002

(1) Attach a DO-NOT-CLOSE tag to the tripped circuit breaker.

S 862-003

(2) Install a circuit breaker lock on the tripped circuit breaker.

S 862-004

(3) If the tripped circuit breaker is one of three circuit breakers protecting a 3-phase circuit:

(a) Open the other two circuit breakers.

(b) Attach DO-NOT-CLOSE tags.
(c) Install circuit breaker locks.

S 862-005
(4) Look in the aircraft logbook to find if there is recorded data about a "tripped" circuit breaker, such as:
(a) The condition existing when the circuit breaker trip occurred.
(b) The conditions existing when the circuit breaker was reset.
(c) The results of resetting the circuit breaker.

S 862-006
(5) Do a visual check for damage to electrical wiring and system components related to the tripped circuit breaker. If necessary, refer to the Wiring Diagram Manual (WDM). Look for these types of damage:
(a) Electrical shorting
(b) Electrical arcing
(c) Corrosion on the contacts of the electrical wiring and system components
(d) Abrasion of the electrical wiring and system components
(e) Cracks on the insulation of the electrical wiring
(f) Split wires

NOTE: A split wire is when you can see the conductor through the crack in the insulation of the electrical wiring.

(g) Broken wires
(h) Discoloration of the insulation of the electrical wiring
(i) Fluid or dust contamination of electrical wiring and system components

NOTE: Contamination can be a fuel source during electrical arcing.

(j) Metal shavings

NOTE: Metal shavings can cause electrical shorting.

S 862-007
(6) Make sure that there are no loose terminal connections.

NOTE: Loose terminal connections can be a source of electrical arcing.

S 862-008
(7) If you find damage to the electrical wiring, refer to the Standard Wiring Practices Manual (SWPM) and repair the electrical wiring.

S 862-009
(8) If you find damage to a system component, refer to the applicable Aircraft Maintenance Manual (AMM) procedure and replace the component.

S 862-010
(9) Remove contamination and metal shavings if necessary.

S 862-011
(10) Remove the DO-NOT-CLOSE tag(s).

S 862-012
(11) Remove the circuit breaker lock(s).

S 862-013

WARNING: DO NOT RESET (CLOSE) A FUEL PUMP CIRCUIT BREAKER THAT HAS OPENED (TRIPPED) UNTIL YOU CORRECT THE PROBLEM. REFER TO FIM 28-22-00/101. THIS CONDITION CAN CAUSE A FIRE OR EXPLOSION.

WARNING: WARNING: MAKE SURE THAT THERE IS NO DAMAGE TO THE ELECTRICAL WIRING OR SYSTEM COMPONENTS RELATED TO THE OPEN CIRCUIT BREAKER. WHEN THE CIRCUIT BREAKER IS CLOSED, DAMAGED ELECTRICAL WIRING, COMPONENTS OR LOOSE TERMINALS CAN CAUSE SPARKS OR FIRES.

(12) Close the circuit breaker(s).

S 862-014
(13) After you close the circuit breaker(s), make sure that there is no electrical arcing or other damage to the system.

S 862-015
(14) To make sure that the airplane system operates correctly, refer to the applicable procedure in the Aircraft Maintenance Manual (AMM).

CLEANING TO REMOVE COMBUSTIBLE MATERIAL AROUND
WIRING (EZAP) - MAINTENANCE PRACTICES

TASK 20-60-02-102-001

1. Cleaning to Remove Combustible Material Around Wiring

A. General

(1) This procedure cleans the wire bundles and the area around it where dust accumulates to significantly reduce the amount of combustible material.

(2) This procedure is an enhanced zonal analysis procedure (EZAP) task.

B. References

(1) AMM (applicable procedure(s))

(2) SWPM (applicable procedure(s))

(3) WDM (applicable diagram(s))

C. Equipment and Materials

(1) B00003 - Cleaner - Alkaline General

(2) G00371 - Brush, Soft-bristle

(3) Vacuum Cleaner - Commercially available

D. Procedure

S 012-002

(1) Remove panels as necessary to gain access to the wire bundles and the area around them.(AMM & WDM applicable procedure(s)).

S 102-003

(2) Do these steps to clean the wire bundles and the area around them:

NOTE: This procedure cleans the wire bundles and the area around where significant dust accumulates to reduce the amount of combustible material.

(a) Remove loose contamination by hand.

(b) Use a vacuum cleaner to remove accumulations of dust.

(c) Use a soft bristle brush to loosen accumulations of dust that remain and vacuum the area again.

(d) Use cleaner and wipe any dust that remains.

S 412-004

(3) Install all panels removed for access (AMM & WDM applicable proce procedures).

DETAILED WIRING INSPECTION (EZAP) - MAINTENANCE PRACTICES

TASK 20-60-03-102-001

1. Detailed Wiring Inspection

A. General

(1) This procedure performs a detailed inspection of wiring.

(2) This procedure is an enhanced zonal analysis procedure (EZAP) task.

