

CHAPTER

20

**STANDARD
PRACTICES**



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CONTROL CABLE AIR SEAL - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) A removal of the air seal.
(2) An installation of the air seal.

TASK 20-10-04-000-801

2. Control Cable Air Seal Removal

(Figure 401)

A. Procedure

SUBTASK 20-10-04-020-003

- (1) Remove the seal retaining bolts.

SUBTASK 20-10-04-020-004

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

SUBTASK 20-10-04-020-001

- (3) If it is necessary to replace the seal plate or seal cover, do these steps:

- (a) Disconnect the turnbuckle adjacent to the pressure bulkhead.
(b) Remove the seal cover and the seal plate from the bulkhead.

SUBTASK 20-10-04-020-002

- (4) Remove the air seal.

END OF TASK

TASK 20-10-04-400-801

3. Control Cable Air Seal Installation

(Figure 401)

A. References

Table with 2 columns: Reference, Title. Row 1: 12-26-00-600-801, Control Cable Lubrication (P/B 301)

B. Consumable Materials

Table with 3 columns: Reference, Description, Specification. Row 1: D00015, Grease - Aircraft Bearing (Use BMS 3-24 until existing stocks are depleted, BMS 3-33 supersedes BMS 3-24), BMS3-24 (Superseded by BMS 3-33). Row 2: D00633, Grease - Aircraft General Purpose, BMS3-33

C. Procedure

SUBTASK 20-10-04-420-001

- (1) If you removed the seal plate or seal cover, do these steps:
(a) Replace them on the control cable.
(b) If necessary, refer to the specific system rigging instructions to adjust the control cable.

SUBTASK 20-10-04-420-002

- (2) Install the gasket to the pressure bulkhead.

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SUBTASK 20-10-04-640-001

CAUTION: DO NOT FILL THE SEAL WITH GREASE. DO NOT APPLY GREASE TO CRES CABLES. CRES CABLES MUST NOT BE LUBRICATED.

- (3) Apply grease, D00633 (recommended) or grease, D00015 (alternate) to the cable for the full length of travel in the seal, do this task: Control Cable Lubrication, TASK 12-26-00-600-801.

SUBTASK 20-10-04-420-004

- (4) Connect the two ball pieces on the cable between the seal cover and seal plate.

SUBTASK 20-10-04-420-005

- (5) Loosely install the seal retaining bolts and washers.

SUBTASK 20-10-04-420-006

- (6) Adjust the seal to attain minimum cable deflection and tighten the seal retaining bolts.

SUBTASK 20-10-04-200-001

- (7) Make sure the cable pressure seals are correctly adjusted after installation .
 - (a) Make sure there is no cable deflection.
 - (b) Make sure the cable moves freely.

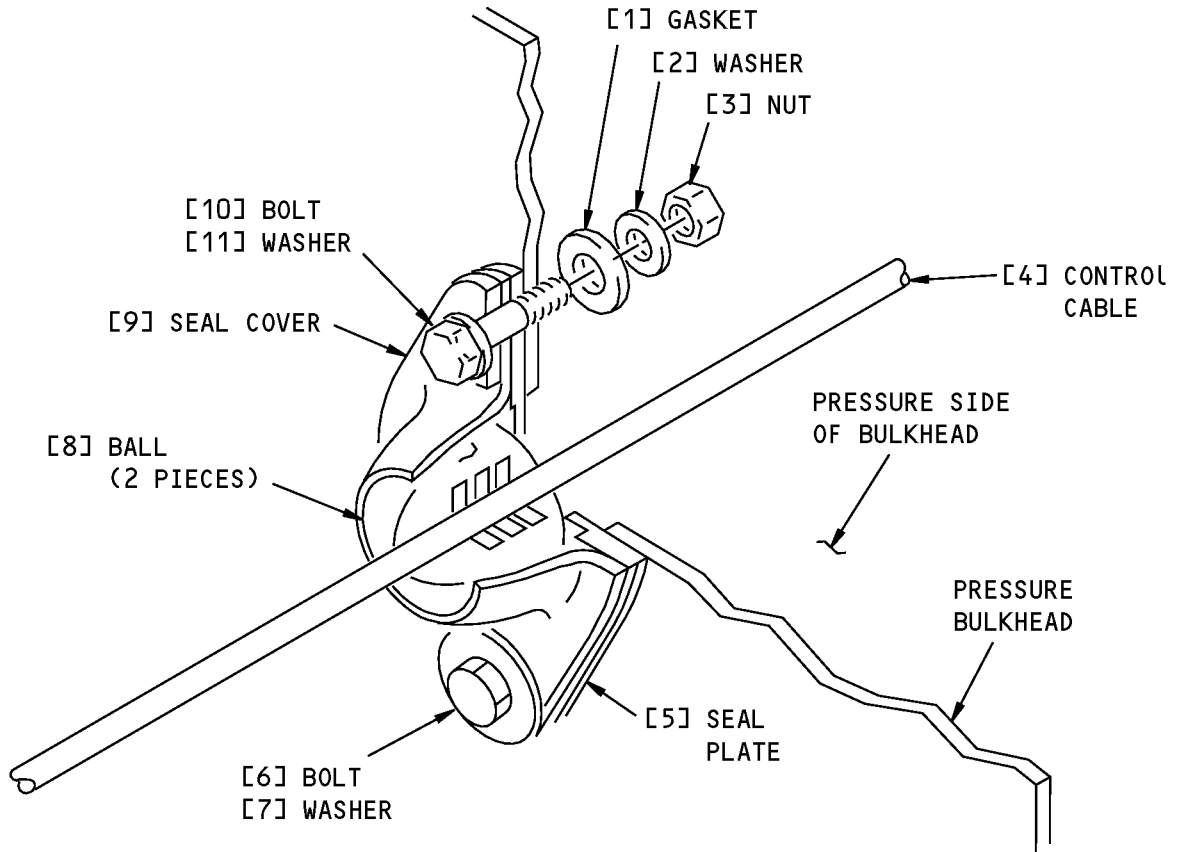
————— **END OF TASK** —————

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**Control Cable Air Seal Installation
Figure 401/20-10-04-990-801**

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E/E RACK-MOUNTED COMPONENTS AND PRINTED CIRCUIT CARD - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) The removal of the electrical/electronics (E/E) box from the rack.
- (2) Adjustment of the lever latch fork.
- (3) The installation of the E/E box.
- (4) The removal of a printed circuit card.
- (5) The installation of a printed circuit card.
- (6) The removal of an E/E shelf assembly.
- (7) The installation of an E/E shelf assembly.

TASK 20-10-07-000-801

2. E/E Box Removal

(Figure 201)

A. References

Reference	Title
20-40-12-000-802	ESDS Handling for Metal Encased Unit Removal (P/B 201)
20-40-12-400-804	Conductive Dust Cap and Connector Cover Installation (P/B 201)

B. Location Zones

Zone	Area
117	Electrical and Electronics Compartment - Left
118	Electrical and Electronics Compartment - Right

HAP ALL; AIRPLANES WITH REXNORD AEROSPACE MECHANISMS EXTRACTOR

C. E/E Box Removal Procedure

SUBTASK 20-10-07-860-001

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

SUBTASK 20-10-07-910-001

CAUTION: DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (2) If the E/E box is sensitive to electrostatic discharge, make sure you do this task: ESDS Handling for Metal Encased Unit Removal, TASK 20-40-12-000-802.

SUBTASK 20-10-07-020-001

CAUTION: DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (3) Remove the connections from the front of the E/E box if it is necessary.

SUBTASK 20-10-07-020-002

- (4) Turn the knob on the front hold-down extractor counterclockwise to disengage the clutch.

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HAP ALL; AIRPLANES WITH REXNORD AEROSPACE MECHANISMS EXTRACTOR (Continued)

SUBTASK 20-10-07-020-003

- (5) Do these steps to disconnect the front hold-down extractor:

NOTE: Apply light pressure down on the E/E box handle while you disconnect the front hold-down extractor.

- (a) Turn the keeper to align the deep slot with the T-hook.
(b) Lower the front hold-down extractor to be clear of the T-hook.

SUBTASK 20-10-07-420-001

CAUTION: DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX

- (6) Install conductive or anti-static caps to the connectors.

SUBTASK 20-10-07-020-004

- (7) Carefully move the E/E box out from the tray and remove the E/E box.

NOTE: Move the front of the E/E box from side to side approximately 1/8 inch (3 mm) to help disconnect the E/E box from the electrical connector.

SUBTASK 20-10-07-420-002

- (8) If the E/E box is not sensitive to electrostatic discharge, put protective covers on the electrical connector(s).

SUBTASK 20-10-07-420-003

- (9) If the E/E box is sensitive to electrostatic discharge, do this task: Conductive Dust Cap and Connector Cover Installation, TASK 20-40-12-400-804.

HAP ALL; AIRPLANES WITH HOLLINGSEAD EXTRACTOR

D. E/E Box Removal Procedure

SUBTASK 20-10-07-860-002

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

SUBTASK 20-10-07-910-002

CAUTION: DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (2) If the E/E box is sensitive to electrostatic discharge, make sure you do this task: ESDS Handling for Metal Encased Unit Removal, TASK 20-40-12-000-802.

SUBTASK 20-10-07-020-005

CAUTION: DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (3) Remove the connections from the front of the E/E box, if it is necessary.

SUBTASK 20-10-07-020-006

- (4) Turn the knob on the front hold-down extractor counterclockwise until you can see the red band.

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HAP ALL; AIRPLANES WITH HOLLINGSEAD EXTRACTOR (Continued)

SUBTASK 20-10-07-020-007

- (5) Do these steps to disconnect the front hold-down extractor:

NOTE: Apply light pressure down on the E/E box handle while you disconnect the front hold-down extractor.

- (a) Turn the latch counterclockwise to disengage the front hold-down extractor from the T-hook.
- (b) Lower the front hold-down extractor to be clear of the T-hook.

SUBTASK 20-10-07-020-008

CAUTION: DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (6) Carefully move the E/E box out from the tray and remove the E/E box.

NOTE: Shake the front of the E/E box from side to side approximately 1/8 inch (3 mm) to help disconnect the E/E box from the electrical connector.

SUBTASK 20-10-07-420-004

- (7) If the E/E box is not sensitive to electrostatic discharge, put protective covers on the electrical connector(s).

SUBTASK 20-10-07-420-005

- (8) If the E/E box is sensitive to electrostatic discharge, do this task: Conductive Dust Cap and Connector Cover Installation, TASK 20-40-12-400-804.

HAP ALL; AIRPLANES WITH HARTWELL EXTRACTOR

E. E/E Box Removal Procedure

SUBTASK 20-10-07-860-003

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

SUBTASK 20-10-07-910-003

CAUTION: DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (2) If the E/E box is sensitive to electrostatic discharge, make sure you do this task: ESDS Handling for Metal Encased Unit Removal, TASK 20-40-12-000-802.

SUBTASK 20-10-07-020-009

CAUTION: DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (3) Remove the connections from the front of the E/E box, if it is necessary.

SUBTASK 20-10-07-020-010

- (4) Turn the knob on the front hold-down extractor counterclockwise to disengage the clutch.

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HAP ALL; AIRPLANES WITH HARTWELL EXTRACTOR (Continued)

SUBTASK 20-10-07-020-011

- (5) Do these steps to disconnect the front hold-down extractor:

NOTE: Apply light pressure down on the E/E box handle while you disconnect the front hold-down extractor.

- (a) Compress the keeper to disengage the extractor from the T-hook.
(b) Lower the front hold-down extractor to be clear of the T-hook.

SUBTASK 20-10-07-020-012

CAUTION: DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (6) Carefully move the E/E box out from the tray and remove the E/E box.

NOTE: Shake the front of the E/E box from side to side approximately 1/8 inch (3 mm) to help disconnect the E/E box from the electrical connector.

SUBTASK 20-10-07-420-006

- (7) If the E/E box is not sensitive to electrostatic discharge, put protective covers on the electrical connector(s).

SUBTASK 20-10-07-420-007

- (8) If the E/E box is sensitive to electrostatic discharge, do this task: Conductive Dust Cap and Connector Cover Installation, TASK 20-40-12-400-804.

HAP ALL; AIRPLANES WITH LEVER LATCH HANDLES

F. E/E Box Removal Procedure

SUBTASK 20-10-07-860-012

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

SUBTASK 20-10-07-910-009

CAUTION: DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (2) If the E/E box is sensitive to electrostatic discharge, make sure you, do this task: ESDS Handling for Metal Encased Unit Removal, TASK 20-40-12-000-802.

SUBTASK 20-10-07-020-017

CAUTION: DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (3) Remove the connections from the front of the E/E box, if it is necessary.

SUBTASK 20-10-07-020-018

- (4) Do these steps to disconnect the lever latch:

- (a) Depress the lever latch allowing the lever to move away from the handles.
(b) Move the lever in an opening direction forcing the unit away from the shelf-mounted connector.

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HAP ALL; AIRPLANES WITH LEVER LATCH HANDLES (Continued)

SUBTASK 20-10-07-020-019

CAUTION: DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE E/E BOX. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

(5) Carefully move the E/E box out from the tray and remove the E/E box.

NOTE: Shake the front of the E/E box from side to side approximately 1/8 inch (3 mm) to help disconnect the E/E box from the electrical connector.

SUBTASK 20-10-07-420-027

(6) If the E/E box is not sensitive to electrostatic discharge, put protective covers on the electrical connector(s).

SUBTASK 20-10-07-420-028

(7) If the E/E box is sensitive to electrostatic discharge, do this task: Conductive Dust Cap and Connector Cover Installation, TASK 20-40-12-400-804.

HAP ALL

————— **END OF TASK** —————

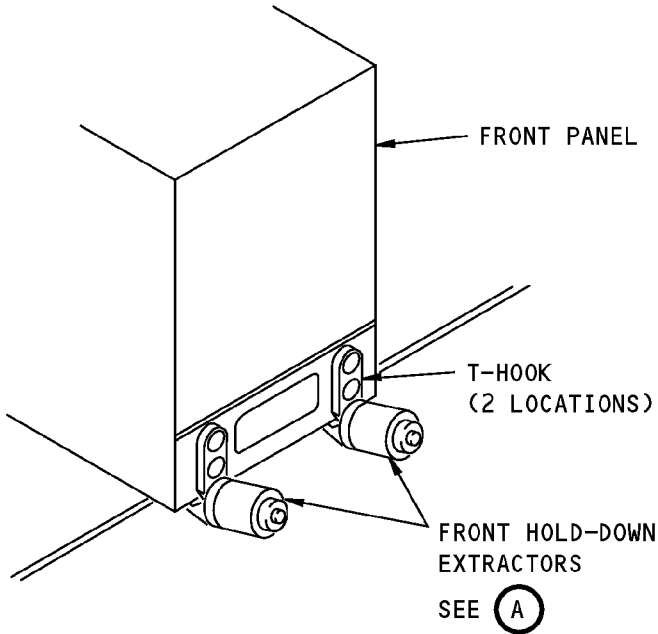
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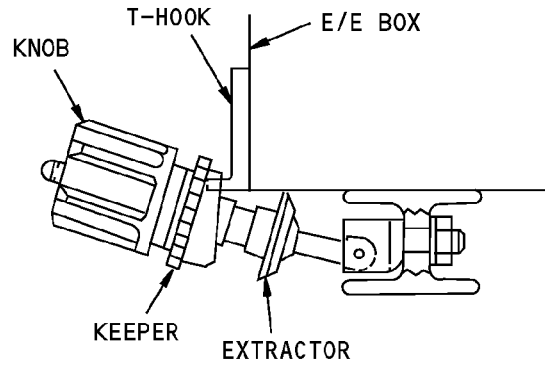
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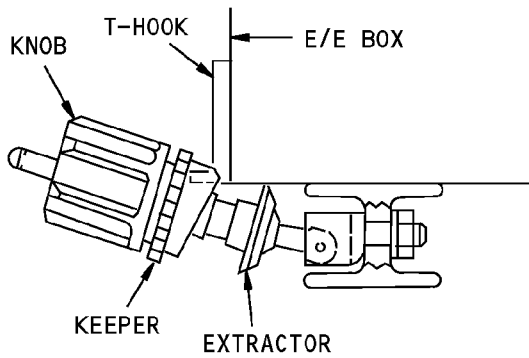


INSTALLED E/E BOX



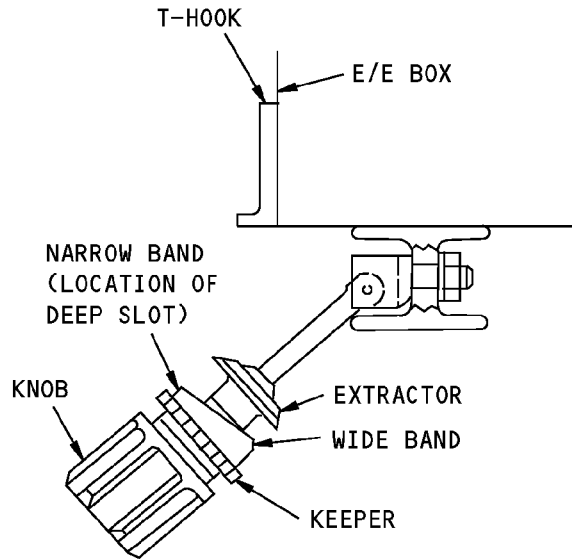
EXTRACTOR LOOSENED

(A)



EXTRACTOR TIGHTENED

(A)



EXTRACTOR FREE POSITION

(A)

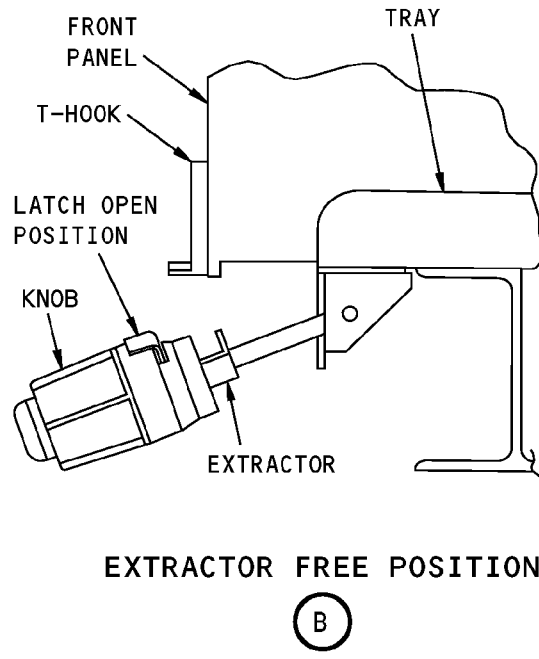
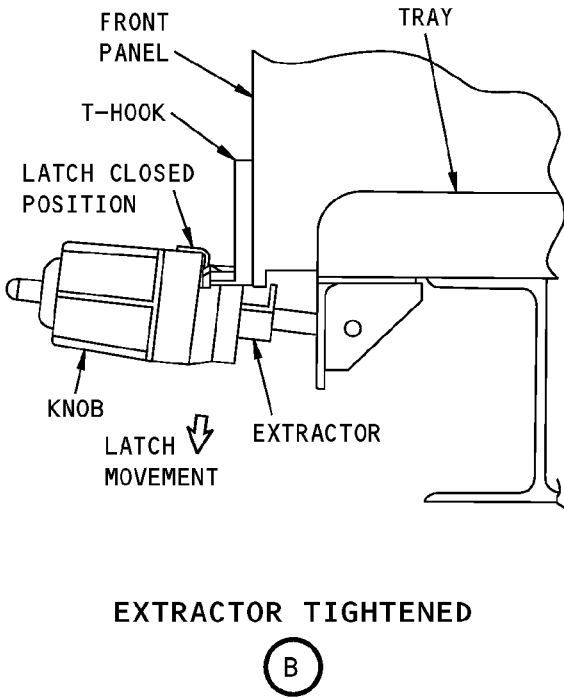
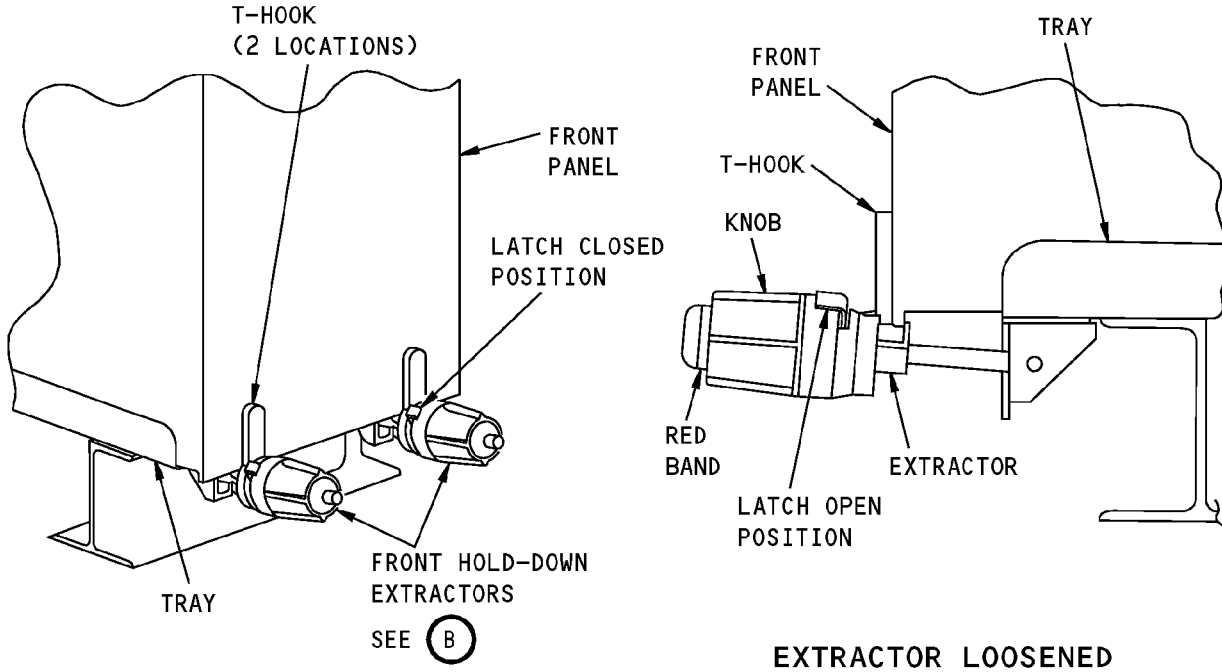
REXNORD AEROSPACE MECHANISMS EXTRACTOR

**E/E Box Installation
Figure 201 (Sheet 1 of 5)/20-10-07-990-801**

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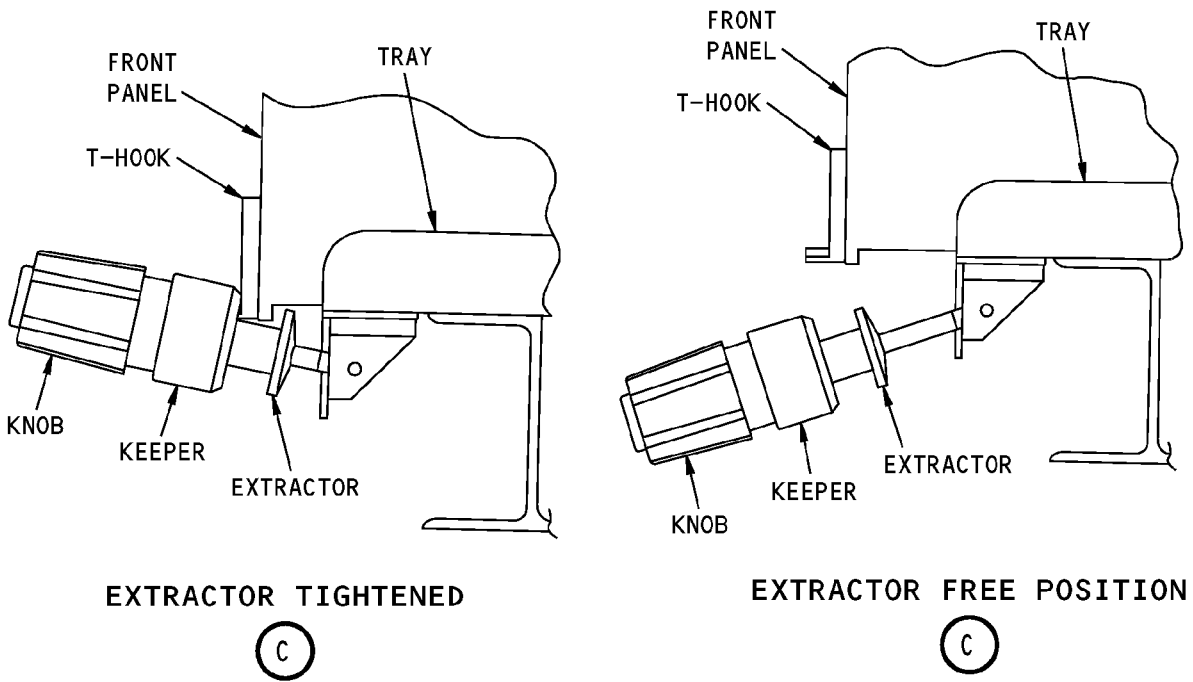
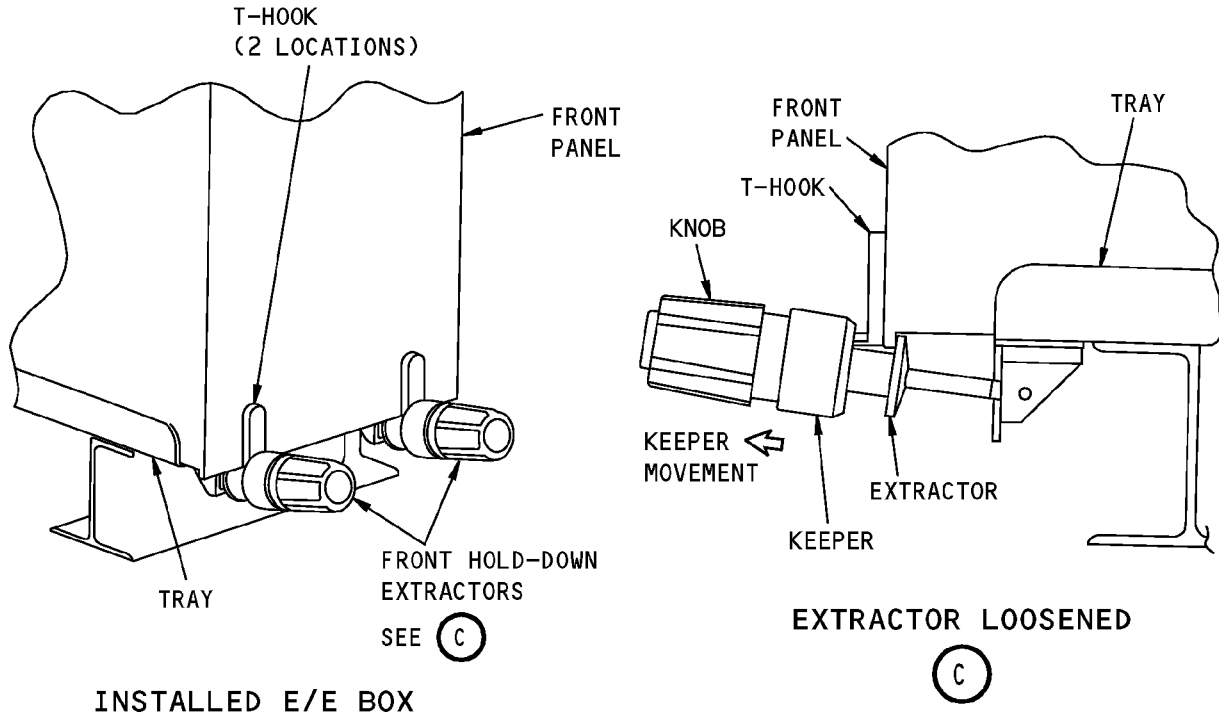
HOLLINGSEAD EXTRACTOR

E/E Box Installation
Figure 201 (Sheet 2 of 5)/20-10-07-990-801

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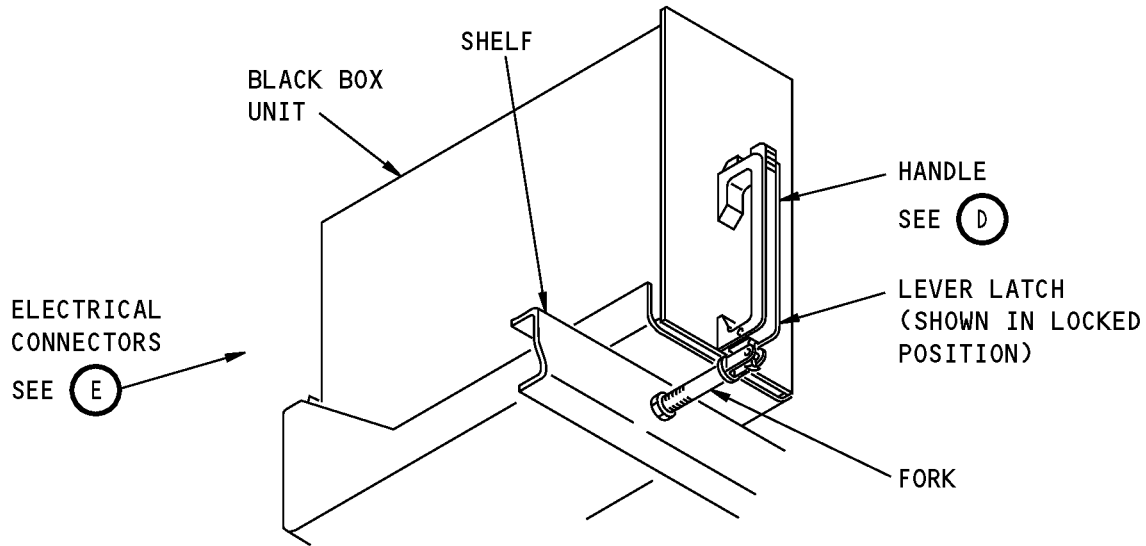
HARTWELL EXTRACTOR

**E/E Box Installation
Figure 201 (Sheet 3 of 5)/20-10-07-990-801**

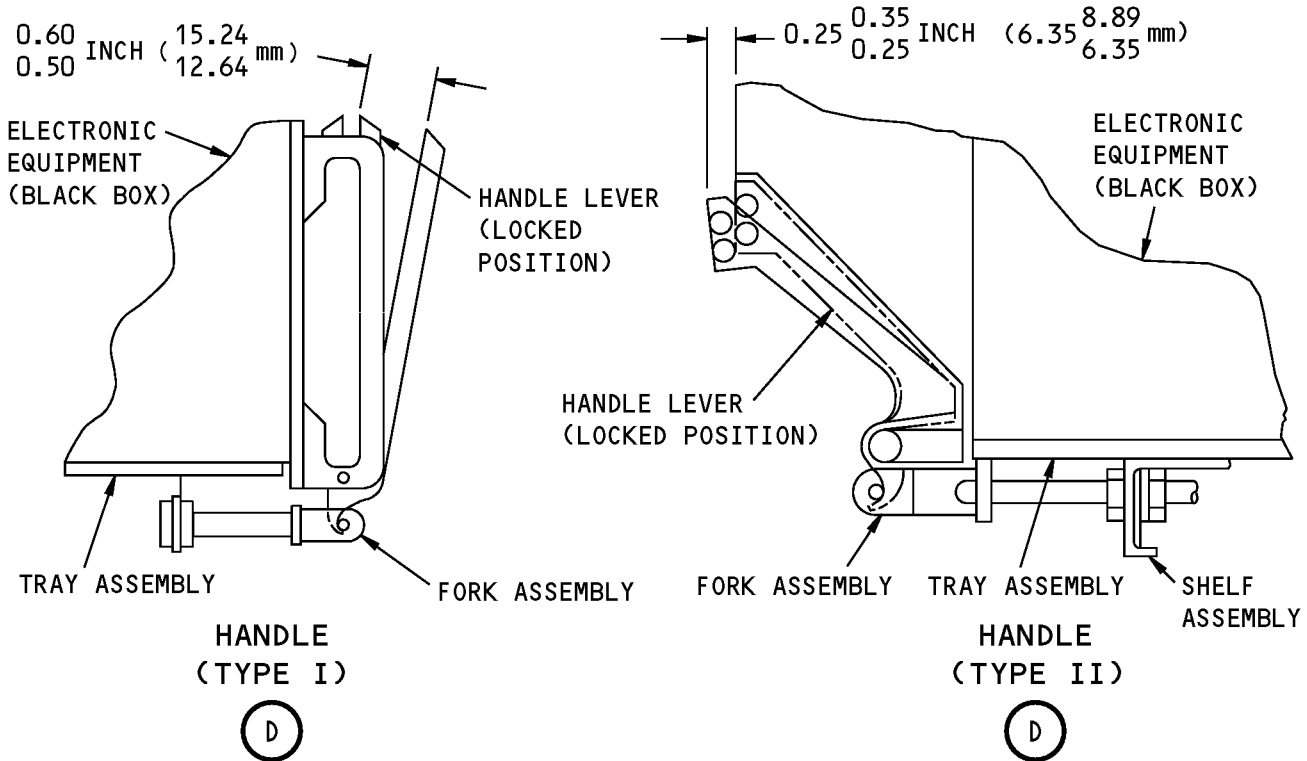
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**LEVER LATCH TYPE
(EXAMPLE)**



NOTE: ADJUST FRONT HOLD DOWNS AS FOLLOWS:
WITH PLUG ON THE REAR OF UNIT FULLY ENGAGED AND THE HANDLE LEVER ON THE FRONT OF THE UNIT AT THE DIMENSION SHOWN, ADJUST FORKS BY ROTATING TO A POSITION WHERE THEY START TO EXERT PRESSURE ON THE LOCKING LEVER.

**E/E Box Installation
Figure 201 (Sheet 4 of 5)/20-10-07-990-801**

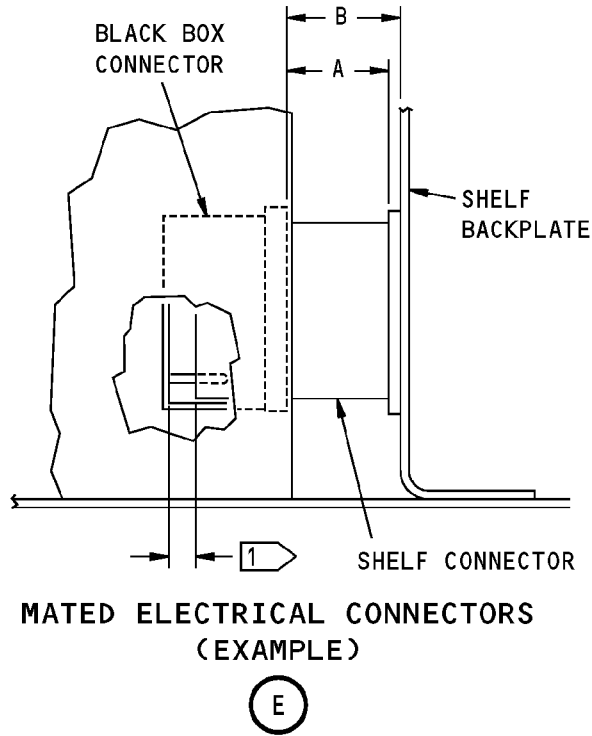
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CONNECTOR TYPE	A INCH (mm) MAXIMUM	B INCH (mm) MAXIMUM
AD2		0.297 (7.544)
AMP		0.297 (7.544)
DPA	0.157 (3.988)	
DPD	0.138 (3.505)	
DPE	UNKNOWN	UNKNOWN
DPDMA	0.138 (3.505)	
DPD2	0.138 (3.505)	
DPXA		0.297 (7.544)
DPXB		0.297 (7.544)
DPX2		0.297 (7.544)
SR-RAI		0.581 (14.757)

NOTE: DIMENSIONS CAN BE MEASURED WITH PUTTY OR A PAPER SLEEVE OR RING OF A SUITABLE LENGTH THAT WILL BE CRUSHED WHEN THE CONNECTOR IS MATED PROPERLY.

1 0.09 INCH (2.286 mm) MAXIMUM FOR ANY CONNECTOR FULLY MATED (ALTERNATE METHOD)

**E/E Box Installation
Figure 201 (Sheet 5 of 5)/20-10-07-990-801**

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TASK 20-10-07-400-801

3. E/E Box Installation

(Figure 201)

A. References

Reference	Title
20-40-12-000-804	Conductive Dust Cap and Conductor Cover Removal (P/B 201)
20-40-12-400-802	ESDS Handling for Metal Encased Unit Installation (P/B 201)
SWPM 20-30-00 Electrical Connection of Equipment	Standard Wiring Practices Manual

B. Location Zones

Zone	Area
117	Electrical and Electronics Compartment - Left
118	Electrical and Electronics Compartment - Right

HAP ALL; AIRPLANES WITH REXNORD AEROSPACE MECHANISMS EXTRACTOR

C. E/E Box Installation Procedure

SUBTASK 20-10-07-860-004

- (1) Make sure the applicable circuit breakers for the E/E box are open.

SUBTASK 20-10-07-210-001

- (2) Compare the quantity and location of the rubber plugs with the decal installed on the tray, if applicable.

NOTE: Each rubber plug location will agree with a block dot on the decal installed on the tray.

- (a) Install or remove rubber plugs if it is necessary.

SUBTASK 20-10-07-910-004

- (3) If the E/E box is sensitive to electrostatic discharge, do these steps:

CAUTION: DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (a) Do this task: ESDS Handling for Metal Encased Unit Installation, TASK 20-40-12-400-802.
- (b) Do this task: Conductive Dust Cap and Conductor Cover Removal, TASK 20-40-12-000-804.

SUBTASK 20-10-07-020-013

- (4) If the E/E box is not sensitive to electrostatic discharge, remove the protective covers from the electrical connector(s).

SUBTASK 20-10-07-210-002

CAUTION: MAKE SURE THE ELECTRICAL PINS AND CONTACTS ON THE E/E BOX CONNECTOR AND TRAY CONNECTOR ARE NOT BENT OR DAMAGED. INSTALLATION OF THE E/E BOX WITH DAMAGED PINS OR CONTACTS CAN CAUSE DAMAGE TO THE E/E BOX, THE TRAY ELECTRICAL CONNECTOR, OR THE SYSTEM COMPONENTS.

- (5) Visually make sure the electrical pins of the E/E box and tray connector are not bent or damaged.
 - (a) Replace components if they are damaged, refer to SWPM 20-30-00 Electrical Connection of Equipment.

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HAP ALL; AIRPLANES WITH REXNORD AEROSPACE MECHANISMS EXTRACTOR (Continued)

SUBTASK 20-10-07-420-008

- (6) Carefully start to install the E/E box into the tray.

NOTE: For easier installation of the E/E box, lift the front of the E/E box approximately 1/8 inch (3 mm) above the tray surface.

SUBTASK 20-10-07-420-009

- (7) Continue to move the E/E box into the tray and engage the electrical connector.

NOTE: The hold-down extractor mechanism does not always provide enough force to completely engage the E/E box with the electrical connector. The E/E box must first be fully engaged and seated before using the hold-down extractor mechanism to secure the installation.

NOTE: The E/E box will engage with the electrical connector easier if you move the front of the E/E box from side to side approximately 1/8 inch (3 mm). While you shake the box, apply a strong and steady horizontal force to the front of the E/E box.

SUBTASK 20-10-07-210-018

- (8) Make sure the electrical connector is engaged.

SUBTASK 20-10-07-210-019

- (9) Move the E/E box to make sure of a tight fit.

SUBTASK 20-10-07-820-001

- (10) Turn the keeper to put the deep slot near to and aligned with the T-hook.

SUBTASK 20-10-07-420-019

- (11) Put the extractor on the T-hook and turn the keeper 180 degrees.

SUBTASK 20-10-07-420-020

- (12) To tighten the front hold-down extractor, turn the knob clockwise until the clutch engages fully.

NOTE: You will feel clicks while you turn the knob.

SUBTASK 20-10-07-420-010

- (13) Tighten the extractor.

SUBTASK 20-10-07-420-021

- (14) Install the connections to the front of the E/E box, if it is necessary.

SUBTASK 20-10-07-860-005

- (15) Close the applicable circuit breakers for the E/E box.

HAP ALL; AIRPLANES WITH HOLLINGSEAD EXTRACTOR

D. E/E Box Installation Procedure

SUBTASK 20-10-07-860-006

- (1) Make sure the applicable circuit breakers for the E/E box are open.

SUBTASK 20-10-07-210-005

- (2) Compare the quantity and location of the rubber plugs with the decal installed on the tray, if applicable.

NOTE: Each rubber plug location will agree with a block dot on the decal installed on the tray.

- (a) Install or remove rubber plugs if it is necessary.

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HAP ALL; AIRPLANES WITH HOLLINGSEAD EXTRACTOR (Continued)

SUBTASK 20-10-07-910-005

- (3) If the E/E box is sensitive to electrostatic discharge, do these steps:

CAUTION: DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (a) Do this task: ESDS Handling for Metal Encased Unit Installation, TASK 20-40-12-400-802.
(b) Do this task: Conductive Dust Cap and Conductor Cover Removal, TASK 20-40-12-000-804.

SUBTASK 20-10-07-020-014

- (4) If the E/E box is not sensitive to electrostatic discharge, remove the protective covers from the electrical connector(s).

SUBTASK 20-10-07-210-006

CAUTION: MAKE SURE THE ELECTRICAL PINS AND CONTACTS ON THE E/E BOX CONNECTOR AND TRAY CONNECTOR ARE NOT BENT OR DAMAGED. INSTALLATION OF THE E/E BOX WITH DAMAGED PINS OR CONTACTS CAN CAUSE DAMAGE TO THE E/E BOX, THE TRAY ELECTRICAL CONNECTOR, OR THE SYSTEM COMPONENTS.

- (5) Visually make sure the electrical pins of the E/E box and tray connector are not bent or damaged.
(a) Replace components if they are damaged.

SUBTASK 20-10-07-420-011

- (6) Carefully start to install the box into the tray.

NOTE: For easier installation of the E/E box, lift the front of the E/E box approximately about 1/8 inch (3 mm) above the tray surface.

SUBTASK 20-10-07-420-012

- (7) Continue to move the box into the tray and engage the electrical connector.

NOTE: The E/E box will engage with the electrical connector easier if you shake the front of the E/E box from side to side approximately 1/8 inch (3 mm). While you shake the box, apply a light horizontal force to the front of the E/E box.

SUBTASK 20-10-07-820-002

- (8) Align the front hold-down extractor with the T-hook.

SUBTASK 20-10-07-420-022

- (9) Put the extractor on the T-hook and turn the latch clockwise.

SUBTASK 20-10-07-420-023

- (10) Turn the knob on the front hold-down extractor clockwise until you cannot see the red band and the clutch engages.

SUBTASK 20-10-07-210-007

- (11) Shake the E/E box to make sure of a tight fit.

SUBTASK 20-10-07-420-013

- (12) Tighten the extractor.

SUBTASK 20-10-07-210-008

- (13) Make sure the electrical connector is engaged.

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SUBTASK 20-10-07-420-024

(14) Install the connections to the front of the E/E box, if it is necessary.

SUBTASK 20-10-07-860-007

(15) Close the applicable circuit breakers for the E/E box.

HAP ALL; AIRPLANES WITH HARTWELL EXTRACTOR

E. E/E Box Installation

SUBTASK 20-10-07-860-008

(1) Make sure the applicable circuit breakers for the E/E box are open.

SUBTASK 20-10-07-210-009

(2) Compare the quantity and location of the rubber plugs with the decal installed on the tray, if applicable.

NOTE: Each rubber plug location will agree with a block dot on the decal installed on the tray.

(a) Install or remove rubber plugs if it is necessary.

SUBTASK 20-10-07-910-006

(3) If the E/E box is sensitive to electrostatic discharge, do these steps:

CAUTION: DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

(a) Do this task: ESDS Handling for Metal Encased Unit Installation, TASK 20-40-12-400-802.

(b) Do this task: Conductive Dust Cap and Conductor Cover Removal, TASK 20-40-12-000-804.

SUBTASK 20-10-07-020-015

(4) If the E/E box is not sensitive to electrostatic discharge, remove the protective covers from the electrical connector(s).

SUBTASK 20-10-07-210-010

CAUTION: MAKE SURE THE ELECTRICAL PINS AND CONTACTS ON THE E/E BOX CONNECTOR AND TRAY CONNECTOR ARE NOT BENT OR DAMAGED. INSTALLATION OF THE E/E BOX WITH DAMAGED PINS OR CONTACTS CAN CAUSE DAMAGE TO THE E/E BOX, THE TRAY ELECTRICAL CONNECTOR, OR THE SYSTEM COMPONENTS.

(5) Visually make sure the electrical pins of the E/E box and tray connector are not bent or damaged.

(a) Replace components if they are damaged.

SUBTASK 20-10-07-420-014

(6) Carefully start to install the box into the tray.

NOTE: For easier installation of the E/E box, lift the front of the E/E box approximately about 1/8 inch (3 mm) above the tray surface.

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SUBTASK 20-10-07-420-015

- (7) Continue to move the box into the tray and engage the electrical connector.

NOTE: The E/E box will engage with the electrical connector easier if you shake the front of the E/E box from side to side approximately 1/8 inch (3 mm). While you shake the box, apply a light horizontal force to the front of the E/E box.

SUBTASK 20-10-07-820-003

- (8) Compress the keeper to engage the T-hook on the E/E box.

SUBTASK 20-10-07-420-025

- (9) To tighten the front hold-down extractors, turn the knob clockwise until the clutch engages fully.

NOTE: You will feel clicks while you turn the knob.

SUBTASK 20-10-07-210-011

- (10) Move the E/E box to make sure of a tight fit.

SUBTASK 20-10-07-420-016

- (11) Tighten the extractor.

SUBTASK 20-10-07-210-012

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

SUBTASK 20-10-07-420-026

- (13) Install the connections to the front of the E/E box, if it is necessary.

SUBTASK 20-10-07-860-009

- (14) Close the applicable circuit breakers for the E/E box.

HAP ALL; AIRPLANES WITH LEVER LATCH HANDLES

F. E/E Box Installation

SUBTASK 20-10-07-860-013

- (1) Make sure the applicable circuit breakers for the E/E box are open.

SUBTASK 20-10-07-210-015

- (2) Compare the quantity and location of the rubber plugs with the decal installed on the tray, if applicable.

NOTE: Each rubber plug location will agree with a block dot on the decal installed on the tray.

- (a) Install or remove rubber plugs if it is necessary.

SUBTASK 20-10-07-910-010

- (3) If the E/E box is sensitive to electrostatic discharge, do these steps:

CAUTION: DO NOT TOUCH THE E/E BOX BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE E/E BOX.

- (a) Do this task: ESDS Handling for Metal Encased Unit Installation, TASK 20-40-12-400-802.
(b) Do this task: Conductive Dust Cap and Conductor Cover Removal, TASK 20-40-12-000-804.

SUBTASK 20-10-07-020-020

- (4) If the E/E box is not sensitive to electrostatic discharge, remove the protective covers from the electrical connector(s).

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SUBTASK 20-10-07-210-016

CAUTION: MAKE SURE THE ELECTRICAL PINS AND CONTACTS ON THE E/E BOX CONNECTOR AND TRAY CONNECTOR ARE NOT BENT OR DAMAGED. INSTALLATION OF THE E/E BOX WITH DAMAGED PINS OR CONTACTS CAN CAUSE DAMAGE TO THE E/E BOX, THE TRAY ELECTRICAL CONNECTOR, OR THE SYSTEM COMPONENTS.

(5) Visually make sure the electrical pins of the E/E box and tray connector are not bent or damaged.

(a) Replace components if they are damaged.

SUBTASK 20-10-07-420-029

(6) Carefully start to install the box into the tray with the lever in the open position.

NOTE: For easier installation of the E/E box, lift the front of the E/E box approximately about 1/8 inch (3 mm) above the tray surface.

SUBTASK 20-10-07-420-030

(7) Continue to move the box into the tray until the lever engages the shelf-mounted fork and the electrical connector is engaged.

NOTE: The E/E box will engage with the electrical connector easier if you shake the front of the E/E box from side to side approximately 1/8 inch (3 mm). While you shake the box, apply a light horizontal force to the front of the E/E box.

SUBTASK 20-10-07-820-004

(8) Move lever latch to its locked position and verify proper adjustment.

(a) To adjust the lever latch fork, do this task, do this task: Adjust Lever Latch Fork, TASK 20-10-07-820-801.

SUBTASK 20-10-07-210-017

(9) Make sure the electrical connector is engaged.

SUBTASK 20-10-07-420-031

(10) Install the connections to the front of the E/E box, if it is necessary.

SUBTASK 20-10-07-860-014

(11) Close the applicable circuit breakers for the E/E box.

HAP ALL

————— **END OF TASK** —————

TASK 20-10-07-820-801

4. Adjust Lever Latch Fork

(Figure 201)

A. Prepare For Adjustment

SUBTASK 20-10-07-020-021

(1) To remove the unit with the lever latch, do this task: E/E Box Removal, TASK 20-10-07-000-801.

SUBTASK 20-10-07-020-022

(2) If installed, loosen jamnut on fork assembly.

SUBTASK 20-10-07-010-002

(3) Examine all parts of latching mechanism for serviceability.

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B. Adjust Lever Latch Fork

SUBTASK 20-10-07-420-032

- (1) Install unit back on shelf until connectors are partially engaged, do this task: E/E Box Installation, TASK 20-10-07-400-801.

SUBTASK 20-10-07-420-033

- (2) Engage lever latch hook with fork assembly pin.

SUBTASK 20-10-07-420-034

- (3) Start closing lever latch handle.

NOTE: It is possible to determine full connector engagement by feel. A sudden increase in handle pressure, resistance to handle movement, indicates that the connectors are fully engaged.

SUBTASK 20-10-07-820-005

- (4) Adjust the fork assembly until resistance to handle movement occurs within the required gap tolerance, as shown in Figure 201.

NOTE: Loosen the nut at the shelf area for fork adjustment.

CAUTION: MAKE SURE THERE IS SUFFICIENT THREAD ENGAGEMENT IN THE LATCH FORK. WITHOUT SUFFICIENT THREAD ENGAGEMENT THE LATCH LEVER COULD FAIL, ALLOWING THE BLACK BOX TO SLIDE OUT OF POSITION.

- (a) Make sure there is sufficient thread engagement in the latch fork.

SUBTASK 20-10-07-820-006

- (5) Close handle until latched.

SUBTASK 20-10-07-420-035

- (6) Tighten jamnut to snug fit.

————— END OF TASK —————

TASK 20-10-07-000-802

5. Printed Circuit Card Removal

(Figure 202)

A. References

Reference	Title
20-40-12-000-801	ESDS Handling for Printed Circuit Board Removal (P/B 201)

B. Procedure

SUBTASK 20-10-07-860-010

- (1) Make sure you remove electrical power from the printed circuit card.

SUBTASK 20-10-07-910-007

CAUTION: DO NOT TOUCH THE PRINTED CIRCUIT CARD BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE PRINTED CIRCUIT CARD.

- (2) Make sure you, do this task: ESDS Handling for Printed Circuit Board Removal, TASK 20-40-12-000-801.

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SUBTASK 20-10-07-010-001

(3) Open the cardfile door.

SUBTASK 20-10-07-020-016

(4) Remove the printed circuit card assembly:

- (a) Release the latches.
- (b) Turn the ejectors on the printed circuit card assembly until the printed circuit card is loose in the guide.
- (c) Carefully move the printed circuit card assembly out along the guide.
- (d) Remove the printed circuit card assembly.