B. References

(1) AMM 20-60-02/201 Cleaning to Remove Combustible Material Around Wiring

C. Equipment and Materials

(1) Mirror - Inspection, Telescoping

D. Procedure

S 012-002

(1) Remove panels as necessary to gain access to the wiring (Ref. AMM applicable procedure(s)).

S 222-003

(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.

1) If combustible material is found, do this task: Cleaning to Remove Combustible Material Around Wiring, AMM 20-60-02/201.

(b) Check the wire and the wire harnessess 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, toque 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.

(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 wires bundles found with defects (SWPM applicable procedure(s)).

S 412-004

(3) Install all panels removed for access (AMM applicable procedure(s)).

GENERAL VISUAL INSPECTION OF WIRE BUNDLES (EZAP) - MAINTENANCE PRACTICES

TASK 20-60-04-102-001

1. General Visual Inspection of Wire Bundles

A. General

(1) This procedure performs a general visual inspection of wire bundles.

(2) This procedure is an enhanced zonal analysis procedure (EZAP) task.

B. References

(1) AMM 20-60-02/201 Cleaning to Remove Combustible Material Around Wiring

C. Procedure

S 012-002

(1) Remove panels as necessary to gain access to the wire bundles (Ref. AMM applicable procedure(s)).

S 102-003

(2) Do these steps to perform a general visual inspection of wire bundles:

(a) Check the wire bundles and the area around them for combustible material.

1) If combustible material is found, do this task: Cleaning to Remove Combustible Material Around Wiring, AMM 20-60-02/201.

(b) Check the wire and wire bundles for degradation due to: wear, vibration, moisture, contamination, and excessive heat.

CAUTION: DO NOT CUT, CAUSE NICKS, OR CAUSE OTHER DAMAGE TO THE CABLES, WIRES, METAL-BRAIDED SHIELD, OR OVERBRAID. DAMAGE TO THESE COMPONENTS CAN CAUSE MALFUNCTIONS, OR DAMAGE TO OTHER EQUIPMENT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL TOOLS, LOOSE PARTS AND UNWANTED MATERIAL FROM THE AREA WHEN YOU COMPLETE MAINTENANCE. DAMAGE TO EQUIPMENT COULD OCCUR.

1) Make sure the wire bundles are protected from damage by drills, metal shavings and other contamination.

2) Repair or replace any wire bundles found with defects (SWP (SWPM applicable procedure(s)).

S 412-004

(3) Install all panels removed for access (AMM applicable procedure(s)).

CIRCUIT BREAKER CYCLING - MAINTENANCE PRACTICES

TASK 20-60-05-802-001

1. Circuit Breaker Cycling

A. General

(1) This procedure is for on-the-ground maintenance and is preventative maintenance for those circuit breakers that are less frequently used. It is not necessary to do this procedure for frequently used circuit breakers. Because each airline operates differently, it is an airline decision as to which circuit breakers are frequently used and which circuit breakers are less frequently used.

(2) Research has shown that the cycling of less frequently used circuit breakers can help to improve operational system reliability. If a circuit breaker has not been operated for some time, it is possible that the circuit breaker may not open when an electrical fault occurs.

(3) Circuit breakers are located in all areas of the airplane such as the flight compartment, electrical equipment bays, cargo compartments, passenger compartment, and other areas.

(4) Too much repeated use of a circuit breaker can result in premature failure of the circuit breaker.

B. References

(1) AMM 24-22-00/201, CONTROL (SUPPLY POWER) - MAINTENANCE PRACTICES

(2) WDM (applicable diagram)

C. Access

(1) Location Zones

100 Lower Half of Fuselage

200 Upper Half of Fuselage

D. Procedure

S 022-002

(1) Do these steps to remove electrical power: AMM 24-22-00/201

NOTE: Electrical power must be off so that subsequent incorrect fault indications or nuisance messages are prevented.

S 862-003

(2) Do these steps to cycle a circuit breaker on the airplane:

(a) Open the circuit breaker.

(b) Do a visual check of the circuit breaker area for damage. Look for these types of damage:

1) Electrical shorting

2) Electrical arcing

3) Discoloration of the circuit breaker

4) Contamination of the circuit breaker

(c) If you find damage to the circuit breaker, replace the circuit breaker. Refer to the Wiring Diagram Manual (WDM).
(d) Close the circuit breaker.

NOTE: After you open and close the circuit breaker, you can possibly find contamination.

(e) Remove contamination, if necessary.
(f) If you find that the circuit breaker is unserviceable After you open and close it, replace the circuit breaker. Refer to the Wiring Diagram Manual (WDM).

S 862-004
(3) If necessary, do this procedure again to cycle another circuit breaker.

ELECTRONIC LINE REPLACEABLE UNIT CLEANING - MAINTENANCE PRACTICES

TASK 20-60-06-102-001

1. Electronic LRU Cleaning

A. General

(1) This procedure cleans the electronic line replaceable units and the area around it where dust can accumulate and obstruct filters and cooling systems.