————— **END OF TASK** —————

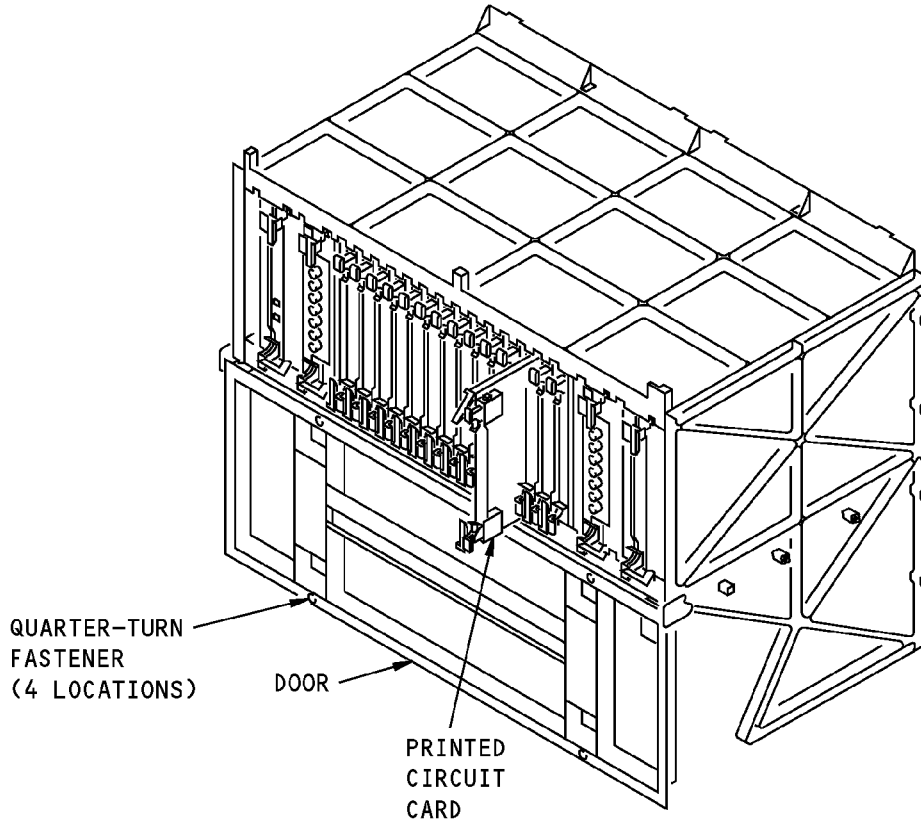
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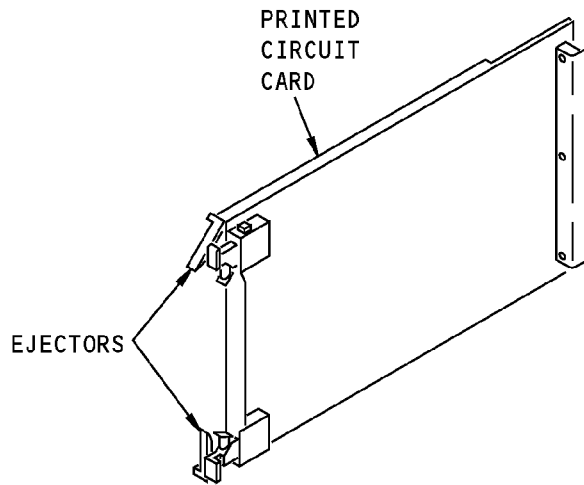
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**SYSTEMS CARDFILE
(EXAMPLE)**



**Printed Circuit Card Installation
Figure 202/20-10-07-990-802**

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TASK 20-10-07-400-802

6. Printed Circuit Card Installation

(Figure 202)

A. References

Reference	Title
20-40-12-400-801	ESDS Handling for Printed Circuit Board Installation (P/B 201)

B. Procedure

SUBTASK 20-10-07-860-011

- (1) Make sure electrical power is removed from the printed circuit card.

SUBTASK 20-10-07-910-008

CAUTION: DO NOT TOUCH THE PRINTED CIRCUIT CARD BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE PRINTED CIRCUIT CARD.

- (2) Make sure you, do this task: ESDS Handling for Printed Circuit Board Installation, TASK 20-40-12-400-801.

SUBTASK 20-10-07-210-013

- (3) Make sure the edge connector has no bent pins.

SUBTASK 20-10-07-420-017

- (4) Put the printed circuit card assembly into the guide.

SUBTASK 20-10-07-420-018

- (5) Carefully push the printed circuit card in until it correctly engages with the electrical connector.

- (a) Press the latches until both of the lock pins snap into position.

SUBTASK 20-10-07-210-014

- (6) Manually turn the ejector levers to tighten the printed circuit card assembly.

NOTE: The levers should be approximately vertical.

END OF TASK

TASK 20-10-07-020-801

7. E/E Shelf Assembly Removal

(Figure 203)

A. Location Zones

Zone	Area
117	Electrical and Electronics Compartment - Left

B. Procedure

SUBTASK 20-10-07-020-023

- (1) Remove each LRU from the applicable rack-mounted shelf. To do this, refer to each applicable LRU removal procedure.

SUBTASK 20-10-07-020-024

- (2) Remove the electrical connector receptacles from the electronic equipment shelf assembly as required.

- (a) Remove the grounding wires as required.

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SUBTASK 20-10-07-020-025

(3) Disconnect the grounding wire from the electronic equipment rack.

SUBTASK 20-10-07-020-026

(4) Disconnect the electronic equipment cooling hoses as required.

SUBTASK 20-10-07-020-027

(5) Remove the shelf assembly attach bolts, washers, and nuts.

SUBTASK 20-10-07-020-028

(6) Remove the shelf assembly.

————— **END OF TASK** —————

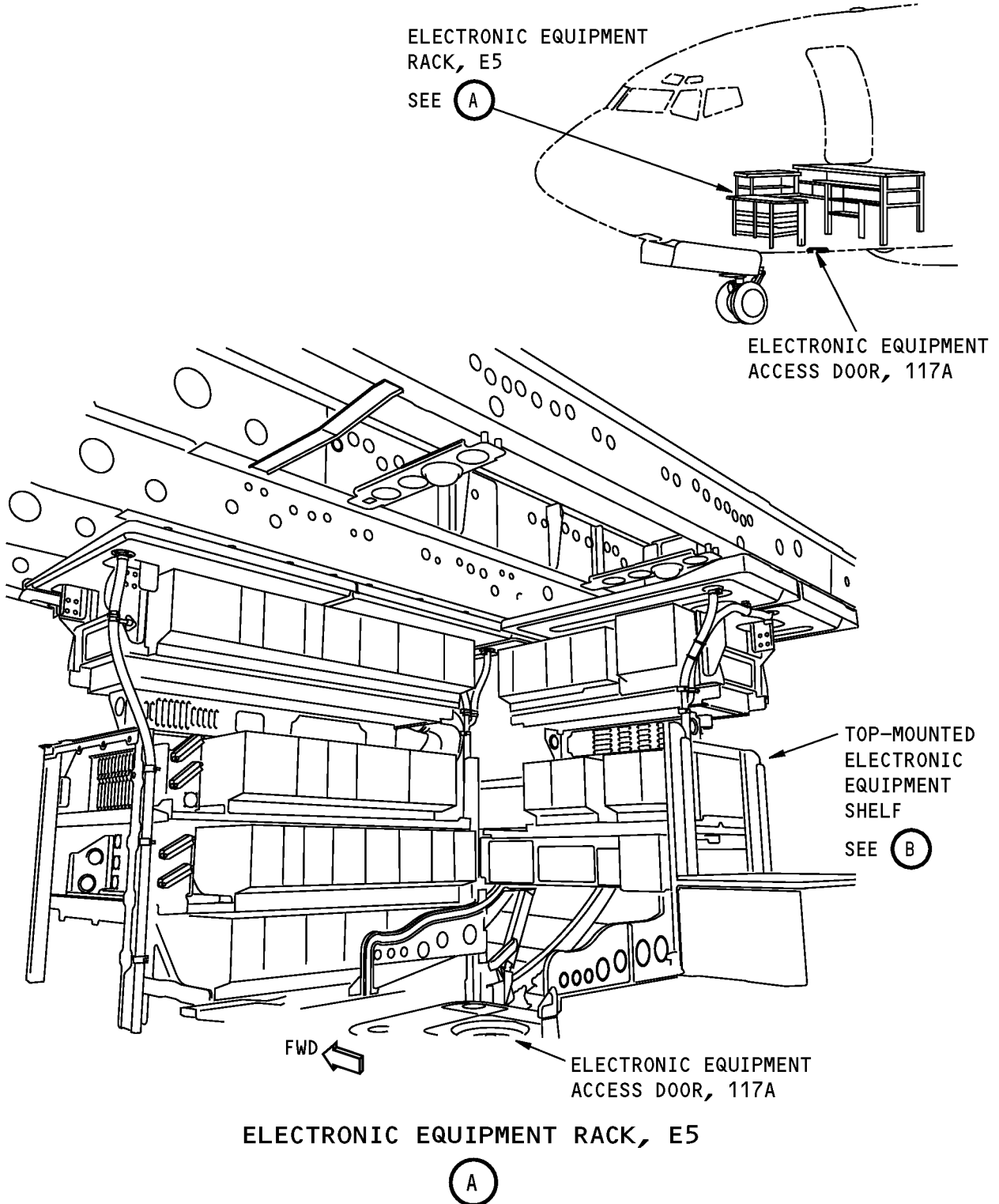
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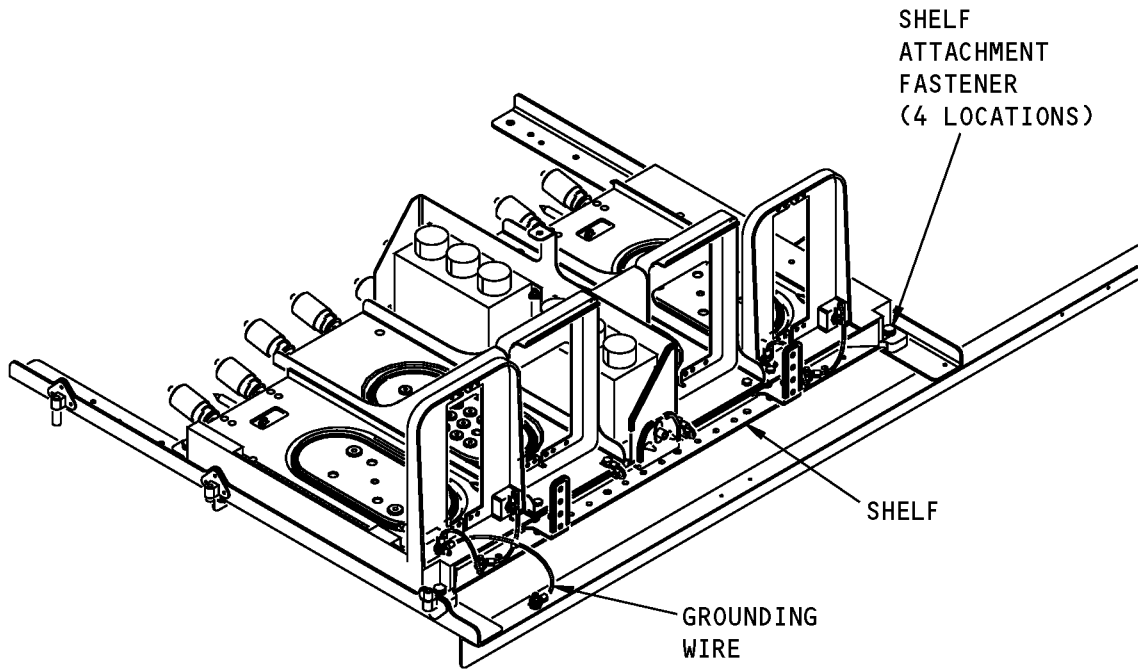
**Electronic Equipment Shelf
Figure 203 (Sheet 1 of 4)/20-10-07-990-803**

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**TOP-MOUNTED ELECTRONIC EQUIPMENT SHELF
(EXAMPLE)**

B

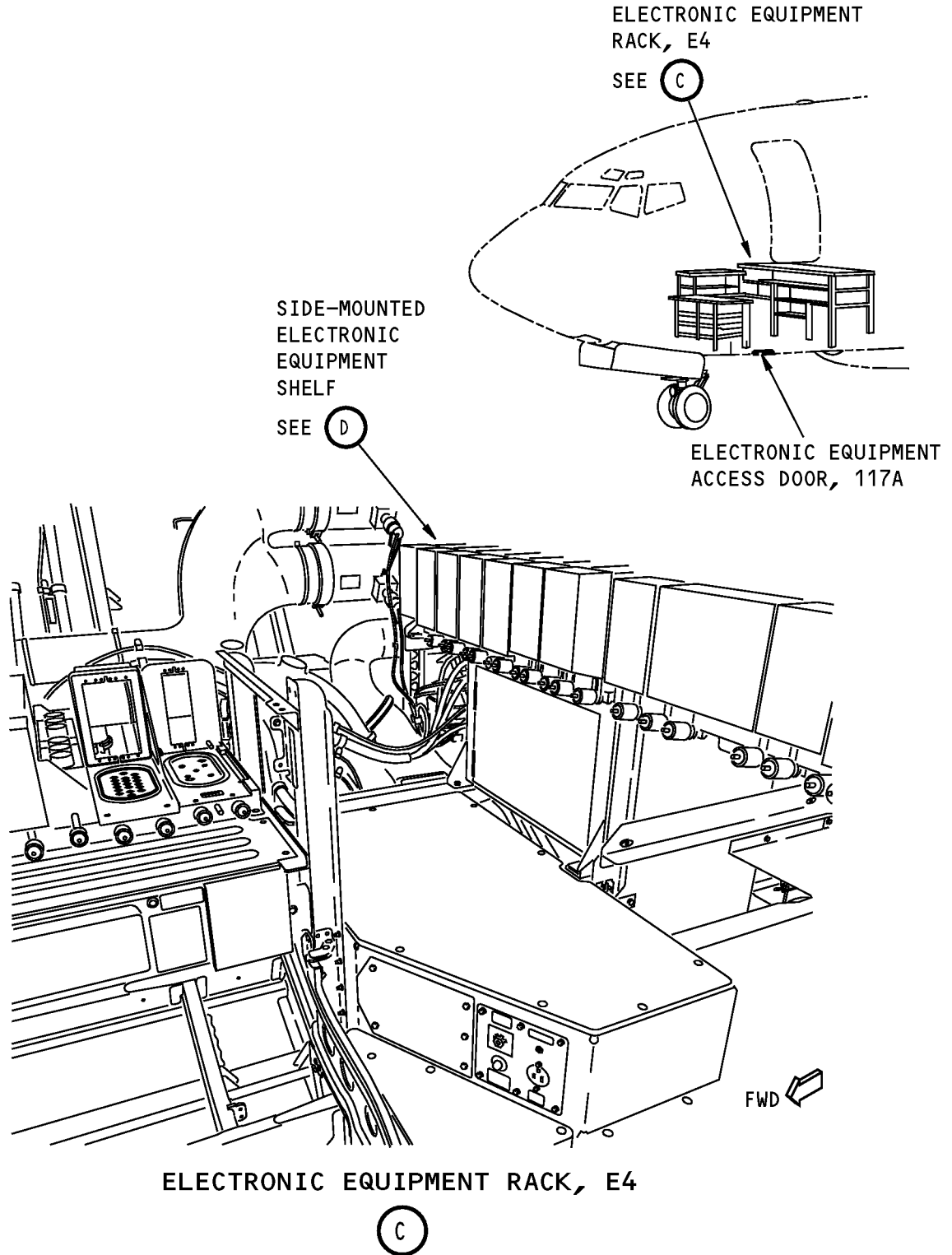
**Electronic Equipment Shelf
Figure 203 (Sheet 2 of 4)/20-10-07-990-803**

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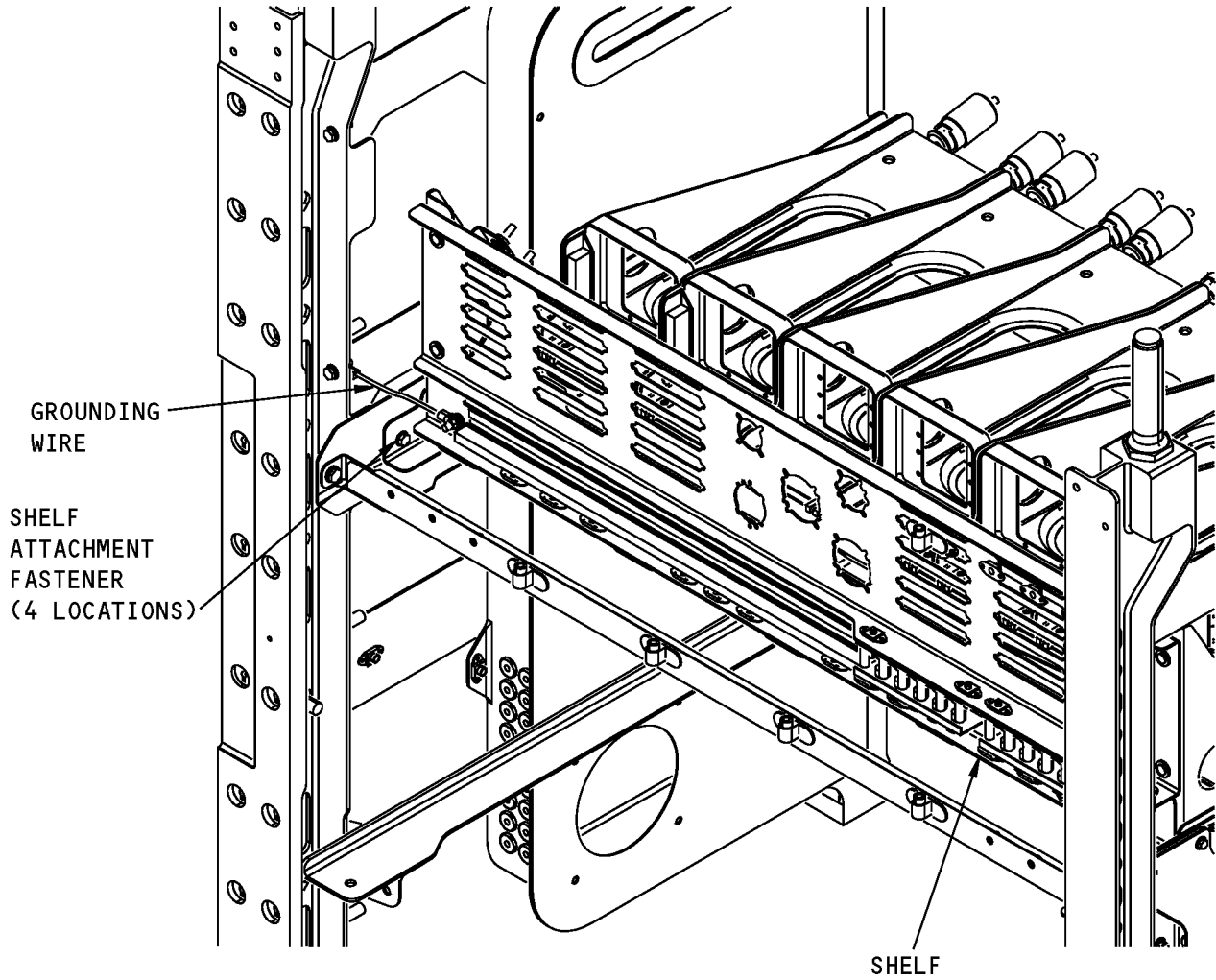
Electronic Equipment Shelf
Figure 203 (Sheet 3 of 4)/20-10-07-990-803

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**SIDE-MOUNTED ELECTRONIC EQUIPMENT SHELF
(EXAMPLE)**

D

**Electronic Equipment Shelf
Figure 203 (Sheet 4 of 4)/20-10-07-990-803**

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TASK 20-10-07-400-803

8. E/E Shelf Assembly Installation

(Figure 203)

A. References

Reference	Title
SWPM 20-20-00	Standard Wiring Practices Manual

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1550	Meter - Bonding (Approved Explosion Proof & Intrinsically Safe) (Part #: C15292 (MODEL T477W), Supplier: 01014, A/P Effectivity: 737-ALL) (Part #: M1, Supplier: 3AD17, A/P Effectivity: 737-ALL) (Part #: M1B, Supplier: 3AD17, A/P Effectivity: 737-ALL)

C. Location Zones

Zone	Area
117	Electrical and Electronics Compartment - Left

D. Procedure

SUBTASK 20-10-07-420-036

- (1) Install the shelf assembly in the electronic equipment rack with the attach bolts, washers, and nuts.

SUBTASK 20-10-07-420-037

- (2) Install the equipment cooling hoses as required.

SUBTASK 20-10-07-420-038

- (3) Install the shelf assembly grounding wire to the electronic equipment rack.
 - (a) Use an bonding meter, COM-1550 to make sure the resistance between the electronic equipment rack and the electronic equipment shelf is less than or equal to .0025 ohms (SWPM 20-20-00).

SUBTASK 20-10-07-420-039

- (4) Install the electrical receptacles in the electronic equipment shelf, as applicable.
 - (a) Connect the electrical connector grounding wires, as applicable.
 - (b) Use an bonding meter, COM-1550 to make sure the resistance between each connector grounding wire and the electronic equipment shelf is less than or equal to .0010 ohms (SWPM 20-20-00).

SUBTASK 20-10-07-420-040

- (5) Install each applicable LRU. To do this, refer to each applicable LRU installation procedure.
 - (a) Make sure you do the LRU replacement test for each LRU installed.

END OF TASK

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CONTROL CABLE STOPS - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) A removal of the control cable stops.
- (2) An installation of the control cable stops.

TASK 20-10-08-960-801

2. Control Cable Stops Removal

(Figure 401)

A. Procedure

SUBTASK 20-10-08-020-001

- (1) Remove the lockwire that attaches the control cable stop to the swaged cable terminal stud.

SUBTASK 20-10-08-020-002

- (2) Move the control cable stop longitudinally away from the swaged cable terminal stud until the control cable stop disengages.

SUBTASK 20-10-08-980-001

- (3) Move the control cable stop laterally to permit the cable to go through the slot in the control cable stop.

————— **END OF TASK** —————

TASK 20-10-08-420-801

3. Control Cable Stops Installation

(Figure 401)

A. References

Reference	Title
20-10-44-400-801	Lockwires Installation (P/B 401)

B. Procedure

SUBTASK 20-10-08-420-001

- (1) Put the large center hole of the control cable stop near the swaged cable terminal stud.

SUBTASK 20-10-08-420-002

- (2) Move the slot of the control cable stop along the cable.

SUBTASK 20-10-08-420-003

- (3) Push the control cable stop on the end of the swaged cable terminal stud until the control cable stop fully engages.

SUBTASK 20-10-08-820-001

- (4) To adjust the control cable stop, twist the swaged cable terminal stud to get the dimension shown.

SUBTASK 20-10-08-420-004

- (5) Install a lockwire from the control cable stop to the swaged cable terminal stud, do this task: Lockwires Installation, TASK 20-10-44-400-801.

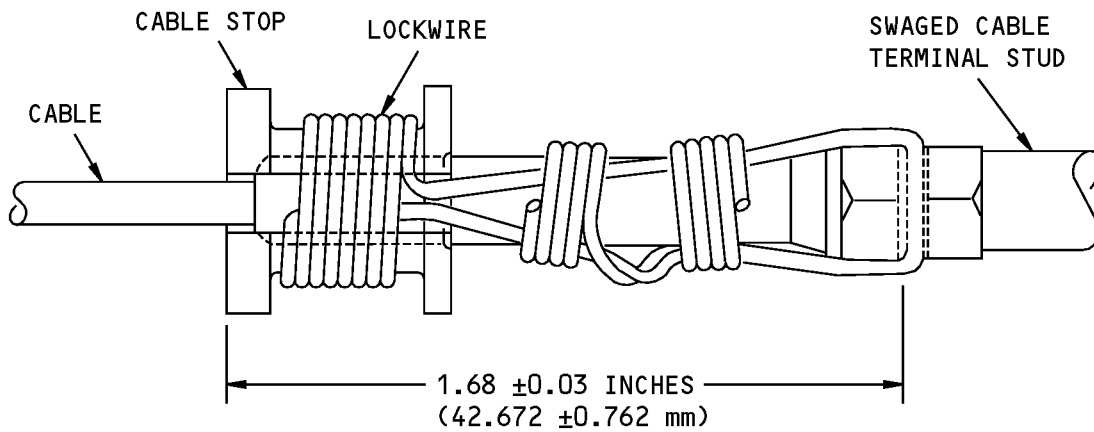
————— **END OF TASK** —————

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**Control Cable Stops Installation
Figure 401/20-10-08-990-801**

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CONTROL CABLE PULLEYS - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) A removal of the control cable pulleys.
- (2) An installation of the control cable pulleys.

B. (Figure 401) shows examples of control cable pulleys. If this procedure does not agree with specified maintenance procedures, use the specified maintenance procedures.

TASK 20-10-09-000-801

2. Control Cable Pulleys Removal

(Figure 401)

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-1569	Clamp - Control Cable (Part #: A20005-9, Supplier: 81205, A/P Effectivity: 737-100, -200, -200C, -300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)

B. Procedure

SUBTASK 20-10-09-020-002

- (1) Install cable control cable clamp, SPL-1569 on the cable between the pulley to keep light tension.

NOTE: Keep light tension on cables not removed so that cable drums will not unwrap and the cable will not move out of the pulley guides. As an option, you can install rigging pins through the applicable drum or quadrant to isolate cable sections.

SUBTASK 20-10-09-020-003

- (2) Loosen the turnbuckle nearest to the control cable pulley to release tension.

SUBTASK 20-10-09-020-004

- (3) Remove the bolt from the pulley disk.

SUBTASK 20-10-09-020-001

- (4) Remove the pulley disk.

————— **END OF TASK** —————

TASK 20-10-09-400-801

3. Control Cable Pulleys Installation

(Figure 401)

A. References

Reference	Title
20-10-10-400-801	Turnbuckle Lock Installation (P/B 401)

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B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1553	Tensiometer - Cable (20 - 200 LB) (Part #: 102-03110, Supplier: 21844, A/P Effectivity: 737-ALL) (Part #: ACM-200, Supplier: 13331, A/P Effectivity: 737-ALL) (Part #: T60-1001-C8-1A, Supplier: 0N8U4, A/P Effectivity: 737-ALL)
SPL-1569	Clamp - Control Cable (Part #: A20005-9, Supplier: 81205, A/P Effectivity: 737-100, -200, -200C, -300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)

C. Procedure

SUBTASK 20-10-09-420-001

- (1) Install the components applicable to the control cable pulley.

SUBTASK 20-10-09-420-002

- (2) Install the turnbuckles with the turnbuckle barrel installed an equal distance on the two threaded terminals.

NOTE: Do not let more than three threads show out of the turnbuckle barrel.

SUBTASK 20-10-09-020-005

- (3) Remove the cable control cable clamp, SPL-1569 and rigging pins from the control cable and drums.

SUBTASK 20-10-09-420-003

- (4) Tighten the cable as shown in the temperature-tension chart of the applicable system chapter.
 - (a) Do a check of the cable tension with a 20 - 200 lb cable tensiometer, COM-1553.

NOTE: Attach the tensiometer to the cable at least six inches (15 mm) from the turnbuckle terminal or other fittings.

SUBTASK 20-10-09-420-004

- (5) Do this task: Turnbuckle Lock Installation, TASK 20-10-10-400-801.
on all turnbuckles that you adjusted.

SUBTASK 20-10-09-710-001

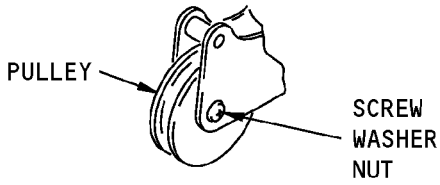
- (6) Operate the controls, as specified in the applicable system chapter, through full travel.
 - (a) Make sure the controls move freely.
 - (b) Make sure the force is not excessive or abnormal.

————— **END OF TASK** —————

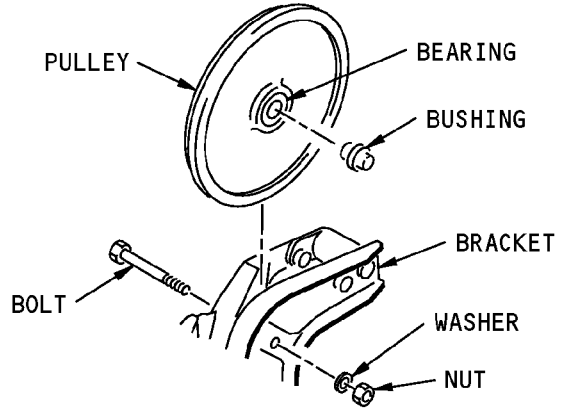
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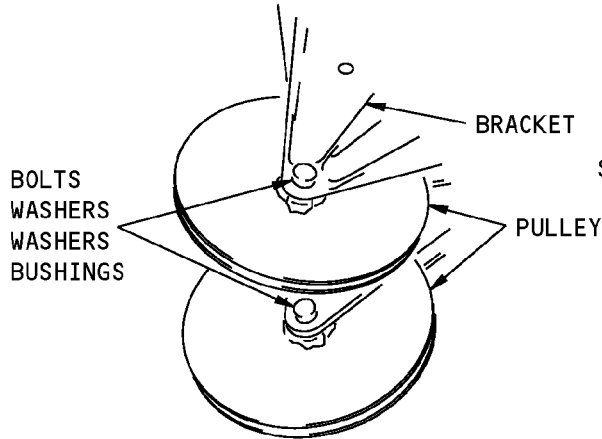
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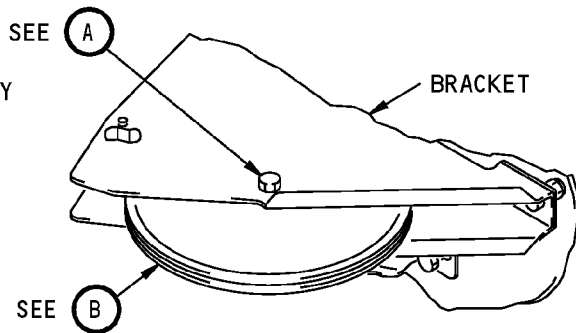
SINGLE PULLEY INSTALLATION



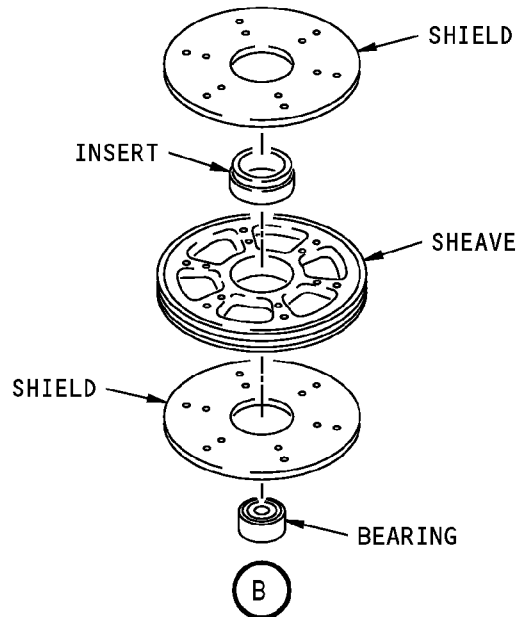
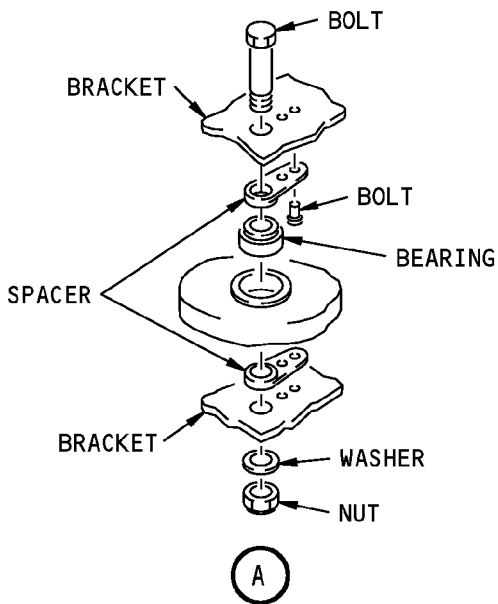
PULLEY WITH BEARING AND BUSHING



DOUBLE PULLEY INSTALLATION



DETAILED PULLEY



Control Cable Pulleys Installation
Figure 401/20-10-09-990-801

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TURNBUCKLE LOCK - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) Turnbuckle lock removal.
- (2) Turnbuckle lock installation.

TASK 20-10-10-000-801

2. Turnbuckle Locking Clips Removal

(Figure 401)

A. Procedure

SUBTASK 20-10-10-860-001

- (1) Twist the turnbuckle locking clip.

SUBTASK 20-10-10-860-002

- (2) Push the locking hook out of the hole in the center of the turnbuckle barrel.

SUBTASK 20-10-10-020-001

- (3) Move the turnbuckle locking clip out from the turnbuckle slot.

————— **END OF TASK** —————

TASK 20-10-10-400-801

3. Turnbuckle Lock Installation

(Figure 401)

A. Consumable Materials

Reference	Description	Specification
C00528	Compound - Corrosion Preventive, Petroleum Hot Application (Soft Film)	MIL-C-11796, Class III

B. Locking Clip Installation

SUBTASK 20-10-10-420-001

CAUTION: DO NOT USE THE TURNBUCKLE LOCKING CLIPS AGAIN. THEY CAN BE DEFECTIVE IF YOU USE THEM AGAIN. THIS CAN CAUSE DAMAGE TO EQUIPMENT.

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

SUBTASK 20-10-10-820-001

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

SUBTASK 20-10-10-420-006

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

SUBTASK 20-10-10-420-002

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

SUBTASK 20-10-10-420-003

- (5) Engage the hook into the hole.

SUBTASK 20-10-10-420-004

- (6) Push the hook shoulder to engage the hook in the turnbuckle.

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SUBTASK 20-10-10-420-005

- (7) Do steps 3 through 5 again to lock the second terminal.

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

SUBTASK 20-10-10-820-002

- (8) To make sure the two turnbuckle locking clips are correctly installed, turn the turnbuckle slightly.

SUBTASK 20-10-10-210-001

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

C. Lockwire Installation (alternate method to locking clips)

SUBTASK 20-10-10-600-001

- (1) Apply a thin coat of compound, C00528 to barrel and cable terminals.

SUBTASK 20-10-10-420-007

- (2) Engage turnbuckle barrel equally with cable terminals and turn barrel until not more than three threads are exposed outside the barrel and the proper cable tension is reached.

SUBTASK 20-10-10-420-008

- (3) Insert correct diameter stainless steel soft annealed wire into either cable terminal. Use .024 for 1/16 inch cable, .031 for 3/32 or 1/8 inch cable, and .043 for 5/32 through 5/16 inch cable.

SUBTASK 20-10-10-420-009

- (4) Twist wire.

NOTE: Do not use a tool which might damage the wire.

SUBTASK 20-10-10-420-010

- (5) Insert ends of wire through opposite holes in barrel. Pull wire through. If tool is used, apply only on ends of wire.

SUBTASK 20-10-10-420-011

- (6) Twist wire down to hole in terminal; insert end of one wire in hole, pull through and twist ends together. Cut off length in excess of 5/8 inch of twisted ends.

SUBTASK 20-10-10-420-012

- (7) Push twisted ends back to lie flat against terminal.

————— **END OF TASK** —————

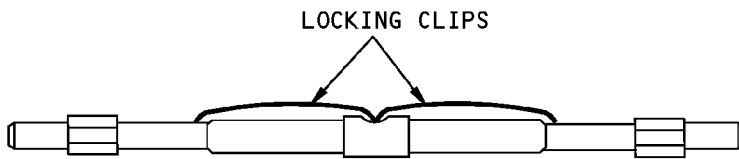
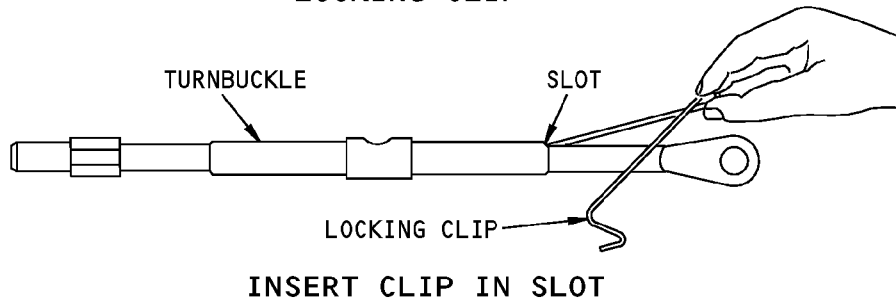
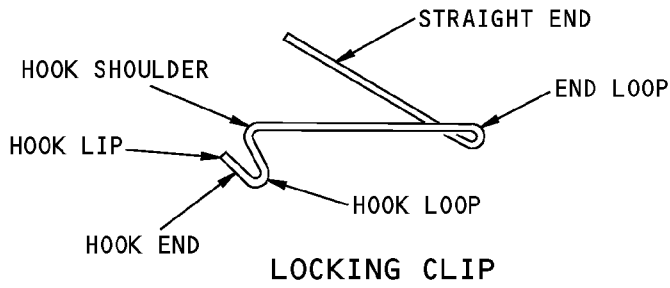
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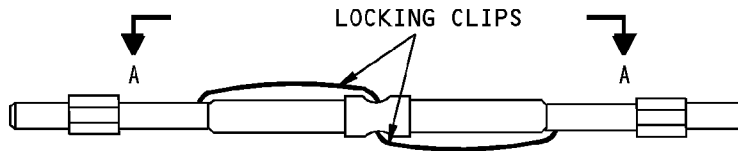
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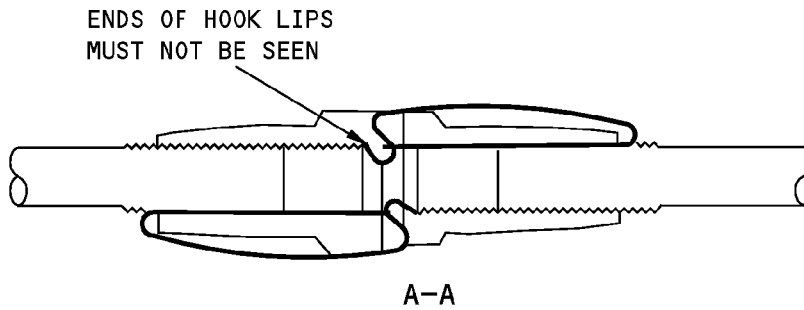
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LOCKING CLIP INSERTED IN SAME TURNBUCKLE BARREL HOLE



LOCKING CLIP INSERTED IN OPPOSITE TURNBUCKLE BARREL HOLE



**Turnbuckle Locking Clip
Figure 401/20-10-10-990-801**

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PRESSURE-SENSITIVE DECALS - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
 - (1) A removal of the pressure-sensitive decals.
 - (2) An installation of the pressure-sensitive decals.
- B. Apply external decal sections in a sequence where the ends make an 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 plastic film decals with naphtha. Do not use adhesive activator.
- E. You can remove air bubbles in the eight hours after you apply the decal. Make a small 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 you use for pressure-sensitive placards. These are the tasks:
 - Pressure Sensitive Placard Removal, TASK 20-10-14-000-801,
 - Pressure Sensitive Placard Installation, TASK 20-10-14-400-801.

TASK 20-10-11-000-802

2. Pressure-Sensitive Decal Removal

(Figure 401)

A. References

Reference	Title
20-30-89-910-801	Final Cleaning of All Organic Coatings Prior to Non-structural Bonding (Series 89) (P/B 201)
51-21-11-150-801	Paint Stripping (P/B 701)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-2481	Tool - Sealant Removal, BAC5000, PSD 6-184 Approved (Part #: 1-6390-A, Supplier: 63318, A/P Effectivity: 737-ALL) (Part #: 10810, Supplier: \$0855, A/P Effectivity: 737-ALL) (Part #: 234350, Supplier: \$0857, A/P Effectivity: 737-ALL) (Part #: 311, Supplier: KA861, A/P Effectivity: 737-ALL) (Part #: 411B60, Supplier: 3DN12, A/P Effectivity: 737-ALL) (Part #: 411B90, Supplier: 3DN12, A/P Effectivity: 737-ALL) (Part #: DAD5013, Supplier: \$0856, A/P Effectivity: 737-ALL) (Part #: DFD5019, Supplier: \$0856, A/P Effectivity: 737-ALL) (Part #: J5-0275-2010, Supplier: 435R8, A/P Effectivity: 737-ALL) (Part #: SCD5019, Supplier: \$0856, A/P Effectivity: 737-ALL) (Part #: ST982LF, Supplier: 3Z323, A/P Effectivity: 737-ALL) (Part #: TS1275-4, Supplier: 1DWR5, A/P Effectivity: 737-ALL)
COM-2615	Light - Work ***Safety*** (Part #: EP-300-026-50, Supplier: 15664, A/P Effectivity: 737-ALL) (Part #: EP326-16S-50, Supplier: 15664, A/P Effectivity: 737-ALL)
STD-3925	Heater - Blower, Explosion Proof, Electric

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C. Consumable Materials

Reference	Description	Specification
B01009	Solvent - Final Clning Of All Organic Ctgs Before Non-Structural Bonding (AMM20-30-89/201) - Series 89	
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5

D. Procedure

SUBTASK 20-10-11-020-001

(1) To remove external decals, do this task: Paint Stripping, TASK 51-21-11-150-801.

SUBTASK 20-10-11-020-002

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

(2) To remove internal decals, use heat or solvent.

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

1) Heat the decal with a explosion proof electric blower - heater, STD-3925 or a work light, COM-2615, to approximately 120°F until the adhesive becomes soft.

NOTE: If you use too much heat, the decal will melt. If the decal melts, remove it with solvent.

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

2) Lift the corner of the decal with a sealant removal tool, COM-2481.

3) Remove the decal from the surface.

(b) Remove decals with solvent:

1) Apply Series 89 solvent, B01009 (TASK 20-30-89-910-801) to the decal with a brush or cloth.

2) When the decal has wrinkles (after approximately two minutes), apply solvent again.

3) After approximately two minutes, move the soft decal off of the surface or remove with a spatula.

(c) If necessary, clean the surface with a cotton wiper, G00034 that is moist with Series 89 solvent, B01009 (TASK 20-30-89-910-801).

————— **END OF TASK** —————

TASK 20-10-11-400-801

3. Pressure-Sensitive Decal Installation

(Figure 401)

A. References

Reference	Title
20-30-89-910-801	Final Cleaning of All Organic Coatings Prior to Non-structural Bonding (Series 89) (P/B 201)
51-21-00-100-801	Airplane Surface Preparation for Application of Finish (P/B 701)

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(Continued)

Reference	Title
51-21-31-350-801	Removal and Control of Corrosion for Aluminum and Aluminum Alloys (P/B 701)
51-21-61-390-801	Hydraulic Fluid Resistant Finish Application (P/B 701)
51-31-00 P/B 201	SEALS AND SEALING - MAINTENANCE PRACTICES

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-2481	Tool - Sealant Removal, BAC5000, PSD 6-184 Approved (Part #: 1-6390-A, Supplier: 63318, A/P Effectivity: 737-ALL) (Part #: 10810, Supplier: \$0855, A/P Effectivity: 737-ALL) (Part #: 234350, Supplier: \$0857, A/P Effectivity: 737-ALL) (Part #: 311, Supplier: KA861, A/P Effectivity: 737-ALL) (Part #: 411B60, Supplier: 3DN12, A/P Effectivity: 737-ALL) (Part #: 411B90, Supplier: 3DN12, A/P Effectivity: 737-ALL) (Part #: DAD5013, Supplier: \$0856, A/P Effectivity: 737-ALL) (Part #: DFD5019, Supplier: \$0856, A/P Effectivity: 737-ALL) (Part #: J5-0275-2010, Supplier: 435R8, A/P Effectivity: 737-ALL) (Part #: SCD5019, Supplier: \$0856, A/P Effectivity: 737-ALL) (Part #: ST982LF, Supplier: 3Z323, A/P Effectivity: 737-ALL) (Part #: TS1275-4, Supplier: 1DWR5, A/P Effectivity: 737-ALL)
SPL-8870	Cutter - Scotchcal (Part #: ST732-190, Supplier: 81205, A/P Effectivity: 737-100, -200, -200C, -300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: ST732-250, Supplier: 81205, A/P Effectivity: 737-100, -200, -200C, -300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: ST732-312, Supplier: 81205, A/P Effectivity: 737-100, -200, -200C, -300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)

C. Consumable Materials

Reference	Description	Specification
B00083	Solvent - Aliphatic Naphtha (For Acrylic Plastics)	TT-N-95 Type II, ASTM D-3735 Type III
B00130	Alcohol - Isopropyl	TT-I-735
B00137	Abrasive - Garnet Coated Paper	ANSI B74.18
B01009	Solvent - Final Clning Of All Organic Ctgs Before Non-Structural Bonding (AMM20-30-89/201) - Series 89	
C00260	Coating - Chemical And Solvent Resistant Finish, Epoxy Resin Enamel	BMS10-11, Type II
C50020	Kit - Edge Seal With Activator (Desothane) - CA8000/B900B with CA8000B	BAC5312
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5
G00270	Tape - Scotch Flatback Masking 250	ASTM D6123 (Supersedes A-A-883)

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D. Prepare the Surfaces for Installation

SUBTASK 20-10-11-110-001

- (1) To clean corroded aluminum surfaces, do this task: Removal and Control of Corrosion for Aluminum and Aluminum Alloys, TASK 51-21-31-350-801.

SUBTASK 20-10-11-110-002

- (2) Clean wax-coated aluminum surfaces until area shows a water-break-free surface, do this task: Airplane Surface Preparation for Application of Finish, TASK 51-21-00-100-801.

SUBTASK 20-10-11-110-003

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE DANGEROUS MATERIALS. SOLVENTS CAN BE FLAMMABLE. OBEY THE MATERIAL SAFETY DATA SHEETS (MSDS) FOR SOLVENTS. OBEY LOCAL REGULATIONS FOR THE CORRECT PROCEDURES TO USE OR DISCARD SOLVENTS. SOLVENTS CAN CAUSE INJURIES TO PERSONNEL AND DAMAGE TO EQUIPMENT.

- (3) Use solvent, B00083 or alcohol, B00130, cleaner and a cotton wiper, G00034, to clean polyester or phenolic plastics that are not painted.
 - (a) Dry surface with a cotton wiper, G00034.

NOTE: Do not let air dry.

SUBTASK 20-10-11-110-004

- (4) Lightly sand cork surfaces with abrasive, B00137, 150 grit, until you get a clean cork surface.

NOTE: The sanded surface must be 0.38 inches (0.97 cm) wider than the decal area.

- (a) Remove sanding dust with a cotton wiper, G00034.

SUBTASK 20-10-11-110-005

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.

- (5) Clean all other surfaces thoroughly with solvent, B00083, and cotton wiper, G00034, except in preparation for application of the Refuel Panel Placard (BAC27NSF223) which requires the use of Series 89 solvent, B01009 (TASK 20-30-89-910-801), a clean dry cloth in place of solvent, B00083.

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

- (a) Dry the surface with a cotton wiper, G00034.

NOTE: Do not let air dry.

E. Prepare the Decal for Installation

SUBTASK 20-10-11-800-002

- (1) On decals with an area less than one square foot (0.093 meter²), remove the backing and put the decal face down on a smooth surface.

SUBTASK 20-10-11-420-001

- (2) On decals with an area more than one square foot (.093 meter²), use Scotch Flatback Masking Tape 250, G00270, to put the decal on the receiving surface.

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- (a) Cut a sheet of carrier tape approximately four inches (10 cm) longer than the decal and approximately the same width.

NOTE: When you use premasked decals, you can use the premask as a carrier.

- (b) Put the carrier over the decal, with the edge you will hang two to three inches beyond the decal edge.
- (c) Hang the carrier on the receiving surface with cotton wiper, G00034.
- (d) Rub the carrier on with a sealant removal tool, COM-2481.

NOTE: Use short strokes and work from the middle of the joint to the edges. Be sure to remove all wrinkles and air bubbles.

- (e) Fold the carrier and decal back at the joint, along the surface with the backing up.

NOTE: Use masking tape to hold in this position.

- (f) Remove the decal backing.

SUBTASK 20-10-11-800-003

- (3) On strip decals, remove about one foot (30 cm) of backing and put the decal face down on a smooth surface.

F. Procedure

SUBTASK 20-10-11-420-002

- (1) To apply decal to a regular surface, do these steps:

- (a) Put the decals with areas less than one square foot (.093 meter ²) in position and bond one edge to the surface.
 - 1) Hold the remainder of the decal taut and a small distance from the surface with a piece of backing on the adhesive side.
- (b) For decals with an area greater than one square foot (.093 meter ²), move the carrier into position.
 - 1) Hold the free end taut and a small distance from the surface with a piece of backing on the adhesive side.
- (c) Align and bond approximately three inches (7.6 cm) of strip decals to the receiving surface.
 - 1) Use the applied section as a joint and strip up to three feet (91.4 cm) of the backing.
 - 2) If necessary, apply activator to the adhesive.
 - 3) Align the stripping and hold it taut and a small distance away from the receiving surface.
- (d) Start at the joint and rub the decal on the surface with the sealant removal tool, COM-2481 with short fan-like strokes.

NOTE: Do not let the adhesive touch the surface until the sealant removal tool, COM-2481 pushes it down.

- (e) Continue to apply strip decals until you apply all of the decal.
- (f) When you apply strip decals around a corner and a splice occurs, overlap decal a minimum of 0.5 inches (1.27 cm) and maximum of 2.0 inches (5.1 cm).

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SUBTASK 20-10-11-420-003

CAUTION: DO NOT CAUSE DAMAGE TO THE AIRPLANE SKIN WHEN YOU CUT THE DECAL. NICKS, CUTS, SCRATCHES, OR SCRIBE LINES WILL DECREASE THE FATIGUE STRENGTH AND LIFE OF THE STRUCTURE.

- (2) To apply decals to irregular surfaces, do these steps:
- (a) To apply decals on a butt joint between two surfaces which move with respect to each other, do one of these steps:
 - 1) For distances of 0.100 inch (2.54 mm) and more, cut the decal at the approximate center of the distance.
 - a) Wind the decal around the two edges (Figure 401).
 - b) If you damage the skin or sealant, obey all the specified steps, cautions and references to inspect and repair the sealant and skin (SEALS AND SEALING - MAINTENANCE PRACTICES, PAGEBLOCK 51-31-00/201) and the applicable structural repair manual.
 - 2) For distances of less than 0.100 inch (2.54 mm), cut the decal aligned with the forward or top skin edge.
 - a) Wind the decal around the aft or bottom skin edge (Figure 401).
 - b) If you damage the skin or sealant, obey all the specified steps, cautions and references to inspect and repair the sealant and skin (SEALS AND SEALING - MAINTENANCE PRACTICES, PAGEBLOCK 51-31-00/201) and the applicable structural repair manual.
 - (b) To apply decals across overlap joints, do one of these steps:
 - 1) Wind the decal smoothly and continuously around the edge of the lap joint (Figure 401).

NOTE: This is the recommended procedure.
 - 2) Cut the decal aligned with the overlap edge and touch the remainder of the decal to the overlap edge (Figure 401) .

NOTE: You can use this method when the decal extends along the lap joint for a long distance.
 - 3) If you damage the skin or sealant, obey all the specified steps, cautions and references to inspect and repair the sealant and skin (SEALS AND SEALING - MAINTENANCE PRACTICES, PAGEBLOCK 51-31-00/201) and the applicable structural repair manual.

SUBTASK 20-10-11-000-001

- (3) To apply decals to external emergency exit handles.
- (a) Before you remove the backing paper, put the decal on the handle and cut 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.
 - (c) Use scotchcal cutter, SPL-8870 to cut decals, except pressure-sensitive Polyester, around the heads of fasteners on removable panels.
 - (d) Push the decal into the recessed slot.
 - (e) Cut and remove an area of film, of pressure-sensitive polyester decals, and approximate the size of a nonflush rivet or fastener, with a scotchcal cutter, SPL-8870.
 - (f) Push the decal firmly in position around the rivet or fastener.
 - (g) Let the adhesive cure for 1/2 hour before you seal the edges.

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- (h) Make a small hole in the decal film, with a sharp pointed instrument, at each rivet on decals applied over pressurized areas.
- (i) If you damage the skin or sealant, obey all the specified steps, cautions and references to inspect and repair the sealant and skin (SEALS AND SEALING - MAINTENANCE PRACTICES, PAGEBLOCK 51-31-00/201) and the applicable structural repair manual.

SUBTASK 20-10-11-800-005

- (4) To remove carrier, or premask and masking tape, pull back parallel to the decal surface.

NOTE: If you will paint the adjacent area, leave the premask in position.

SUBTASK 20-10-11-390-002

- (5) Seal the edges.

- (a) If you painted up to the edges of decals, seal the edges of the decal with paint.

WARNING: USE ONLY APPROVED TRANSPARENT MATERIALS ON THE ACRYLIC WINDOW PANES. PAINT, MATERIALS THAT ARE NOT TRANSPARENT, AND TRANSPARENT MATERIALS THAT ARE NOT APPROVED CAN PREVENT DETECTION OF DAMAGE. THESE MATERIALS CAN ALSO CAUSE DAMAGE TO THE STRUCTURE OF ACRYLIC WINDOWS. THIS CAN MAKE FLIGHT DANGEROUS.

- 1) If the decal has a premask, remove the premask only after you apply the last layer of paint up to the decal.

NOTE: If the edges are not sealed with paint, then apply edge sealer to decal.

- (b) Use a brush to apply CA8000/B900B with CA8000B kit, C50020 or clear base 683-3-2 with X-310A catalyst (edge sealer) to the edges of the decals that follow.

NOTE: CA8000/B900B CA800B is the preferred option for hydraulic fluid resistance and adhesion in high wind shear marker applications and has a shorter cure time. 683-3-2 with X-310A catalyst is the preferred option for hydraulic fluid resistance application only and has a long cure time.

- (c) Make sure you have a dry film thickness of 0.0010 to 0.0020 inches (0.0254-0.0508 mm).

NOTE: To make sure there is sufficient edge seal thickness, two applications of edge sealer may be necessary.

- (d) Extend the edge seal to a minimum of 0.2 inches (0.508 cm) around the marker and 0.2 inches (0.508 cm) on the marker.

- (e) Dry the edge sealer for a minimum of 30 minutes.