B. Equipment and Materials

(1) B01000 - Series 80 solvent
(2) G00371 - Brush, Soft-bristle
(3) Vacuum cleaner - Commercially available

C. Procedure

S 012-002

(1) Remove panels as necessary to gain access to the LRUs and the area around them.

S 142-003

(2) Do the steps that follow to clean the LRUs and the area around them:
(a) Remove any contamination by hand.
(b) Use a vacuum cleaner to remove any loose dirt or debris.
(c) Use a soft bristle brush to loosen any dust on or around the LRU and vacuum the area again.
(d) Do the following steps to clean the LRU filters if applicable:
1) Replace fiberglass and paper filters if contaminated.
2) Clean metallic screens and filters with series 80 solvent if conaminated.

S 412-004

(3) Install all panels removed for access.

WIRE BUNDLE PROTECTION (EZAP) - MAINTENANCE PRACTICES

1. General
   A. This procedure has one task:
      (1) Protection of wire bundles during maintenance.
   B. This procedure is an enhanced zonal analysis procedure (EZAP) task.
   C. This procedure gives instructions for the installation of temporary protection for the wire bundles during maintenance work when contamination or mechanical damage could occur.
   D. Protect all airplane wires, regardless of the gauge or insulation material, during airplane mainenance to prevent or significantly decrease the potential for damage from contamination or debris. Protection of the wire bundles starts with identification of the potential for contamination or mechanical damage and ends with making sure that the wire bundles and their related components are free of all sources of contamination. Prevention and frequently removing contamination during all maintenance work is necessary to keep the wire bundles and their related components and systems in an airworthy condition. Wire bundles can be easily damaged during the removal of aircraft equipment or if used as a handhold or support for personal equipment. In general, wire bundles that are undisturbed and kept free of contamination will allow for trouble-free servicing without the need for unscheduled maintenance.
   E. Wire bundles and their related components are designed to be resistant to chemical contaminants. However, to maintain necessary properties of the wire bundles and their related components, they are not resistant to all chemicals and must be kept free of all chemicals and debris. Hydraulic fluid is a common cause of degradation in wire bundles and their related components. Hydraulic fluid is very damaging to connector grommets, wire bundle clamps, and to wire insulation when exposed over a long time. This can lead to indirect damage such as arcing and chafing, and breakdown of the insulation.
   F. Before maintenance work such as servicing, repairing, cleaning, or modifying, make sure that the wire bundles and systems components have protection against the accumulation of contamination.

TASK 20-60-07-842-001

2. Protection of the Wire Bundles during Maintenance
   A. Procedure

S 622-002

WARNING: KEEP THESE MATERIALS AWAY FROM WIRES. THESE MATERIALS WILL DECREASE THE LIFE OF WIRES. IF YOU SPILL THESE MATERIALS, OR LET LEAKAGE GET ON THE WIRES, INJURIES TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Keep the wires away from these materials:

NOTE: Fumes from these materials can cause damage to wires. Fluid from these materials can move up or down the wires into connectors, and other components.

(a) Hydraulic Fluid
(b) Battery Electrolytes
(c) Fuel
(d) Corrosion-Inhibiting Compounds
(e) Waste System Chemicals
(f) Cleaning Agents
(g) Deicing Fluids
(h) Paint

S 622-003

CAUTION: KEEP TOOLS, TOOL TRAYS, AND OTHER WORK ITEMS OFF OF THE WIRES. OBJECTS PUT ON THE WIRE BUNDLES OR THEIR RELATED COMPONENTS CAN CAUSE DAMAGE TO THE WIRES, INSULATION, AND CONNECTORS.

(2) Install covers on the areas below and adjacent to the maintenance area.
  (a) Use a cover that is applicable to protect components from the specific contaminant.
    1) Examples of covers are as follows:
      a) Plastic sheeting
      b) Canvas sheeting
      c) Paper masking tape
  (b) Use tape to attach the cover to the aircraft structure.
    1) Install the tape carefully to prevent damage to the structure and the collection of remaining adhesives.
    2) Make sure that you do not tape the cover to the wire bundles or other components protected by the cover.
    3) Make sure that the cover is in a shape to collect and contain fluids.

(c) Make sure that the cover is attached in place.
1) Make sure that the wire bundles and their related components stay covered during all of the maintenance work.

B. Put the Airplane Back to Its Original Condition

S 022-004

(1) Remove the covers.
(a) Make sure that the contaminants are contained and do not spill.

S 212-005

(2) Do the Detailed Wiring Inspection (EZAP) procedure to examine the area to make sure that no contaminants spilled (AMM 20-60-03/201).
(a) If there is contamination on the wire bundles, do the Cleaning to Remove Combustible Material Around Wiring (EZAP) procedure (AMM 20-60-02/201).
(b) If there is damage to the wiring bundles, refer to the Standard Wiring Practices Manual for applicable repairs.