- (f) Let adhesive cure for a minimum of 1/2 hour, then seal the edges of pressure-sensitive polyester decals with CA8000/B900B with CA8000B kit, C50020 or clear base 683-3-2 and X-310A catalyst (edge sealer) (TASK 51-21-61-390-801).

- (g) Use a brush to apply the applicable color of coating, C00260 enamel on all open exposed rivet or fastener heads on pressure-sensitive polyester decals.

NOTE: Make an overlap on the edge of the decal of 1/4 inch (6.35 mm).

————— **END OF TASK** —————

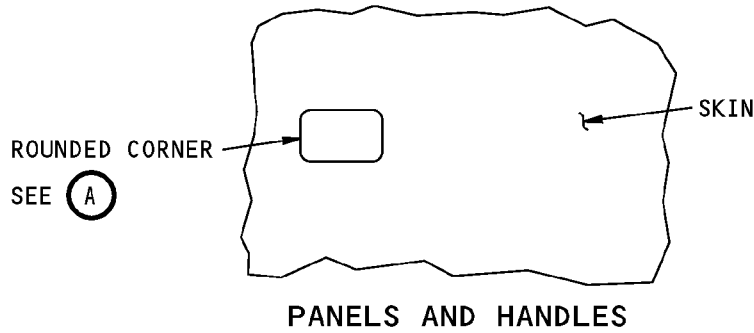
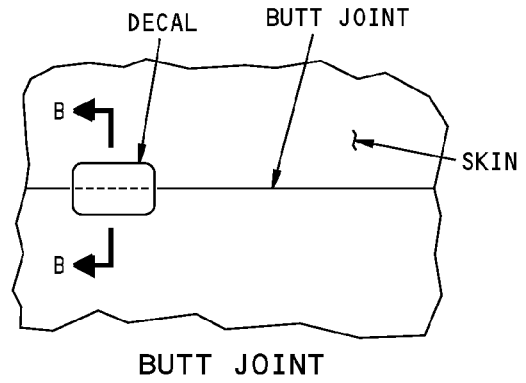
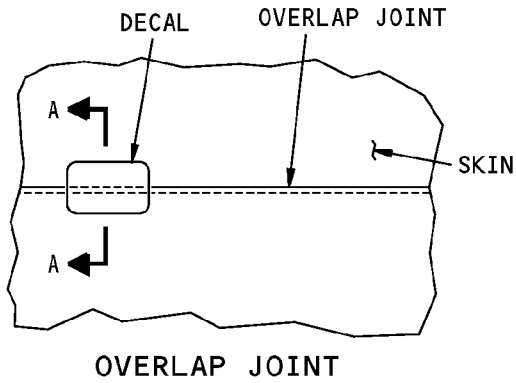
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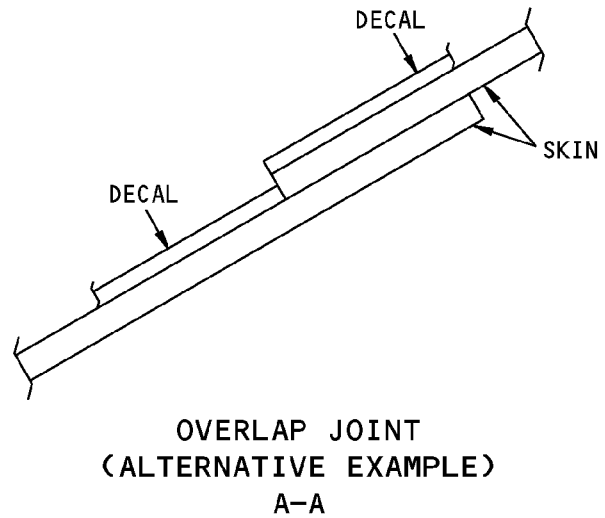
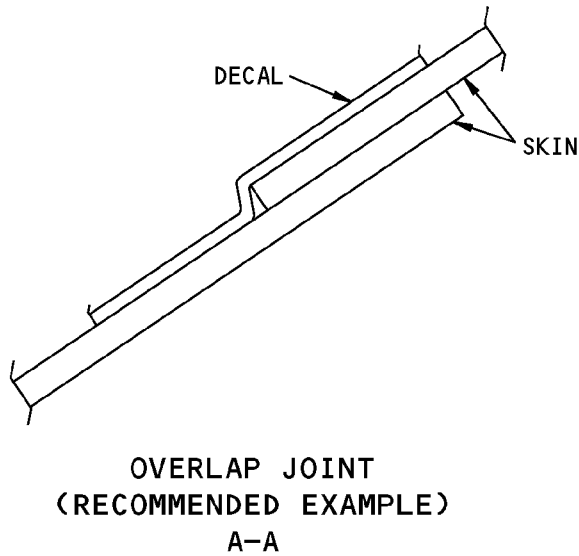
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EXAMPLES OF IRREGULAR SURFACES

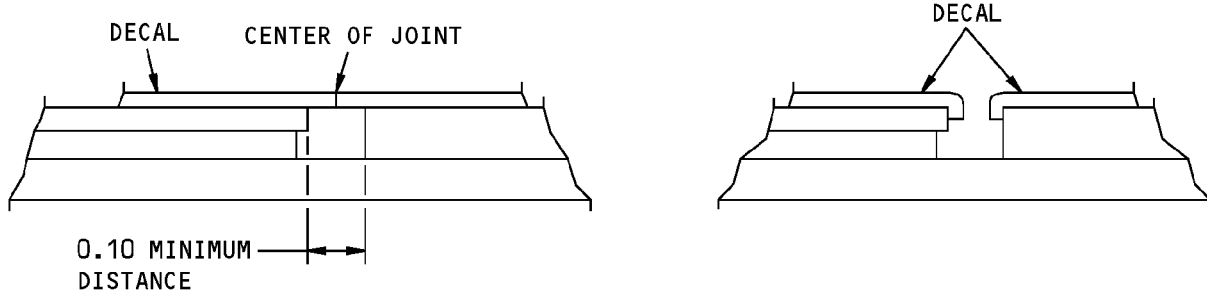


**Decal Application Over Irregular Surfaces
Figure 401 (Sheet 1 of 2)/20-10-11-990-801**

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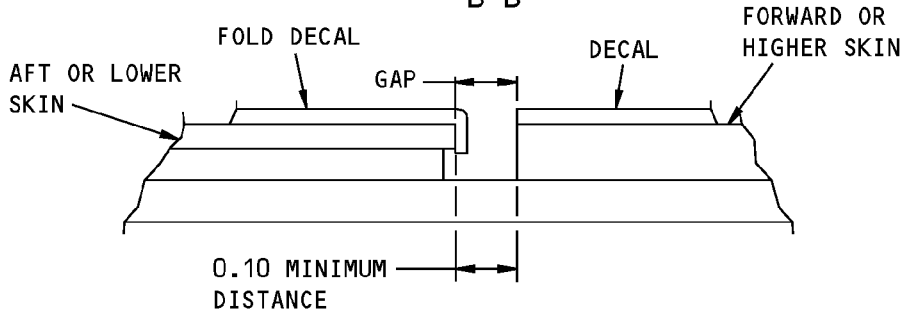


DECAL BEFORE CUT

DECAL AFTER CUT

**BUTT JOINT
(MINIMUM DISTANCE)
(EXAMPLE)**

B-B

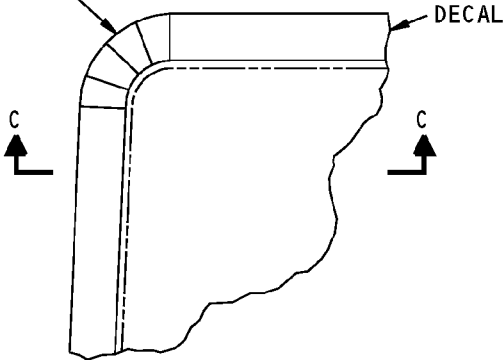


**BUTT JOINT
(MAXIMUM DISTANCE)
(EXAMPLE)**

B-B

CUT BEFORE
INSTALLATION

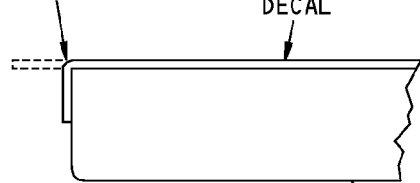
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ROUNDED CORNER

(A)

FOLD DECAL
AROUND EDGE



SKIN PANEL
OR HANDLE

C-C

1 CUT DECAL TO MAKE SURE IT
CONFORMS TO CORNER RADII

**Decal Application Over Irregular Surfaces
Figure 401 (Sheet 2 of 2)/20-10-11-990-801**

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PRESSURE-SENSITIVE DECALS - REPAIRS

1. General

- A. This procedure contains one task. The task is to repair external decals.
- B. To repair damaged external decals, apply patches of equivalent decals.

NOTE: Replace damaged internal decals.

TASK 20-10-11-000-801

2. Repair External Pressure Sensitive Decals

A. References

Reference	Title
51-31-00 P/B 201	SEALS AND SEALING - MAINTENANCE PRACTICES

B. Procedure

SUBTASK 20-10-11-020-003

- (1) Cut away all loose decal film but be careful not to cut the airplane skin.

SUBTASK 20-10-11-800-001

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CAUTION: DO NOT CAUSE DAMAGE TO THE AIRPLANE SKIN WHEN YOU CUT THE DECAL. NICKS, CUTS, SCRATCHES, OR SCRIBE LINES WILL DECREASE THE FATIGUE STRENGTH AND LIFE OF THE STRUCTURE.

- (2) Cut a patch of decal film of the same type and color as the initial decal.
 - (a) Make sure the patch is of sufficient size to make an overlap of 1/4 inch on the part of the decal that is not damaged.
 - 1) If you damage the skin or sealant, obey all the specified steps, cautions and references to inspect and repair the sealant and skin (SEALS AND SEALING - MAINTENANCE PRACTICES, PAGEBLOCK 51-31-00/201) and the applicable structural repair manual.

SUBTASK 20-10-11-420-004

- (3) Apply the patch.

SUBTASK 20-10-11-390-001

- (4) Seal all around the repair with the applicable edge sealer.

————— **END OF TASK** —————

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PRESSURE SENSITIVE PLACARDS - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) A removal of the pressure sensitive placards.
- (2) An installation of the pressure sensitive placards.

B. Vinyl placards are prepared on a material that will not easily follow the contour of rough or textured surfaces. The placard will touch only the high spots and have a poor bond. Use an adhesive with vinyl placards to get a smooth surface and a firm bond for the placard. Foil markers are made on a soft metal that, when applied, will have the contour of the surface and make a good bond. If the surface is textured, you can apply adhesive to get a smoother surface and more satisfactory installation of foil markers.

TASK 20-10-14-000-801

2. Pressure Sensitive Placard Removal

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-2481	Tool - Sealant Removal, BAC5000, PSD 6-184 Approved (Part #: 1-6390-A, Supplier: 63318, A/P Effectivity: 737-ALL) (Part #: 10810, Supplier: \$0855, A/P Effectivity: 737-ALL) (Part #: 234350, Supplier: \$0857, A/P Effectivity: 737-ALL) (Part #: 311, Supplier: KA861, A/P Effectivity: 737-ALL) (Part #: 411B60, Supplier: 3DN12, A/P Effectivity: 737-ALL) (Part #: 411B90, Supplier: 3DN12, A/P Effectivity: 737-ALL) (Part #: DAD5013, Supplier: \$0856, A/P Effectivity: 737-ALL) (Part #: DFD5019, Supplier: \$0856, A/P Effectivity: 737-ALL) (Part #: J5-0275-2010, Supplier: 435R8, A/P Effectivity: 737-ALL) (Part #: SCD5019, Supplier: \$0856, A/P Effectivity: 737-ALL) (Part #: ST982LF, Supplier: 3Z323, A/P Effectivity: 737-ALL) (Part #: TS1275-4, Supplier: 1DWR5, A/P Effectivity: 737-ALL)

B. Consumable Materials

Reference	Description	Specification
B00083	Solvent - Aliphatic Naphtha (For Acrylic Plastics)	TT-N-95 Type II, ASTM D-3735 Type III
B00130	Alcohol - Isopropyl	TT-I-735
B00143	Solvent - Trichlorotrifluorethane (Freon)	MIL-C-81302

C. Removal

SUBTASK 20-10-14-210-001

- (1) Do a check of the placard to see if it is sufficiently bonded.

NOTE: If the placard is bonded firmly and the new placard is the same size, you can install the new placard over the used placard.

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SUBTASK 20-10-14-020-001

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

(2) Lift the corner of the placard with a sealant removal tool, COM-2481.

SUBTASK 20-10-14-110-001

(3) Remove remaining adhesive film with solvent, B00143, solvent, B00083, or alcohol, B00130.

————— **END OF TASK** —————

TASK 20-10-14-400-801

3. Pressure Sensitive Placard Installation

A. Consumable Materials

Reference	Description	Specification
A00016	Adhesive - Pressure Sensitive Film For Interior Non-Structural Bonding	BMS5-91
A00119	Adhesive - Synthetic Rubber Cement, Naphtha Soluble	BMS5-55
B00083	Solvent - Aliphatic Naphtha (For Acrylic Plastics)	TT-N-95 Type II, ASTM D-3735 Type III
B00130	Alcohol - Isopropyl	TT-I-735
B00137	Abrasive - Garnet Coated Paper	ANSI B74.18
B00143	Solvent - Trichlorotrifluorethane (Freon)	MIL-C-81302
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5
G00270	Tape - Scotch Flatback Masking 250	ASTM D6123 (Supersedes A-A-883)

B. Prepare for the Installation

SUBTASK 20-10-14-800-001

(1) If the placard uses adhesive, A00016, no special placard preparation is necessary.

SUBTASK 20-10-14-840-001

(2) If the placard has no backing adhesive, prepare placard as follows:

- (a) Make the rear surface of the placard rough with abrasive, B00137.
- (b) Clean the placard with solvent, B00083.
- (c) Remove the release paper from one side of the adhesive, A00016.
- (d) Apply the adhesive, A00016 to the rear of placard.
- (e) Cut the unwanted adhesive, A00016.
- (f) Laminate the adhesive, A00016 to the placard with one of these steps:
 - 1) Roll placard on hot roll laminator heated to 140°F (60°C).
 - 2) Heat the placard to not more than 140°F (60°C) with a dry air blast or other applicable source and rub release paper with cotton wiper, G00034.

NOTE: Heat makes the bond between the adhesive and the release paper soft. Be careful not to move the release paper.

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C. Installation

SUBTASK 20-10-14-110-002

(1) Clean the surface with solvent, B00143, alcohol, B00130, or solvent, B00083.

SUBTASK 20-10-14-800-002

(2) Dry fully.

SUBTASK 20-10-14-420-001

(3) Install the placard.

NOTE: You can install the new placard immediately if you did not remove the old placard. If you removed the old placard, do the steps that follow.

CAUTION: MAKE SURE THE MASKED AREA IS IN THE CORRECT POSITION. YOU CAN REMOVE DRY ADHESIVE WITH NAPHTHA CLEANER. IF YOU TRY TO REMOVE CURED ADHESIVE, YOU WILL CAUSE DAMAGE TO THE SURFACE.

- (a) Mask an area approximately 1/16 inch smaller than the placard with masking tape or attach a mask of necessary size.
- (b) Use a brush to apply adhesive, A00119 to the prime contact area.
- (c) Let the adhesive dry fully (approximately 15 minutes).
- (d) Remove the Scotch Flatback Masking Tape 250, G00270 or mask.
- (e) Remove the release paper from the placard.
- (f) Apply the placard to the center of the surface, but be careful to prevent air pockets.
- (g) Rub the placard with firm hand pressure and a cheesecloth pad.
- (h) If the primed surface shows around the placard, remove unwanted adhesive with solvent, B00083.

————— END OF TASK —————

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RECESSED BOSS SEAL FITTINGS - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) Removal of adapter fittings and positioning fittings (boss fittings).
- (2) Installation of adapter (straight) fittings.
- (3) Installation of the positioning (elbow) fittings.

TASK 20-10-15-000-801

2. Boss Fitting Removal

A. Procedure

SUBTASK 20-10-15-020-002

- (1) Loosen the jamnut.

SUBTASK 20-10-15-020-003

- (2) Disconnect the hose or tube, from the fitting as applicable.

SUBTASK 20-10-15-020-001

- (3) Remove the fitting from the boss.

————— END OF TASK —————

TASK 20-10-15-400-801

3. Adapter (Straight) Fitting Installation

A. References

Reference	Title
20-50-11-910-801	Standard Torque Values (P/B 201)

B. Procedure

SUBTASK 20-10-15-640-001

- (1) Lubricate a new O-ring and backup ring and install them in the fitting groove.

SUBTASK 20-10-15-420-004

- (2) Lubricate a new O-ring and put it in the groove under the nut hex.

SUBTASK 20-10-15-420-001

CAUTION: IF YOU DO NOT INSTALL THE BACK-UP RING CORRECTLY, YOU CAN CAUSE DAMAGE TO EQUIPMENT.

- (3) Install the fitting into the boss and tighten to the correct torque for the size of the fitting, (TASK 20-50-11-910-801).

————— END OF TASK —————

TASK 20-10-15-400-802

4. Positioning (Elbow Type) Fitting Installation

A. References

Reference	Title
20-50-11-910-801	Standard Torque Values (P/B 201)

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B. Procedure

SUBTASK 20-10-15-420-005

- (1) Install the jamnut on the fitting and turn it to the stop.

SUBTASK 20-10-15-640-002

- (2) Lubricate a new O-ring and install it in the groove between the two sets of threads.

SUBTASK 20-10-15-420-006

- (3) Lubricate a new O-ring and backup ring with the applicable system lubricant and install them in the fitting groove.

SUBTASK 20-10-15-420-002

CAUTION: INSTALL THE BACK-UP RING CORRECTLY. IF YOU DO NOT INSTALL THE BACK-UP RING CORRECTLY, YOU CAN CAUSE DAMAGE TO EQUIPMENT.

- (4) Install the fitting into the boss until it touches bottom, then loosen until the fitting aligns with the hose or tube (one turn maximum).

SUBTASK 20-10-15-420-003

- (5) Hold the fitting stable and tighten the jamnut to the correct torque for the size of the fitting, (TASK 20-50-11-910-801).

SUBTASK 20-10-15-420-007

- (6) Connect the hose or tube, to the fitting and tighten according to (TASK 20-50-11-910-801).

————— **END OF TASK** —————

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O-RINGS - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) A removal of O-Rings.
- (2) An installation of O-Rings.

B. You may install O-Rings over sharp edges. Sharp edges include threaded fasteners, keyways, slots, splines, and ports.

TASK 20-10-17-000-801

2. O-Rings Removal

(Figure 401)

A. Removal

SUBTASK 20-10-17-210-001

- (1) Examine the old O-rings for cuts, abrasions, deformities, and surface defects.

SUBTASK 20-10-17-020-001

- (2) Remove the used O-Rings with an appropriate hook or tool.
 - (a) Be careful not to scratch the groove or adjacent surfaces.

SUBTASK 20-10-17-020-002

- (3) Cut the used O-ring and discard.

————— **END OF TASK** —————

TASK 20-10-17-400-801

3. O-Rings Installation

(Figure 401) (Table 401)

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-1575	Kit - O-Ring Tool, Installation (Part #: PSAT-KIT, Supplier: 1V757, A/P Effectivity: 737-ALL) (Part #: ST848, Supplier: 81205, A/P Effectivity: 737-100, -200, -200C, -300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: ST848R, Supplier: 81205, A/P Effectivity: 737-100, -200, -200C, -300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)

B. Procedure

SUBTASK 20-10-17-800-001

- (1) Use one of the installation tools ((Table 401)) in the O-ring toolkit, SPL-1575:

Table 401/20-10-17-993-802 Installation tools

TOOL NO.	TUBE OR HOSE FITTING SIZE
ST848 -187	1/16
-250	1/4

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TOOL NO.	TUBE OR HOSE FITTING SIZE
-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

SUBTASK 20-10-17-640-001

CAUTION: REPLACE USED O-RINGS WITH NEW O-RINGS. USED O-RINGS CAN CAUSE LEAKAGE.

(2) Lubricate the O-ring with a thin layer of the fluid used with the component or system.

SUBTASK 20-10-17-420-003

CAUTION: DO NOT MAKE THE ELASTOMERIC O-RING INNER DIAMETERS LARGER BY MORE THAN 50% DURING INSTALLATION. DO NOT MAKE THE TEFLON AND PLASTIC O-RING INNER DIAMETERS LARGER BY MORE THAN 5% DURING INSTALLATION. FAILURE CAN OCCUR.

(3) Put the thimble over the fitting.

SUBTASK 20-10-17-420-001

(4) Put the O-ring on the thimble.

SUBTASK 20-10-17-420-002

(5) Move the expanding body over the thimble and against the O-ring, then push the O-ring into the groove.

SUBTASK 20-10-17-020-003

(6) Use the extracting rod to remove the expanding body from the thimble.

SUBTASK 20-10-17-020-004

(7) Remove the thimble.

SUBTASK 20-10-17-210-002

CAUTION: DO NOT PINCH THE O-RINGS. MAKE SURE ATTACHED BOLTS ARE CORRECTLY TIGHTENED. FAILURE CAN OCCUR.

(8) Examine the O-ring for twists and pinches caused by installation.

(a) Make sure you align the O-ring with no twists before you close the gland.

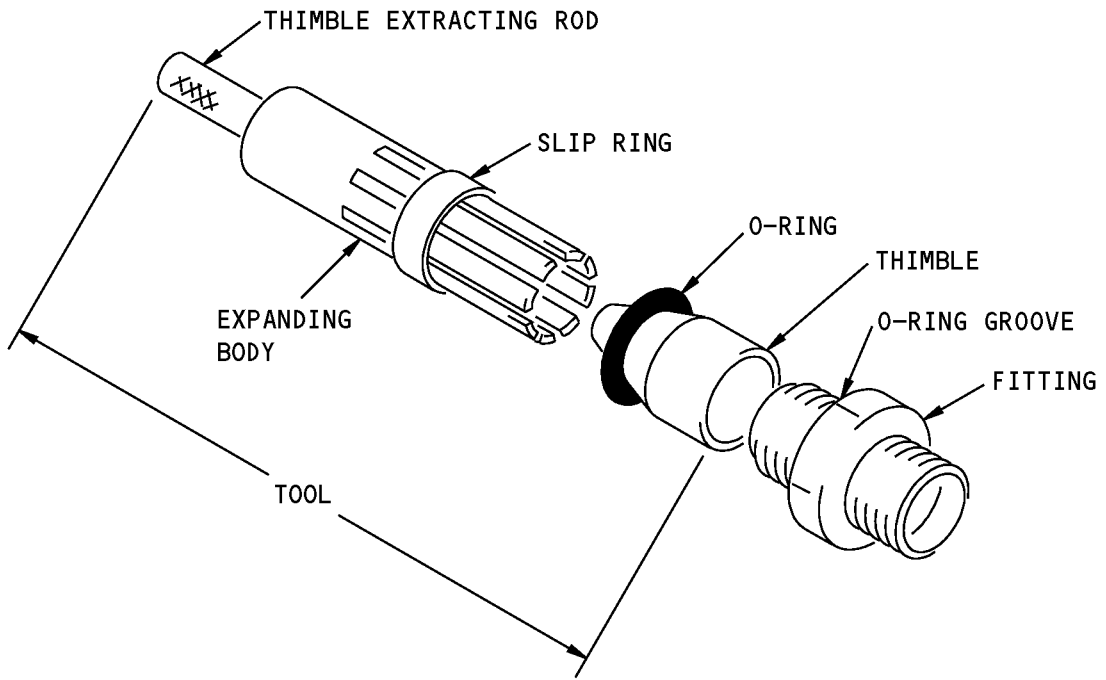
————— **END OF TASK** —————

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**O-Ring Installation
Figure 401/20-10-17-990-801**

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ALUMINUM FOIL MARKERS - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
(1) A removal of aluminum foil markers.
(2) An installation of aluminum foil markers.
B. Replace aluminum foil markers that have creases, damaged edges, or words you cannot read.
C. Replace aluminum foil markers that are not satisfactorily bonded to external primed or painted surfaces.
D. Replace aluminum foil markers that are not satisfactorily bonded to internal primed or painted surfaces.
E. Remove and replace aluminum foil markers that are not satisfactorily bonded to bare metal surfaces.
NOTE: For aluminum foil markers that you install on textured surfaces or that do not bond satisfactorily, you can use the procedure for pressure sensitive placards. This gives a better installation (TASK 20-10-14-400-801).
F. Do not install a new aluminum foil marker on a used aluminum foil marker. Remove the used aluminum foil marker and install the new aluminum foil marker.

TASK 20-10-21-000-801

2. Aluminum Foil Markers Removal

A. References

Table with 2 columns: Reference, Title. Row 1: 20-30-88-910-801, Final Cleaning of Metal Prior to Non-structural Bonding (Series 88) (P/B 201)

B. Consumable Materials

Table with 3 columns: Reference, Description, Specification. Rows include B00344 (Solvent - Xylene, Nitration Grade), B01008 (Solvent - Final Cleaning Of Metal Prior To Non-Structural Bonding), and G00034 (Cotton Wiper - Process Cleaning Absorbent Wiper).

C. Procedure

SUBTASK 20-10-21-020-001

- (1) Put a sharp knife, or equivalent object, under the edge of the placard and remove the marker from the adhesive area.

SUBTASK 20-10-21-110-001

- (2) On primed, painted, or plastic interior surfaces, use solvent, B00344, to remove all adhesive from surfaces and markers.

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SUBTASK 20-10-21-110-002

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR 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) On metal surfaces, use a cotton wiper, G00034 that is wet with Series 88 solvent, B01008 (TASK 20-30-88-910-801) to remove all adhesive from surfaces and markers.

END OF TASK

TASK 20-10-21-400-801

3. Aluminum Foil Markers Installation

A. Consumable Materials

Reference	Description	Specification
A00119	Adhesive - Synthetic Rubber Cement, Naphtha Soluble	BMS5-55
A00134	Adhesive - Synthetic Rubber, Buna-N, 1 Part, Fuel Resistant	BMS 5-14
A00253	Adhesive - Epoxy, 2 Part, RT Cure	BMS5-109, Type II, Class 2
B00046	Acid, Corrosion Removing, Metal Conditioning, Phosphoric	MIL-C-10578
B00083	Solvent - Aliphatic Naphtha (For Acrylic Plastics)	TT-N-95 Type II, ASTM D-3735 Type III
B00137	Abrasive - Garnet Coated Paper	ANSI B74.18
B00148	Solvent - Methyl Ethyl Ketone (MEK)	ASTM D740
B00344	Solvent - Xylene, Nitration Grade	ASTM D843
C00012	Coating - Clear Polyurethane Topcoat, 683-3-2 Base with X-310A Catalyst (Akzo Nobel Advance Coatings)	
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5

B. Prepare for installation

SUBTASK 20-10-21-020-002

- (1) Do not install a new aluminum foil marker on a used aluminum foil marker.

SUBTASK 20-10-21-080-001

- (2) Remove the used foil marker, clean the surface and then install the new foil marker.

SUBTASK 20-10-21-820-001

- (3) If it is necessary, use an electric typewriter with pica type set at the highest impression level to add data to the placard.

SUBTASK 20-10-21-820-002

- (4) Make sure all typed data is clear with letters that do not cut through the aluminum foil marker.

SUBTASK 20-10-21-800-001

- (5) If it is necessary, cut the aluminum foil marker to the necessary dimension before you remove the protective backing.

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SUBTASK 20-10-21-100-001

(6) Clean the surface to apply the aluminum foil marker.

(a) To clean aluminum surfaces, do these steps:

1) Clean aluminum surfaces that have corrosion with a wire brush.

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2) Clean surfaces that have grease with solvent, B00083.

3) Apply a solution of one-fourth phosphoric acid and three-fourths water, by volume, with a brush, rag, or sponge to the surface.

4) Let the acid, B00046, stay on the metal approximately 1/2 minute.

5) Rub the surface with a damp cotton wiper, G00034, and then with a dry cotton wiper, G00034, until the surface is dry and free of corrosion.

(b) Use solvent, B00344, xylene to clean polyester, epoxy, phenolic or polyurethane surfaces that are not painted.

(c) To clean aluminized paint (EC-843) coated surfaces, do these steps:

1) Sand with abrasive, B00137.

2) Clean with solvent, B00083.

(d) To clean cork surfaces, do these steps:

1) Lightly sand with abrasive, B00137, until you get a clean cork surface.

2) Rub the surface with a clean cotton wiper, G00034, to remove any dust.

(e) Clean all other surfaces with solvent, B00083.

SUBTASK 20-10-21-800-002

(7) On cadmium-plated surfaces, laminated not painted polyester materials, laminated not painted phenolic materials, and rough surfaces that are not painted, do these steps:

(a) Apply a light layer of adhesive, A00134, 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.

SUBTASK 20-10-21-800-003

(8) 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 adhesive, A00119, 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.

C. Install the Aluminum Foil Marker

SUBTASK 20-10-21-480-001

(1) Use supports for surfaces of thin panels during the installation of markers.

SUBTASK 20-10-21-420-006

(2) Do not use an aluminum foil marker that is not flat or is damaged.

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SUBTASK 20-10-21-840-001

- (3) Do not touch or contaminate the adhesive on the aluminum foil marker after you remove the protective backing.

SUBTASK 20-10-21-840-002

- (4) Make sure the aluminum foil marker and the open surface are free of moisture.

SUBTASK 20-10-21-840-003

- (5) 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.

SUBTASK 20-10-21-420-001

- (6) To install a cellophane-backed aluminum foil marker, do these steps:

- (a) Put the aluminum foil marker in water (50 to 120°F) (10 to 48.9°C) for approximately 30 to 120 seconds.
- (b) Remove the aluminum foil marker from the water and remove unwanted water with a clean, cotton wiper, G00034.
- (c) With dry hands, move a finger across the edge of the aluminum foil marker and move back the cellophane.
- (d) Carefully remove the backing from the aluminum foil marker.

SUBTASK 20-10-21-420-002

- (7) To install a paper-backed aluminum foil marker, do these steps:

- (a) Remove the paper backing from the aluminum foil marker, but be careful not to touch the adhesive coating.
 - 1) Where the paper backing has a cut, bend the paper backing lightly along the cut line. Hold the backing and move it slowly away from the aluminum foil marker to prevent damage to the marker.
 - 2) Where 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.

NOTE: The backing can also have a tab which will help to remove the backing.

SUBTASK 20-10-21-420-003

- (8) To install aluminum 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) Apply a light layer of adhesive, A00119, to the rear of the aluminum foil marker.
 - 2) Let the adhesive dry until it is tacky but will not bond to a clean finger when lightly touched.
- (b) On bare metal surfaces, do these steps:
 - 1) Apply a light layer of adhesive, A00134, to the rear of the aluminum foil marker.
 - 2) Let the adhesive dry until it is tacky but will not bond to a clean finger when lightly touched.

SUBTASK 20-10-21-420-004

- (9) Put the aluminum foil marker in the correct position and push down to attach it.

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SUBTASK 20-10-21-420-005

- (10) Use a roller and start at one end of the marker and roll the marker into position. Be careful to prevent air bubbles. To prevent roll marks, do not let the edge of the roller touch the aluminum foil marker.

SUBTASK 20-10-21-800-004

- (11) To remove air bubbles, make a small hole with a pin and make a smooth surface with a roller.

SUBTASK 20-10-21-110-003

WARNING: DO NOT GET SOLVENT IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENT. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE SOLVENT. KEEP SOLVENT AWAY FROM SPARKS, FLAME, AND HEAT. SOLVENTS CAN BE POISONOUS AND FLAMMABLE WHICH CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

- (12) If it is necessary, remove unwanted adhesive. Use solvent, B00148 for adhesive, A00134 or solvent, B00083 for adhesive, A00119.

SUBTASK 20-10-21-020-003

- (13) To remove the protective paper facing, strip it parallel to the surface of the aluminum foil marker.

SUBTASK 20-10-21-210-001

- (14) Make sure there is a good bond on the edge of the aluminum foil marker.

NOTE: Be careful not to lift the edge.

SUBTASK 20-10-21-390-001

- (15) For protection of markers from fuel, hydraulic fluid, or outdoor weather do the following
- (a) Seal the marker edges or put an overcoat on the markers by brush or spray with adhesive, A00253 or Akzo Nobel 683-3-2 coating, C00012.

————— **END OF TASK** —————

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LUBRICATION FITTINGS - SERVICING

1. General

A. This procedure contains this task.

- (1) A temporary lubrication for blown-out lubrication fittings.

TASK 20-10-24-600-801

2. Temporary Lubrication for Blown Out Lubrication Fittings

A. General

- (1) This task contains temporary lubrication instructions for lubrication fittings that were blown out.
 - (a) 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.

B. References

Reference	Title
20-30-21-910-801	Lubricants (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-7616	Adapter - Rubber Tipped (Part #: B411, Supplier: 0FKM1, A/P Effectivity: 737-ALL)
STD-438	Gun - Grease

D. Procedure

SUBTASK 20-10-24-010-001

- (1) Gain access to the blown-out lubrication fitting(s).

SUBTASK 20-10-24-940-001

- (2) Using the applicable grease gun, STD-438 and the proper grease for the location, attach the rubber tipped adapter, COM-7616 to the grease gun, STD-438.
 - (a) Refer to Lubricants, TASK 20-30-21-910-801 for a list of appropriate lubricants for the area.

SUBTASK 20-10-24-940-002

- (3) Press the rubber tipped adapter, COM-7616 firmly against the opening where the lubrication fitting was blown out.

SUBTASK 20-10-24-640-001

- (4) Gently pump the grease into the fitting opening, making sure that the rubber tipped adapter, COM-7616 remains firmly seated against the opening.

SUBTASK 20-10-24-140-001

- (5) Clean up any excess grease.

SUBTASK 20-10-24-410-001

- (6) Close any panels opened for access.

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SUBTASK 20-10-24-840-003

(7) Return the aircraft to normal.

————— **END OF TASK** —————

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LUBRICATION FITTINGS - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) A removal of the lubrication fitting.
(2) An installation of the lubrication fitting.

B. This procedure contains the installation instructions for a lubrication fitting (press-in type). Refer to the repair instructions in the Component Maintenance Manual for lubrication fittings on landing gear components.

TASK 20-10-24-000-801

2. Lubrication Fitting Removal

(Figure 401)

A. Procedure

SUBTASK 20-10-24-020-001

- (1) Remove damaged or broken lubrication fittings.

SUBTASK 20-10-24-160-001

- (2) Clean the area before installing a new fitting.

END OF TASK

TASK 20-10-24-420-801

3. Lubrication Fitting Installation

(Figure 401)

A. General

- (1) This task contains instructions for the installation of new lubrication fittings and lubrication fittings that were blown out.

B. References

Table with 2 columns: Reference, Title. Row 1: 20-30-89-910-801, Final Cleaning of All Organic Coatings Prior to Non-structural Bonding (Series 89) (P/B 201)

C. Consumable Materials

Table with 3 columns: Reference, Description, Specification. Rows include A00026 (Compound - Sealing, Locking And Retaining, Single Component), B01009 (Solvent - Final Clning Of All Organic Ctgs Before Non-Structural Bonding), G00018 (Nitrogen - Gaseous, Pressurizing, 99.5 Percent Pure), G00106 (Compound - Retaining, Single Component, Anaerobic), G01659 (Swab - Disposable, Cotton Or Rayon Applicator)

D. Procedure

SUBTASK 20-10-24-840-001

- (1) Get an applicable standard fitting to install in the hole.

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SUBTASK 20-10-24-160-002

CAUTION: BE CAREFUL NOT TO CONTAMINATE THE BEARING, JOINT OR ITEM THAT IS LUBRICATED THROUGH THE FITTING HOLE. DAMAGE TO EQUIPMENT MAY OCCUR.

- (2) Do these steps to clean the lubrication fitting hole:
 - (a) Use swab, G01659 to remove as much grease as possible from the inner surface of the lubrication fitting hole.
 - (b) Clean the hole to a depth of at least 0.5 inch (12.7 mm) with Series 89 solvent, B01009 (TASK 20-30-89-910-801) on a clean cotton swab.
 - (c) Clean the hole until you can see no more grease or dirt removed from the hole.

SUBTASK 20-10-24-420-001

CAUTION: MAKE SURE YOU USE THE CORRECT TOOL TO INSTALL THE LUBRICATION FITTING. MOVE THE FITTING IN A STRAIGHT LINE TO PREVENT DAMAGE TO THE MATING PART.

- (3) Use a drive tool to install the lubrication fitting.

E. Procedure For Blown-Out Fittings

SUBTASK 20-10-24-840-002

- (1) Get a special approved or an oversized fitting to install in the hole.

SUBTASK 20-10-24-160-003

- (2) Do these steps to clean the lubrication fitting hole:
 - (a) Use swab, G01659 to remove as much grease as possible from the inner surface of the lubrication fitting hole.

CAUTION: BE CAREFUL NOT TO CONTAMINATE THE BEARING, JOINT OR ITEM THAT IS LUBRICATED THROUGH THE FITTING HOLE. DAMAGE TO EQUIPMENT MAY OCCUR.

- (b) Clean the hole to a depth of at least 0.5 inch (12.7 mm) with Series 89 solvent, B01009 (TASK 20-30-89-910-801) with a clean swab, G01659.
- (c) Clean the hole until you can see no more grease or dirt removed from the hole.

SUBTASK 20-10-24-390-001

- (3) Do these steps to apply the primer and compound, A00026:
 - (a) Use swab, G01659 to apply a thin layer of compound, A00026 to the inner diameter of the hole.
 - (b) Let the primer air dry at approximately 70°F (21.1°C) for at least five minutes before you apply the retainer compound, A00026 or compound, G00106.

SUBTASK 20-10-24-420-002

CAUTION: DO NOT APPLY TOO MUCH COMPOUND ON THE FITTING AND THE PART IT CONNECTS TO. TOO MUCH COMPOUND ON THE FITTING WILL CAUSE A BLOCKAGE TO THE LUBRICATION PASSAGES AND CAUSE DAMAGE TO EQUIPMENT.

- (4) Do these steps to install the lubrication fitting:
 - (a) Use swab, G01659 to apply a thin layer of adhesive to the inner diameter of the hole (between 0.25 and 0.40 inch in depth) (6.35 & 10.16 millimeters).
 - (b) Put the lubrication fitting into nitrogen, G00018 for at least one minute to make sure the fitting is fully cool.

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CAUTION: MAKE SURE YOU USE THE CORRECT TOOL TO INSTALL THE LUBRICATION FITTING. MOVE THE FITTING IN A STRAIGHT LINE TO PREVENT DAMAGE TO THE MATING PART.

(c) Use a drive tool to install the lubrication fitting.

NOTE: Install the lubrication fitting into the hole in the mating part immediately. If you do not install the fitting immediately it will become too warm.

(d) Let the lubrication fitting cure for 24 hours at approximately 70°F (21.1°C) before you use it.

————— **END OF TASK** —————

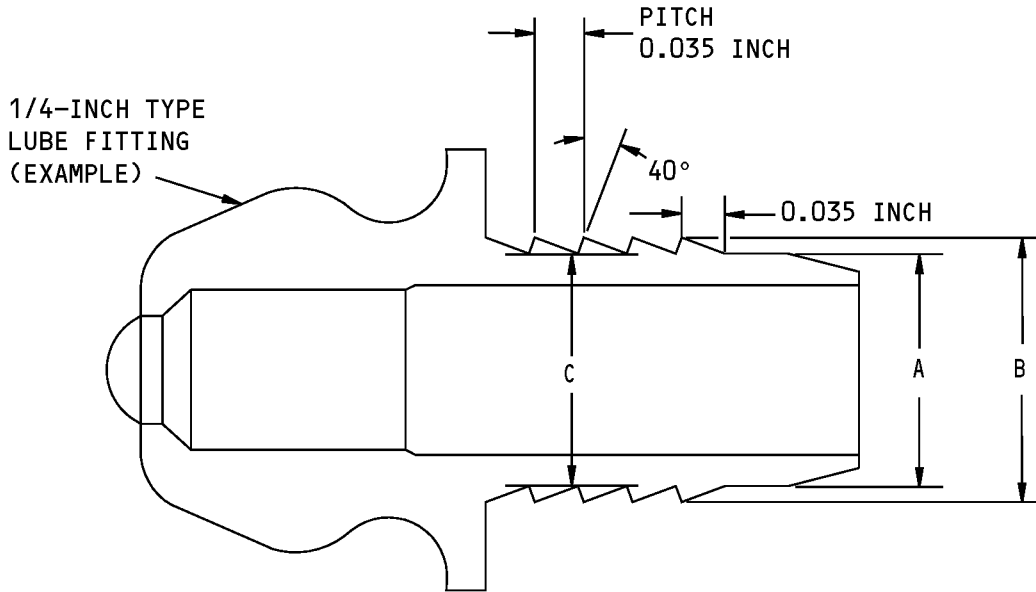
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LUBE HOLE DIA (X) (INCHES)	LUBE FITTING DIA (INCHES)
0.194 MAX	3/16 [1]
0.195-0.247	1/4 MODIFIED [1]
0.248-0.249	1/4 [2]
0.250-0.254	1/4 [1]

NOTE: DESIGN LUBE HOLE DIA IS 0.188/0.189 INCH.

ALL DIMENSIONS ARE IN INCHES
 X (NOT SHOWN) = HOLE DIA IN MATING COMPONENT
 A = SHANK DIA (X MINUS 0.007/0.012)
 B = SERRATION OD (X PLUS 0.005/0.010)
 C = SERRATION ROOT OD (X MINUS 0.003/0.010)

- [1] INSTALL WITH ADHESIVE
- [2] INSTALLATION WITH ADHESIVE OPTIONAL

Lubrication Fitting Modification and Installation
Figure 401/20-10-24-990-801

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HEAT DEVICES - MAINTENANCE PRACTICES

1. General

A. This procedure contains one task:

- (1) Precautions for Heat Devices.

TASK 20-10-27-910-801

2. Precautions for Heat Devices

A. General

- (1) This procedure has the minimum recommended safety procedures for the operation of heat guns, soldering guns, soldering irons, and other heat devices.
- (2) You must also obey the regulations of your airline and local agencies.
- (3) In this procedure heat guns, soldering guns, and soldering irons are referred to as heat devices.
- (4) We recommend you use crimped splices and (1) sleeves with nylon ties or (2) heat shrinkable covering in areas that could have flammable fumes.

B. Tools/Equipment

Reference	Description
STD-4057	Combustible Gas Indicator - Explosion Proof Gastech Model 1314 Super Surveyor

C. Precautions

SUBTASK 20-10-27-880-001

WARNING: DO NOT USE HEAT DEVICES NEAR FLAMMABLE FLUIDS OR FUMES. HEAT OR SPARKS FROM HEAT DEVICES CAN CAUSE EXPLOSIONS AND FIRES.

- (1) Use heat devices only in safe areas.
 - (a) Do not use heat devices in areas that are less than 100 feet (31 meters) from the airplane if these conditions are present:
 - 1) Airplane fueling
 - 2) Airplane defueling
 - 3) The fuel tanks are open.
 - (b) Do not use heat devices in areas where smoking is not permitted.

D. How to Measure Fume Levels

SUBTASK 20-10-27-750-001

WARNING: DO NOT USE HEAT DEVICES UNLESS AN AREA HAS NO FUMES. A FUME LEVEL OF ZERO IS THE ONLY SAFE LEVEL. HEAT OR SPARKS FROM HEAT DEVICES CAN CAUSE EXPLOSIONS AND FIRES.

- (1) Measure the fumes:
 - (a) Use the gas indicator, STD-4057 to measure the fume level.

NOTE: The following conditions can occur.

 - 1) A liquid fuel or fume source is near.
 - 2) The local fuel fume level are high or the ventilation is not sufficient.
 - (b) Make sure the fuel fume levels are at zero.
 - (c) Continue to monitor the fume levels during the repair

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- (d) Keep a good flow of air in the fuel tanks

NOTE: You can make the fuel tanks safer with nitrogen inert equipment installed to maintain the fuel system oxygen content at 10% or less by volume.

E. How to Keep the Area Safe

SUBTASK 20-10-27-800-001

- (1) If it is possible for other persons to move flammable fluids into the area, obey these steps:
 - (a) Do not use a possible ignition source near open fuel tanks, fuel vents, or fuel leaks where fume concentrations cannot be known or controlled.
 - (b) Make sure a person monitors the work area.

NOTE: 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.

- (c) Do not start or continue to do work on a fuel system component while equipment that can cause the fuel to burn is near.
- (d) Keep the number of maintenance and safety persons included to a minimum.

————— **END OF TASK** —————

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TEFLON BACKUP RINGS - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) A removal of teflon backup rings, MS28783.
- (2) An installation of teflon backup rings.

TASK 20-10-31-000-801

2. Teflon Backup Rings Removal

(Figure 401)

A. Procedure

SUBTASK 20-10-31-020-001

- (1) If you see a broken teflon ring, remove it.
 - (a) Use an appropriate hook or tool.
 - (b) Use care not to scratch the groove or the adjacent surfaces.

————— **END OF TASK** —————

TASK 20-10-31-400-801

3. Teflon Backup Rings Installation

(Figure 401)

A. Procedure

SUBTASK 20-10-31-420-001

- (1) Install split-teflon backup rings, MS28783, with the direction of the spiral clockwise.
 - (a) Make sure the scarfed ends face as shown in (Figure 401).

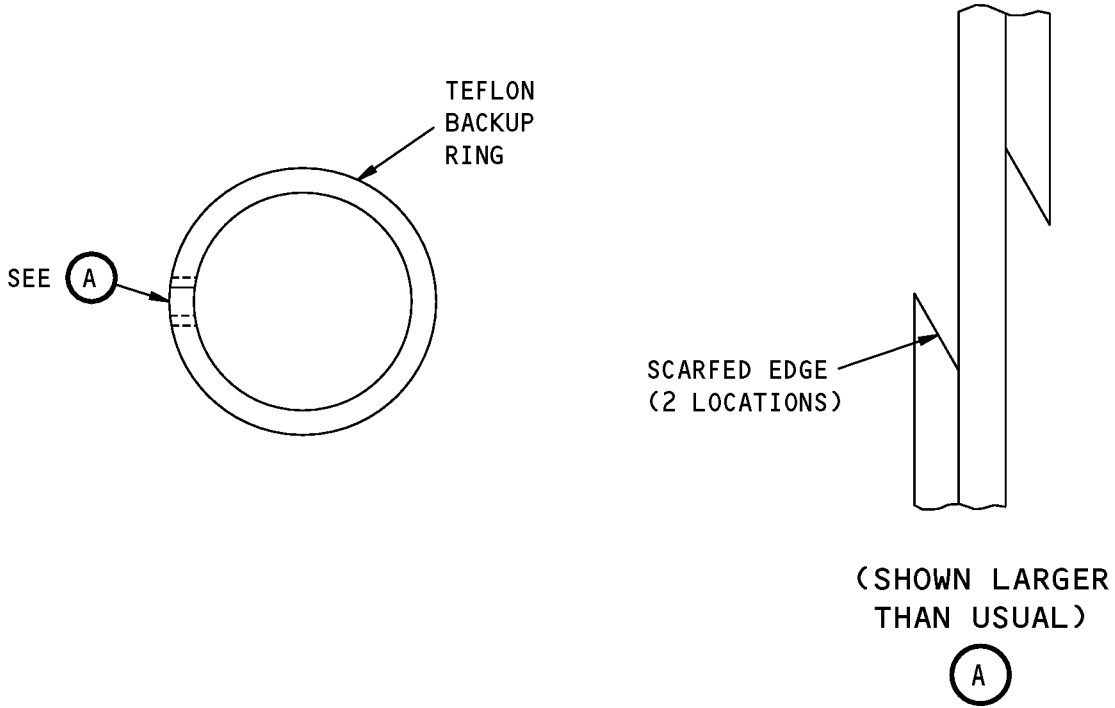
————— **END OF TASK** —————

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**Teflon Backup Ring Installation
Figure 401/20-10-31-990-801**

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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 20-10-33-000-801

2. Power Device Cartridge (Squib) Removal

A. References

Reference	Title
20-40-11-910-801	Static Grounding (P/B 201)
24-22-00-860-812	Remove Electrical Power (P/B 201)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1550	Meter - Bonding (Approved Explosion Proof & Intrinsically Safe) (Part #: C15292 (MODEL T477W), Supplier: 01014, A/P Effectivity: 737-ALL) (Part #: M1, Supplier: 3AD17, A/P Effectivity: 737-ALL) (Part #: M1B, Supplier: 3AD17, A/P Effectivity: 737-ALL)
COM-1565	Strap - Adjustable Wrist, Conductive, Static Control (Part #: 14810, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 2214, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 9070, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2211, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2212, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2213, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)
STD-1168	Cap - Shorting or Faraday Cap

C. Procedure

SUBTASK 20-10-33-940-001

- (1) Ground the airplane, do this task: Static Grounding, TASK 20-40-11-910-801.

SUBTASK 20-10-33-940-002

- (2) Make sure you remove electrical power before you remove the squib, do this task: Remove Electrical Power, TASK 24-22-00-860-812.

SUBTASK 20-10-33-760-001

- (3) You must wear a static control wrist strap, COM-1565 during the removal of the squib.

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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.

- (a) Do the following steps to do a resistance test of the static control wrist strap, COM-1565:
1) Use an bonding meter, COM-1550 to make sure the static control wrist strap, COM-1565, assembly has a minimum resistance of 250 kilohms and a maximum of 1.5 megohms.
2) Put the static control wrist strap, COM-1565, on the wrist of the person that will remove the squib.
3) Use an bonding meter, COM-1550 to make sure the resistance is less than 10 megohms.

SUBTASK 20-10-33-480-001

- (4) Connect the static control wrist strap, COM-1565 to an applicable electrostatic ground jack.

SUBTASK 20-10-33-940-003

WARNING: PUT PROTECTIVE COVERS ON THE BOTTLE SQUIBS AND FLOW VALVE SQUIBS. IF YOU DO NOT PUT PROTECTIVE COVERS ON THE SQUIBS, THE SQUIBS CAN FIRE ACCIDENTALLY AND CAUSE INJURIES TO PERSONNEL.

- (5) 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.

SUBTASK 20-10-33-020-001

- (6) Remove the electrical connector.

SUBTASK 20-10-33-480-002

- (7) Make sure the shorting cap, STD-1168 (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.

SUBTASK 20-10-33-940-004

- (8) After the shorting cap, STD-1168 is attached to the squib, the wrist strap may be removed.

END OF TASK

TASK 20-10-33-400-801

3. Power Device Cartridge (Squib) Installation

A. References

Table with 2 columns: Reference, Title. Row 1: 24-22-00-860-812, Remove Electrical Power (P/B 201)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

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Reference	Description
COM-1550	Meter - Bonding (Approved Explosion Proof & Intrinsically Safe) (Part #: C15292 (MODEL T477W), Supplier: 01014, A/P Effectivity: 737-ALL) (Part #: M1, Supplier: 3AD17, A/P Effectivity: 737-ALL) (Part #: M1B, Supplier: 3AD17, A/P Effectivity: 737-ALL)
COM-1565	Strap - Adjustable Wrist, Conductive, Static Control (Part #: 14810, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 2214, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 9070, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2211, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2212, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2213, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)
STD-1168	Cap - Shorting or Faraday Cap

C. Procedure

SUBTASK 20-10-33-940-005

- (1) Make sure you remove electrical power before you install the squib, do this task: Remove Electrical Power, TASK 24-22-00-860-812.

SUBTASK 20-10-33-940-006

- (2) Wear a static control wrist strap, COM-1565 during the installation of the squib.

SUBTASK 20-10-33-760-002

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.

- (3) Do these steps to do a resistance test of the static control wrist strap, COM-1565:
 - (a) Use an bonding meter, COM-1550 to make sure the static control wrist strap, COM-1565, assembly has a minimum resistance of 250 kilohms and a maximum of 1.5 megohms.
 - (b) Put the static control wrist strap, COM-1565, on the wrist of the person that will install the squib.
 - (c) Use an bonding meter, COM-1550 to make sure the resistance is less than 10 megohms.

SUBTASK 20-10-33-480-003

- (4) Connect the static control wrist strap, COM-1565 to an applicable electrostatic ground jack.

SUBTASK 20-10-33-940-007

WARNING: PUT PROTECTIVE COVERS ON THE BOTTLE SQUIBS AND FLOW VALVE SQUIBS. IF YOU DO NOT PUT PROTECTIVE COVERS ON THE SQUIBS, THE SQUIBS CAN FIRE ACCIDENTALLY AND CAUSE INJURIES TO PERSONNEL.

- (5) Make sure the shorting cap, STD-1168 (protective cover) is installed on the squib whenever the airplane electrical connector is removed from the squib.

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SUBTASK 20-10-33-480-004

- (6) Stray voltage on the airplane can cause the squib to discharge. Make sure any stray voltage is discharged before you install the aircraft electrical connector.

NOTE: The shorting cap, STD-1168 is attached to the squib. This protective cover has electrically conductive surfaces to prevent possible squib explosion because of static discharge.

SUBTASK 20-10-33-420-001

- (7) Remove the shorting cap, STD-1168 and install the electrical connector.

SUBTASK 20-10-33-940-008

- (8) After the electrical connector is installed, the static control wrist strap, COM-1565 may be removed.

————— **END OF TASK** —————

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METAL SURFACES - CLEANING/PAINTING

1. General

- A. Use this procedure for faying surface bonds and bonding jumper installation. Do not use abrasives or wire brushes on CRES, plated surfaces, or clad aluminum that is not painted.
- B. This procedure is for cleaning by one of the following methods:
 - (1) Hand Clean Metal Surfaces with Abrasives.
 - (2) Clean Metal Surface with a Rotary Bonding Brush.
 - (3) Clean with a Rotary Abrasive Disk.
 - (4) Remove Paint from Metal Surfaces with solvent, B00139 or solvent, B00083.
 - (5) Clean Bare, Clad, or Plated Metal with solvent, B00139.

TASK 20-10-34-120-801

2. Hand Clean Metal Surfaces with Abrasives

- A. General
 - (1) Do not use abrasives on plated surfaces, clad aluminum, or CRES that is not painted.
 - (2) This is the only procedure you can use to clean titanium.
- B. Consumable Materials

Reference	Description	Specification
B00062	Solvent - Acetone (99.5% Grade)	ASTM D 329 (Supersedes O-A-51)
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5

C. Procedure

SUBTASK 20-10-34-100-001

- (1) Make the surface wet with solvent, B00062 and wipe or scrub the surface with a cotton wiper, G00034
 - (a) Spray or flow the solvent, B00062 on the surface to assist in cleaning or rinsing.
 - (b) Wipe up the excessive solvent and allow the surface to drain dry.

SUBTASK 20-10-34-120-001

CAUTION: DO NOT LET PARTICLES FROM THE ABRASIVE CAUSE CONTAMINATION OF THE MECHANISMS OR ELECTRICAL EQUIPMENT. DAMAGE CAN OCCUR.

- (2) Manually use a circular or elliptical movement of the abrasive to get an equally smooth surface.

SUBTASK 20-10-34-100-002

- (3) Make the surface wet with solvent, B00062 and wipe or scrub the surface with a cotton wiper, G00034

————— **END OF TASK** —————

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TASK 20-10-34-140-801

3. Clean Metal Surfaces with a Rotary Bonding Brush

(Figure 701)

A. General

- (1) Use this procedure to remove paint from metal or to remove Alodine, Iridite, or light anodize from aluminum. Do not use a bonding brush on plated surfaces or on metals that are not painted, for example, CRES, titanium, or clad aluminum. Clean these surfaces with solvent.

B. Consumable Materials

Reference	Description	Specification
B00062	Solvent - Acetone (99.5% Grade)	ASTM D 329 (Supersedes O-A-51)
B00102	Abrasive - Aluminum Oxide Coated Cloth	ANSI B74.18
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5

C. Procedure

SUBTASK 20-10-34-930-001

- (1) Identify the bonding brush housings by color.

NOTE: The colors show which bonding brush housings you will use on which metal. The chart below gives color codes for identification of bonding brushes for individual metals.

Table 701/20-10-34-993-801

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

SUBTASK 20-10-34-140-001

CAUTION: DO NOT USE CARBON STEEL BONDING BRUSHES. STEEL PARTICLES ON METAL SURFACES COULD CAUSE CORROSION.

- (2) Use a drill motor or other applicable drive to apply a stainless steel bonding brush of the correct size to clean the necessary diameter.
 - (a) Apply brush intermittently and keep the cutting face parallel with the surface.
 - (b) Examine results after each time you apply the brush and continue operation until necessary area is clean.

NOTE: Keep the decrease in surface metal to a minimum.

- (c) If it is a problem to get through an anodic film, clean it with abrasive cloth, B00102.

SUBTASK 20-10-34-100-003

- (3) Make the surface wet with solvent, B00062 and wipe or scrub the surface using a cotton wiper, G00034.

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- (a) Spray or flow the solvent, B00062 on the surface to assist in cleaning or rinsing.
- (b) Wipe up the excessive solvent and allow the surface to drain dry.

————— END OF TASK —————

TASK 20-10-34-120-802

4. Clean with a Rotary Abrasive Disk

(Figure 701)

A. General

- (1) Use this task to remove anodize, Iridite, Alodine, BMS 3-11 resistant finish, or equivalent hard finishes that are not painted. You can also remove paint with this task, but the disk will become quickly clogged.
- (2) Do not use this procedure on plated surfaces or metals that are not painted, for example, CRES, titanium, or clad aluminum.

B. Consumable Materials

Reference	Description	Specification
B00062	Solvent - Acetone (99.5% Grade)	ASTM D 329 (Supersedes O-A-51)
B00102	Abrasive - Aluminum Oxide Coated Cloth	ANSI B74.18
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5

C. Procedure

SUBTASK 20-10-34-120-002

CAUTION: DO NOT LET PARTICLES FROM THE ABRASIVE CAUSE CONTAMINATION OF THE MECHANISMS OR ELECTRICAL EQUIPMENT. DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Use a drill motor or other applicable drive to apply an abrasive disk (abrasive cloth, B00102) (Figure 701) of correct size to clean the necessary diameter.
 - (a) Apply the disk intermittently with light pressure and keep the face of the disk parallel to the metal surface.
 - (b) Examine results after each time you apply the disk and continue operation until necessary area is clean.

NOTE: Keep the decrease in surface metal to minimum.

SUBTASK 20-10-34-100-004

- (2) Make the surface wet with solvent, B00062 and wipe or scrub the surface with a cotton wiper, G00034

————— END OF TASK —————

TASK 20-10-34-110-801

5. Remove Paint from Metal Surfaces with Lacquer Thinner or Solvent

A. General

- (1) Use this procedure to remove lacquer-based primer or enamel from clad aluminum or other metal surfaces. Do not use lye, alkaline paint remover, or hydroxides to clean surfaces.

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B. References

Reference	Title
20-30-81-910-801	General Cleaning of All Organic Coatings (Series 81) (P/B 201)

C. Consumable Materials

Reference	Description	Specification
B00139	Solvent - Lacquer Thinner	A-A-857
B01001	Solvent - General Cleaning Of All Organic Coatings (AMM 20-30-81/201) - Series 81	
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5

D. Remove Paint

SUBTASK 20-10-34-110-001

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.

- (1) Apply solvent, B00139 or Series 81 solvent, B01001 (TASK 20-30-81-910-801) to the specified area with a cotton wiper, G00034.

SUBTASK 20-10-34-110-002

- (2) Use a clean part of the cloth each time you apply solvent to the surface.
 - (a) Make sure you do not get solvent on adjacent surfaces.

SUBTASK 20-10-34-110-003

- (3) When the specified area is fully clean, immediately rub dry with cotton wiper, G00034.

————— END OF TASK —————

TASK 20-10-34-110-802

6. Clean Bare, Clad, or Plated Metal with Solvent

A. General

- (1) Use this procedure to clean plated surfaces and CRES, titanium, or clad aluminum that is not painted.

B. Consumable Materials

Reference	Description	Specification
B00083	Solvent - Aliphatic Naphtha (For Acrylic Plastics)	TT-N-95 Type II, ASTM D-3735 Type III
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5

C. Procedure

SUBTASK 20-10-34-110-004

- (1) Apply solvent, B00083 to bonding surfaces with a cotton wiper, G00034.

SUBTASK 20-10-34-110-005

- (2) Rub with the necessary force to remove contamination you can see.

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SUBTASK 20-10-34-110-006

(3) Immediately dry surfaces with a cotton wiper, G00034.

————— **END OF TASK** —————

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BRUSH OR DISK DIA. (INCH)	PILOT DIA. (INCH)	SHANK DIA. (INCH)	BONDING BRUSHES			
			WIRE SIZE (INCH)		OSBORN NO.	MORRIS NO.
			MAX	MIN		
11/32	1/4	1/4	0.005	0.004		
1/2	3/32	1/4	0.005	0.004	94-SV-37	P-31-SS
1/2	1/8	1/4	0.005	0.004	94-SV-47	P-32-SS
1/2	5/32	1/4	0.005	0.004	94-SV-48	P-33-SS
1/2	3/16	1/4	0.005	0.004	94-SV-36	P-34-SS
3/4	3/16	1/4	0.006	0.005		P-31-516-SS
3/4	1/4	1/4	0.006	0.005		P-31-517-SS
3/4	5/16	1/4	0.006	0.005		P-31-53-SS
1.0	3/16	1/4	0.008	0.006		P-36-SS
1.0	1/4	1/4	0.008	0.006		P-36-S1-SS
1.0	5/16	1/4	0.008	0.006		P-36-S5-SS

BONDING BRUSHES			DISK MANDRELS
BRUSH OR DISK DIA. (INCH)	MANUFAC- TURERS BRUSH CO.	BOEING ST NO.	BOEING ST NO.
11/32		ST913K-34-24	ST913M-34-24
1/2	220-NN	ST913K-50-09	ST913M-50-09
1/2	221-NN	ST913K-50-12	ST913M-50-12
1/2	222-NN	ST913M-50-16	ST913M-50-16
1/2	223-NN	ST913M-50-19	ST913M-50-19
3/4	224-NN	ST913K-75-19	ST913M-75-19
3/4	225-NN	ST913K-75-25	ST913M-75-25
3/4	226-NN	ST913K-75-31	ST913M-75-31
1.0	227-NN	ST913K-100-19	ST913M-100-19
1.0	228-NN	ST913K-100-25	ST913M-100-25
1.0	229-NN	ST913K-100-31	ST913M-100-31

Rotary Bonding Brushes and Abrasive Disk Mandrels
Figure 701/20-10-34-990-801

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ELECTRICAL BONDING - INSPECTION/CHECK

1. General

- A. This procedure provides an requirements for airplane electrical bonding.
- B. This procedure has one task:
 - (1) An inspection of electrical bonding.

TASK 20-10-37-120-801

2. Electrical Bonding Inspection

A. Procedure

SUBTASK 20-10-37-100-001

- (1) For electrical bonding requirements, refer to the Standard Wiring Practices Manual (SWPM).

————— **END OF TASK** —————

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CONTROL CABLE GROMMET - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) A removal of the control cable grommet.
(2) An installation of the control cable grommet.

B. You can replace the control cable grommets in the 3/4, 1, and 1-1/4 inch (19.05, 25.4, 31.75 mm) 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:

- (1) You can use a replacement NAS1368 grommet and cut one side of the grommet for installation.
(2) You can use a BACG20H nylon grommet, which is a divided grommet.

TASK 20-10-41-000-801

2. Control Cable Grommet Removal

(Figure 401)

A. Procedure

SUBTASK 20-10-41-020-001

- (1) Cut the grommet to remove the grommet from the bulkhead.

END OF TASK

TASK 20-10-41-400-801

3. Control Cable Grommet Installation

(Figure 401)

A. References

Table with 2 columns: Reference, Title. Row 1: 20-30-98-910-802, Cleaning of Phenolics or Nylon (Series 98-1) (P/B 201)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Table with 2 columns: Reference, Description. Row 1: SPL-1549, Set - Installation, NAS 1368 Grommets (Part #: A20006-32, Supplier: 81205, A/P Effectivity: 737-100, -200, -200C, -300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: ST1065C, Supplier: 81205, A/P Effectivity: 737-100, -200, -200C, -300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)

C. Consumable Materials

Table with 3 columns: Reference, Description, Specification. Row 1: A00119, Adhesive - Synthetic Rubber Cement, Naphtha Soluble, BMS5-55. Row 2: A00273, Adhesive - Epoxy Polyamide, 2 Part, Natural Colored, BMS5-126, Type II, Class 1. Row 3: A00435, Adhesive - Epoxy Polyamide, 2 Part, Thickened, BMS5-126, Type III

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Reference	Description	Specification
B01051	Solvent - Cleaning Of Phenolics Or Nylon (AMM 20-30-98/201) - Series 98-1	

D. Install the Grommet with the Control Cable Removed

SUBTASK 20-10-41-110-001

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.

- (1) Clean the bulkhead area that will touch the grommet with Series 98-1 solvent, B01051 (TASK 20-30-98-910-802).

SUBTASK 20-10-41-640-001

- (2) Apply adhesive, A00273, or adhesive, A00435 on the NAS1368 grommet area that will touch the bulkhead.

SUBTASK 20-10-41-420-001

- (3) Put the grommet in the bulkhead hole.

SUBTASK 20-10-41-480-001

- (4) Put the grommet tool NAS 1368 grommet installation set, SPL-1549 around the grommet and tighten the NAS1801 screw.

SUBTASK 20-10-41-080-001

- (5) Remove the grommet tool.

NOTE: The grommet can be loose in the bulkhead hole, but it should not fall out.

E. Install the Grommet with the Control Cable Installed

SUBTASK 20-10-41-110-002

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.

- (1) Clean the bulkhead area that will touch the grommet with Series 98-1 solvent, B01051 (TASK 20-30-98-910-802).

SUBTASK 20-10-41-420-002

- (2) Do these steps to install the NAS1368 grommet:

- (a) Cut one side of the NAS1368 grommet.
- (b) Place the grommet over the control cable.
- (c) Apply adhesive, A00273, or adhesive, A00435, on the NAS1368 grommet area that will touch the bulkhead.
- (d) Install the grommet in the bulkhead hole.
- (e) Align the slit part of the grommet at the 12 o'clock position.

SUBTASK 20-10-41-420-003

- (3) Do this step to install the BACG20H grommet:

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- (a) Apply adhesive, A00119, on the BACG20H grommet area that will touch the bulkhead.
- (b) Install the grommet in the bulkhead hole.
- (c) Align the cut part of the grommet at the 12 o'clock position.

————— **END OF TASK** —————

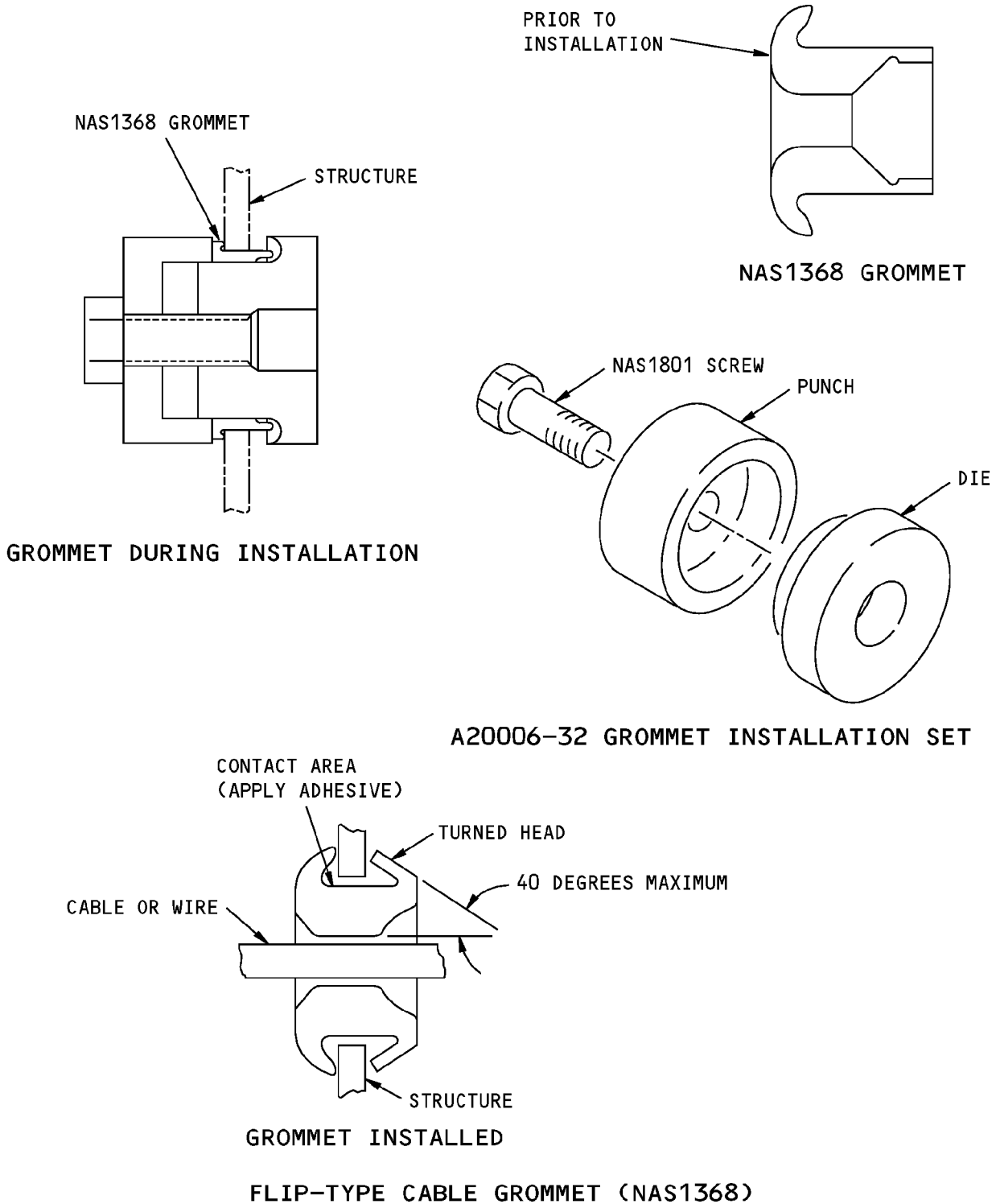
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**Control Cable Grommets Installation
Figure 401/20-10-41-990-801**

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LOCKWIRE - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
 - (1) A removal of the lockwire.
 - (2) An installation of the lockwire.
- B. If this procedure does not agree with lockwire installation methods in a specific ATA chapter, use the methods specified in that ATA chapter.
- C. Do not use lockwire more than once.
- D. Install lockwire so it is in tension when the parts become loose.
- E. Make three to six twists at the end of the wire. Bend the twists back or under to give the ends protection so they will not catch something.
- F. Use the double twist procedure for all lockwire unless a single wire procedure is specified.

TASK 20-10-44-000-801

2. Lockwires Removal

(Figure 401, Figure 402, Figure 403)

- A. Remove the Lockwire

SUBTASK 20-10-44-020-001

- (1) Cut and remove the lockwire or remove the pin.

————— **END OF TASK** —————

TASK 20-10-44-400-801

3. Lockwires Installation

- A. Install the Lockwire

SUBTASK 20-10-44-800-001

- (1) Use these types of wires for lockwire:
 - (a) Use monel, inconel, or corrosion-resistant lockwire in high temperature areas.
 - (b) Use copper wire, 0.020 in. diameter, on emergency equipment only.

NOTE: Use it where a seal is necessary on emergency equipment to show no person has used the equipment. 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 to prevent galvanic corrosion.
- (d) This table shows BAC standard wire sizes.

Table 401/20-10-44-993-801

BAC Standard Wire Sizes	
MATERIAL	SIZE (INCH)
Monel or Inconel	.020 .032 .040 .051 .091
Corrosion Resistant Steel	.020 .032 .040 .051 .091
Aluminum Alloy	.020 .032 .040 .051 .091

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SUBTASK 20-10-44-420-001

- (2) Use these steps to install lockwire to bolts and screws (Figure 401):
- On all fittings where you install lockwire, attach the fitting to the mating part or an adjacent part.
 - Install lockwire for right threads as shown in (Figure 401, Figure 402, Figure 403).
 - Install lockwire for left threads opposite to that shown in (Figure 401, Figure 402, Figure 403).
 - Make sure the loop of double wire goes around, not above, 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.

- When you install lockwires on nuts and bolts, tighten the nuts and bolts to the low values of the torque range.

NOTE: If necessary, continue to tighten until a slot aligns with the safety hole.

SUBTASK 20-10-44-420-002

- (3) To install lockwire on electrical connectors, (Figure 402).
- Use the instructions for the installation of lockwires to bolt and screws when you install lockwires on electrical connectors.

SUBTASK 20-10-44-420-003

- (4) To install cotter pins (Figure 403), do the applicable step:
- To install cotter pins in castellated nuts, install the pin with the head parallel to the slot in the nut.
 - Bend the cotter pin ends to the bolt end or to the castellated nut's slit adjacent to the pin end.
 - 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.
 - To install cotter pins in non-castellated nuts, install the pin through the hole on the bolt and bend the pin ends back on each side of the bolt approximately 90 degrees.

SUBTASK 20-10-44-420-004

- (5) To install lock rings (Figure 403), do these steps:
- Put the bent hook of the lock ring into an aligned locking hole in the shaft and nut but do not spring the ring.
 - Move the lock ring over the flange into the groove with minimum expansion of the lock ring.

————— **END OF TASK** —————

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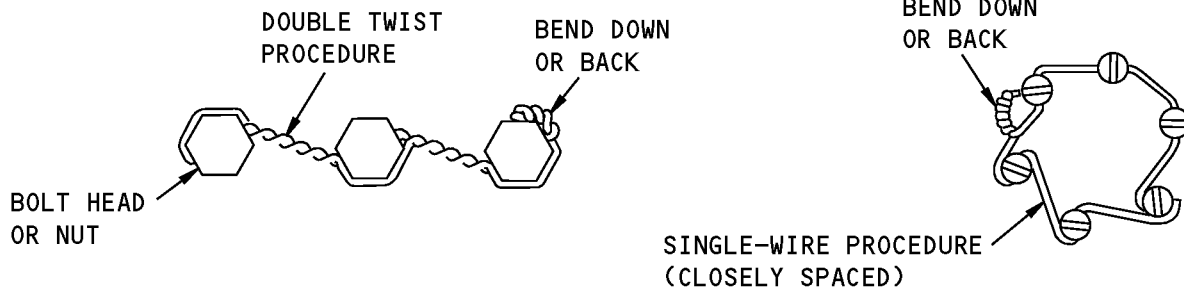
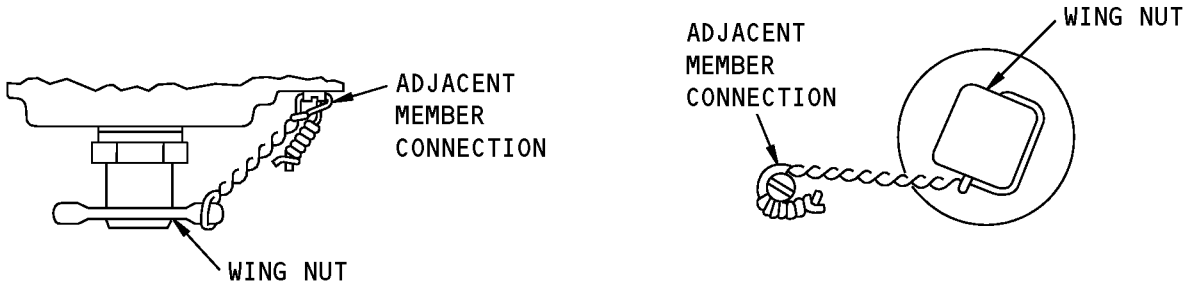
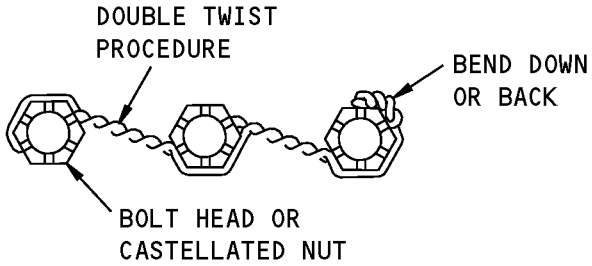
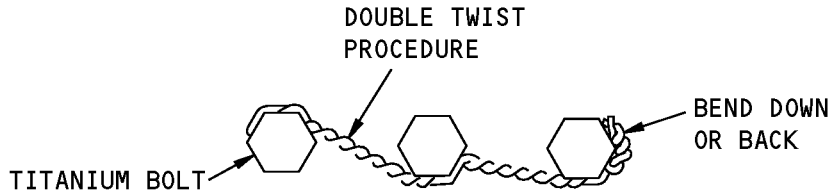
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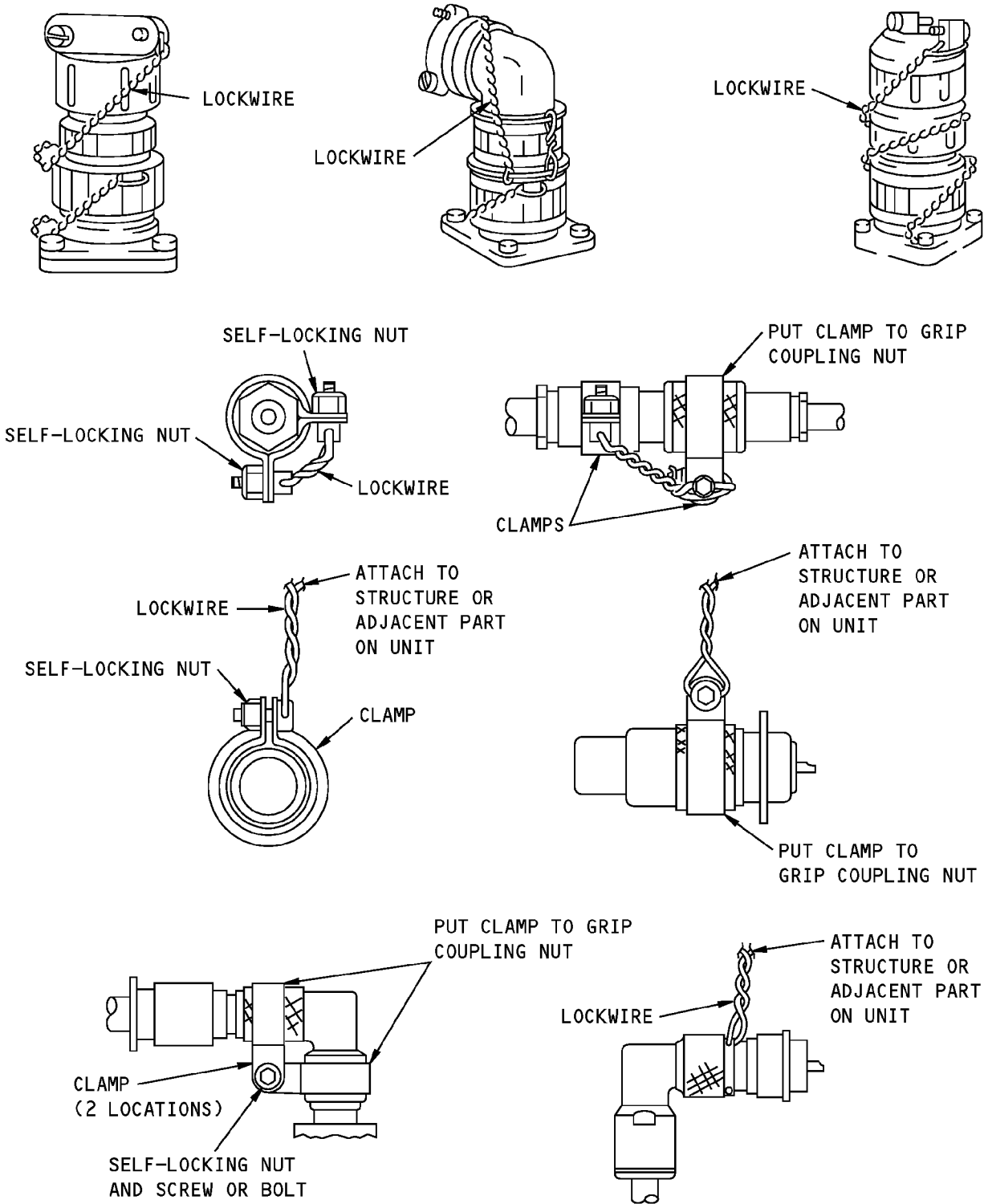


**Lockwire Installation
Figure 401/20-10-44-990-801**

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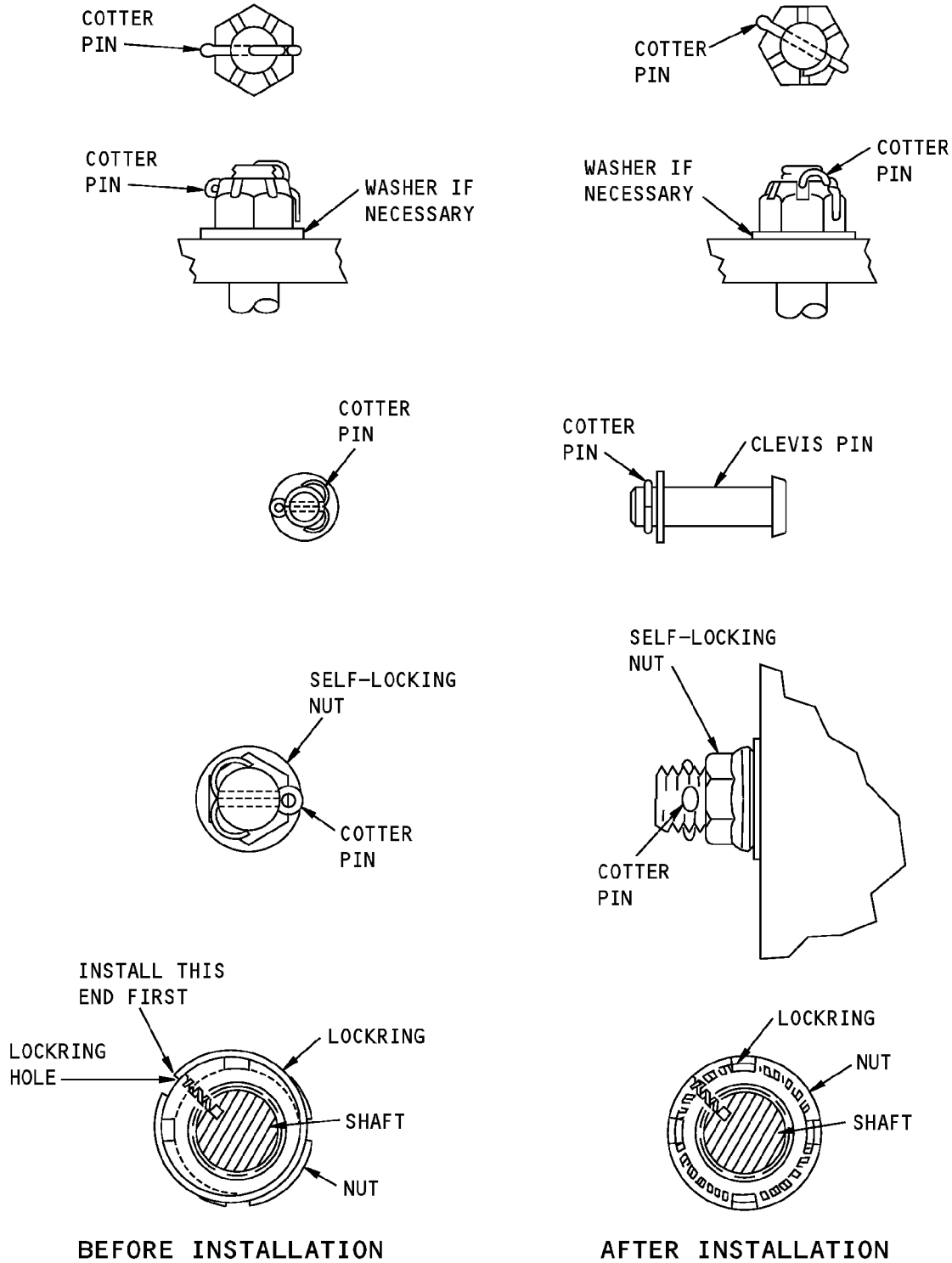
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**Connector Lockwire Installation
Figure 402/20-10-44-990-802**

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Locking Pins Installation
Figure 403/20-10-44-990-803

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SEALS ON OPEN ELECTRICAL TERMINALS IN FLAMMABLE LEAKAGE ZONES - MAINTENANCE PRACTICES

1. General

- A. This procedure has this task:
 - (1) The task is to seal the uninsulated electrical terminals and connections in the flammable leakage zones.
- B. When you replace or install components on the lighting systems in flammable leakage zones, seal these uninsulated items:
 - (1) Lamp terminals
 - (2) Terminal strips
 - (3) Circuit breakers
 - (4) Transformers
 - (5) Switches
 - (6) Hardwire
 - (7) Wire junctions.
 - (8) Lamp terminals with a rubber sleeve are open.
- C. Do not seal the dual grounds in the flammable leakage zones or the wire junctions in fuel tanks.
- D. Do not seal the generator terminals on the engines or APU.
- E. Install wire and protectors on all secondary switch leads and seal all secondary switch terminals in the flammable leakage zones. Insulated splices are not open.
- F. To identify flammable leakage zones, (SWPM 20-30-00), Protection of Electrical Connections in a Flammable Leakage Zone.

TASK 20-10-47-390-801

2. Seal the Unprotected Terminals

(Figure 201)

A. References

Reference	Title
SWPM 20-30-00 Electrical Connection of Equipment	Standard Wiring Practices Manual

B. Tools/Equipment

Reference	Description
STD-1080	Brush - Paint

C. Consumable Materials

Reference	Description	Specification
B00083	Solvent - Aliphatic Naphtha (For Acrylic Plastics)	TT-N-95 Type II, ASTM D-3735 Type III
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5

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D. Procedure

SUBTASK 20-10-47-110-001

- (1) Remove all dirt and grease for a minimum of 1.00 in. (25.40 mm) adjacent to the area you will seal.
 - (a) Use a cotton wiper, G00034 moist with solvent, B00083.

SUBTASK 20-10-47-390-001

CAUTION: DO NOT SEAL THE SHANK OF LAMP TERMINALS THAT ARE MOVABLE 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.

- (2) Use a paint brush, STD-1080 to apply one layer of sealant to the uninsulated areas.
 - (a) Refer to SWPM 20-30-00 Electrical Connection of Equipment, Protection of Electrical Connections in a Flammable Leakage Zone, for approved sealants.

SUBTASK 20-10-47-390-002

- (3) On ring torque terminals, apply sealant as follows:
 - (a) Apply sealant to the uninsulated parts of the terminal (Figure 201).

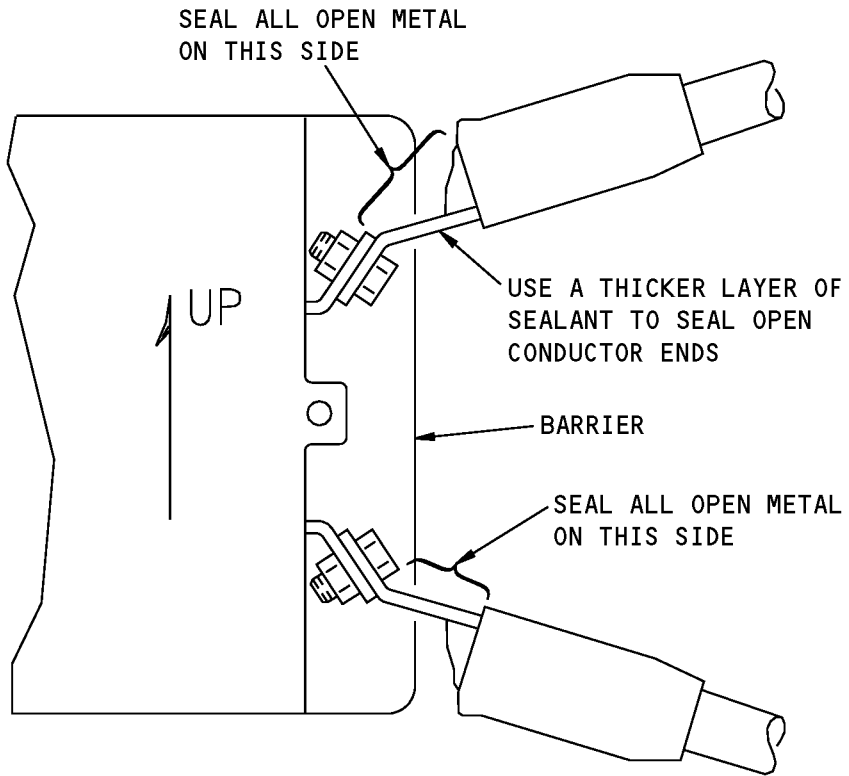
————— **END OF TASK** —————

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**Sealant Installation on Ring Tongue Terminals
Figure 201/20-10-47-990-802**

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FLARELESS TUBING ASSEMBLY - REMOVAL/INSTALLATION

1. General

- A. You must consult with Boeing before conducting any repairs to oxygen system tubing.
- B. This procedure contains these tasks:
 - (1) A removal of the flareless tubing assembly.
 - (2) An installation of the flareless tubing assembly.
 - (3) A check of the electrical resistance specifications in the fuel tank.
 - (4) An installation of flareless fittings in pressurized areas.
 - (5) A check of the tubing clearances.
 - (6) A check of the space between tubing clamps.

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.

- C. You can use these procedures to remove and install all flareless tubing except tubing for the oxygen systems and water and waste systems. Refer to AMM Chapter 38 for repairs on Water and Waste Systems.
- D. You must identify the tubing assembly configuration and the tubing material before removal.
- E. 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.
- F. 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 bas effects can occur:
 - (a) If you move or change the 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 become possible that the tube will have too much stress. Stress can cause cracks in the tubes.
 - (3) Do this task: Clean the External Surfaces of the Airplane, TASK 12-40-00-100-801.
- G. You can use the nuts and fittings again if they are not damaged and there is a good seal on the assembly. Make sure the threads on the nuts and fittings turn smoothly.
- H. Flareless BACS13AP sleeves that are not correctly set can cause leaks. It is recommended that you set flareless sleeves by machine. Set the flareless sleeves by hand only when you cannot set them by machine.

NOTE: It is recommended that cadmium-plated corrosion-resistant steel or cadmium-plated steel fittings be used as replacements for aluminum fittings in the high pressure and normal brake return systems between the antiskid module and parking brake module. Cadmium-plated corrosion-resistant steel or cadmium-plated steel fittings can be used as replacements for aluminum fittings in other systems.

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- I. When you install the tubing, align the fittings and tubing so you can tighten the B-nuts by hand before you tighten the B-nuts with a wrench. Do not use the fitting nuts to align the tubing and connections.

NOTE: Move the sleeve until it touches the mating surface. Do not use the nut to pull the tube into position. Leakage from the fittings or the tubing can occur if you cause damage to the fittings or the tubing.

TASK 20-10-51-000-801

2. Flareless Tubing Assembly Removal

A. References

Reference	Title
20-10-51-300-805	Tube Repair (P/B 801)

B. Procedure

SUBTASK 20-10-51-010-001

WARNING: REMOVE ALL PRESSURE FROM THE SYSTEM AS SPECIFIED IN THE APPLICABLE MAINTENANCE INSTRUCTIONS BEFORE YOU START THE REMOVAL OF THE FLARELESS TUBING ASSEMBLY. A PRESSURIZED SYSTEM CAN CAUSE INJURY.

- (1) Get access to the tube assembly fittings.

SUBTASK 20-10-51-020-002

- (2) Remove the support clamps on the tubing you will remove.

SUBTASK 20-10-51-020-004

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

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

SUBTASK 20-10-51-020-003

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

SUBTASK 20-10-51-020-001

- (5) Remove the tubing assembly from the airplane.

SUBTASK 20-10-51-420-015

- (6) Install caps on the ports and the hydraulic lines to prevent leakage and contamination.

SUBTASK 20-10-51-160-001

CAUTION: QUICKLY CLEAN THE AREA OF ALL HYDRAULIC FLUID. THE HYDRAULIC FLUID CAN CAUSE DAMAGE TO THE AIRPLANE EQUIPMENT.

- (7) Clean all hydraulic fluid from the area.

- (a) Do this task: Tube Repair, TASK 20-10-51-300-805.

————— END OF TASK —————

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TASK 20-10-51-400-804

3. Flareless Tubing Assembly Installation

(Figure 401, Figure 402)

A. References

Reference	Title
12-40-00-100-801	Clean the External Surfaces of the Airplane (P/B 201)

B. Procedure

SUBTASK 20-10-51-160-002

CAUTION: QUICKLY CLEAN THE INSTALLATION AREA OF ALL HYDRAULIC FLUID. THE HYDRAULIC FLUID CAN CAUSE DAMAGE TO THE AIRPLANE EQUIPMENT.

- (1) Clean all hydraulic fluid from the installation area.
 - (a) Do this task: Clean the External Surfaces of the Airplane, TASK 12-40-00-100-801.

SUBTASK 20-10-51-210-015

- (2) Examine the tube ends and fittings for defects or contamination that can prevent a good seal when you install them.
 - (a) Clean the area if necessary.

SUBTASK 20-10-51-210-016

- (3) Look for worn areas or dents on the tube.
 - (a) Replace the tube if it is necessary.

SUBTASK 20-10-51-640-002

- (4) Apply the thread compound applicable to your system, (Table 401) immediately before installation as follows (Figure 401):
 - (a) Apply the thread compound to the outer diameter of the external threads, the shoulder, and the conical seal surface of the sleeve.

NOTE: Thread compound is not required when you assemble Dri-Lubed B-nuts.
 - (b) Do not get the thread compound on the internal surfaces of the tube or the inner surface of the bore of the fitting.

Table 401/20-10-51-993-842 Thread Compounds

SYSTEM	BULK CODE	APPROVED THREAD COMPOUND (Straight Thread Fittings)
Compressed Gas (Not Oxygen)	D00002	Antiseize Compound BMS3-28
Deicing or Anti-icing	D00002	Antiseize Compound BMS3-28
Instrument Air	D00002	Antiseize Compound BMS3-28
Pneumatic	D00002 D00062	Antiseize Compound BMS3-28 or Pneumatic Grease MIL-G-4343
Air Conditioning	D00002 D01062 D00062	Antiseize Compound BMS3-28 or Never-Seez Pure Nickel Special or Pneumatic Grease MIL-G-4343
Fire Protection	D00002	Antiseize Compound BMS3-28

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(Continued)

SYSTEM	BULK CODE	APPROVED THREAD COMPOUND (Straight Thread Fittings)
Coolant	D00070 D00465	Hydraulic Fluid MIL-H-5606 or Shock Strut Fluid BMS 3-32
Water Injection	D00002	Antiseize Compound BMS3-28
Fuel	D00070 D00465	Hydraulic Fluid MIL-H-5606 or Shock Strut Fluid BMS 3-32
Lubrication	D00070 D00465	Hydraulic Fluid MIL-H-5606 or Shock Strut Fluid BMS 3-32
Hydraulic MIL-H-5606	D00070 D00465	Hydraulic Fluid MIL-H-5606 or Shock Strut Fluid BMS 3-32
Hydraulic BMS3-11	D00054	Skydrol Assy Lube MCS 352B or Hydraulic BMS3-11
Hydraulic MIL-H-6083	D00070 D00106 D00465	Hydraulic Fluid MIL-H-5606 or Hydraulic Fluid MIL-H-6083 or Shock Strut Fluid BMS 3-32
Miscellaneous Tubing	D00002 D00053	Antiseize Compound BMS3-28 or Grease MIL-G-6032

SUBTASK 20-10-51-420-008

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

SUBTASK 20-10-51-820-003

- (6) Align the tube and fitting by hand and make the tube end touch the bottom of the fitting.

SUBTASK 20-10-51-210-017

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

SUBTASK 20-10-51-420-016

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

SUBTASK 20-10-51-420-009

CAUTION: USE TWO WRENCHES TO TIGHTEN THE TUBE COUPLING NUTS. USE ONE TO HOLD THE NIPPLE, AND THE OTHER TO TIGHTEN THE COUPLING NUT. IF YOU DO NOT USE TWO WRENCHES, DAMAGE TO THE TUBES AND NIPPLES CAN OCCUR.

- (9) Tighten the flareless tubing assembly with a torque wrench to the installation torque in (Table 404), if it is one of the following types:
 - (a) Steel, Titanium, and Cres Tubes:
 - 1) 21-6-9 Cres and all other Cres tube ends with BACS13BX swaged sleeves
 - 2) MIL-T-6845, MIL-T-8504 and MIL-T-8808 Cres flared tube ends
 - 3) MIL-T-6845 (304-1/8 hard) Cres with BACS13AP preset sleeve with a minimum wall thickness shown in (Table 402):

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Table 402/20-10-51-993-843 Minimum Wall Thickness

Tube Dash No.	Wall Thickness Inches (mm)
-4	0.020 (.508)
-5	0.020 (.508)
-6	0.028 (.711)
-8	0.035 (.889)
-10	0.049 (1.245)
-12	0.049 (1.245)
-16	0.065 (1.651)

- 4) Hose end fittings with steel inserts (nipples).
- 5) All titanium tube ends.
- (b) Aluminum and Annealed Cres Tubes:
 - 1) Aluminum with BACS13BX swaged sleeves
 - 2) 6061-T6 aluminum and Annealed Cres with BACS13AP sleeves with a minimum wall thickness shown in Table 403:

Table 403/20-10-51-993-844 Minimum Wall Thickness

Tube Dash No.	Wall Thickness Inches (mm)
-3	0.028 (.711)
-4	0.028 (.711)
-5	0.028 (.711)
-6	0.028 (.711)
-8	0.028 (.711)
-10	0.028 (.711)
-12	0.028 (.711)
-16	0.035 (.889)
-20	0.049 (1.245)
-24	0.049 (1.245)

- 3) Flareless type hose end fittings with aluminum inserts (nipples)
- 4) Aluminum flared tube ends.
- (c) Tube Material Specifications:
 - 1) 6061-T6 aluminum - MIL-T-7081, WW-T-700/6, AMS4083
 - 2) Annealed Cres - MIL-T-8504, MIL-T-8606, MIL-T-8808
 - 3) 1/8 hard Cres - MIL-T-6845
 - 4) 21-6-9 Cres - BMS7-185
 - 5) TI-3AL-2.5V-BMS7-234 and AMS4945.

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Table 404/20-10-51-993-845 Installation Torque

ANNEALED OUTER DIAM. Inch (mm)	TUBE DASH NO.	STEEL, TITANIUM, AND CRES TUBES TORQUE ^{*[1]} Pound-Inches +/- 5 (N-m) +/- .56	ALUMINUM & ANNEALED CRES TUBES TORQUE ^{*[1]} Pound-Inches +/- 5 (N-m) +/- .56
3/16 (4.76)	-3	100 (11.3)	80 (9.03)
1/4 (6.35)	-4	140 (15.8)	110 (12.4)
5/16 (7.94)	-5	190 (21.5)	140 (15.8)
3/8 (9.53)	-6	270 (30.5)	170 (19.2)
1/2 (12.7)	-8	500 (56.5)	280 (31.6)
5/8 (15.88)	-10	700 (79.1)	360 (40.7)
3/4 (19.05)	-12	900 (101.7)	450 (50.8)
1 (25.4)	-16	1200 (135.6)	750 (84.7)
1-1/4 (31.75)	-20	1600 (180.8)	900 (101.7)
1-1/2 (38.1)	-24	2000 (226)	900 (101.7)
2 (50.8)	-32	2000 (226)	--

*[1] For ACS Ducts all torque values must be reduced by 50%.

SUBTASK 20-10-51-420-010

- (10) If the flareless tubing assembly is a reducer fitting, use the boss or bulkhead size to get the correct torque and tighten the assembly.

SUBTASK 20-10-51-420-011

CAUTION: USE TWO WRENCHES TO TIGHTEN THE TUBE COUPLING NUTS. USE ONE TO HOLD THE NIPPLE, AND THE OTHER TO TIGHTEN THE COUPLING NUT. IF YOU DO NOT USE TWO WRENCHES, DAMAGE TO THE TUBES AND NIPPLES CAN OCCUR.

- (11) Tighten the flareless tubing assembly with a torque wrench to the installation torques in (Table 404) if it is an assembly that follows:

- (a) Steel, Titanium, and Cres Tubes:

- 1) MIL-T-6845 (304-1/8 hard) Cres with BACS13AP preset sleeve with a wall thickness shown in (Table 405):

Table 405/20-10-51-993-846 Wall Thickness

Tube Dash No.	Wall Thickness Inch (mm)	Torque Pound-Inches (Newton-Meters)
-8	0.028 (.7112)	375 (42.37)
-10	0.035 (.889)	575 (64.97)
-12	0.042 (1.0668)	725 (81.91)

- (b) Aluminum and Annealed Cres Tubes:

- 1) 6061-T6 aluminum and annealed Cres with BACS13AP sleeves with a wall thickness shown in (Table 406):

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Table 406/20-10-51-993-847 Wall Thickness

Tube Dash No.	Wall Thickness Inches (mm)	Torque Pound-Inches (Newton-Meters)
-6	0.020 (.508)	160 (18.08)
-10	0.020 (.508)	250 (28.25)
-12	0.020 (.508)	325 (36.72)

SUBTASK 20-10-51-420-012

(12) Tighten the flareless tubing assembly with a torque wrench to the installation torque (Table 404) if it is a material listed above as follows:

(a) Hold the union with a wrench and tighten the B-nut to the installation torque value.

NOTE: If you have a leak, you can loosen and tighten the B-nut again.

- 1) Do not use the B-nut to align the tube.
- 2) Do not let the B-nut touch the bottom of the sleeve shoulder.

SUBTASK 20-10-51-420-013

CAUTION: USE TWO WRENCHES TO TIGHTEN THE TUBE COUPLING NUTS. USE ONE TO HOLD THE NIPPLE, AND THE OTHER TO TIGHTEN THE COUPLING NUT. IF YOU DO NOT USE TWO WRENCHES, DAMAGE TO THE TUBES AND NIPPLES CAN OCCUR.

(13) On nuts that you can not get access to with a torque wrench, tighten the nuts with your hand as follows:

- (a) Hand tighten until a clear increase in torque occurs, then tighten 1/6 to 1/3 turn more.
- (b) Tighten the flareless fittings with the BACS13AP sleeves two times (tighten, loosen, and tighten again).

NOTE: The maximum tube collapse permitted after you tighten the BACS13AP sleeves is 0.015 inches (.381 mm) less than the tube inside diameter.

SUBTASK 20-10-51-420-014

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.

(14) Tighten all of the tube clamps.

SUBTASK 20-10-51-710-001

(15) 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.

SUBTASK 20-10-51-710-002

(16) 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.

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

END OF TASK

TASK 20-10-51-760-801

4. Electrical Resistance Specifications in the Fuel Tank Check

(Figure 403, Figure 404)

A. References

Table with 2 columns: Reference, Title. Row 1: 28-11-00-910-802, Purging and Fuel Tank Entry (P/B 201)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Table with 2 columns: Reference, Description. Row 1: COM-1550, Meter - Bonding (Approved Explosion Proof & Intrinsically Safe) (Part #: C15292 (MODEL T477W), Supplier: 01014, A/P Effectivity: 737-ALL) (Part #: M1, Supplier: 3AD17, A/P Effectivity: 737-ALL) (Part #: M1B, Supplier: 3AD17, A/P Effectivity: 737-ALL)

C. Procedure

SUBTASK 20-10-51-910-001

- (1) Perform all applicable steps from the following task: Purging and Fuel Tank Entry, TASK 28-11-00-910-802.

SUBTASK 20-10-51-760-003

WARNING: MAKE SURE THE METER YOU USE WILL NOT CAUSE 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. IF NOT, AN EXPLOSION CAN OCCUR THAT CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

- (2) Do a check of the electrical resistance with the bonding meter, COM-1550.

SUBTASK 20-10-51-760-004

CAUTION: MAKE SURE THE BOND RESISTANCE IS NOT MORE THAN THE VALUES SHOWN. BOND RESISTANCE IS VERY IMPORTANT IF A LIGHTNING STRIKE OCCURS. IF A LIGHTNING STRIKE OCCURS, DAMAGE TO EQUIPMENT CAN OCCUR.

- (3) Replace the fittings that have resistances more than the values in (Table 407). (a) Do a check of the resistance again.

NOTE: Do not use bonding jumpers to connect high resistance hydraulic installations.

SUBTASK 20-10-51-760-005

- (4) Measure the resistance between the bulkhead fittings and hydraulic tube.

- (a) Make sure the resistance is less than the value shown in (Table 408).

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Table 407/20-10-51-993-848 Resistance Between Bulkhead Fittings and Hydraulic Tubes

MAXIMUM RESISTANCE (Milliohm)			
TUBE DASH NO.	ALUMINUM	TITANIUM	
		PERMASWAGE	WELD-ON
-4	_____	6	12
-6	0.70	4	8
-8	0.50	2.5	5
-10	0.41	1.5	3
-12	0.30	1.30	2.6
-16	0.20	0.81	1.7
-20	0.10	0.64	1.3

SUBTASK 20-10-51-760-006

(5) Measure the resistance across the in-line union/tee fittings (tube-to-tube) (Figure 404).

(a) Make sure the resistance is less than the value in (Table 408).

Table 408/20-10-51-993-849 Resistance Across Union/Tee Fittings (Tube-to-Tube)

MAXIMUM RESISTANCE (Milliohm)		
TUBE DASH NO.	ALUMINUM	TITANIUM
-4	_____	12.0
-6	1.30	8.0
-8	0.95	5.0
-10	0.75	5.0
-12	0.60	2.6
-16	0.40	1.7
-20	0.20	1.3

END OF TASK

TASK 20-10-51-000-802

5. Flareless Fittings in Pressurized Areas Installation

A. References

Reference	Title
20-10-51-300-805	Tube Repair (P/B 801)

B. Procedure

SUBTASK 20-10-51-300-001

(1) Make the necessary repairs to the flareless tubing assembly.

(a) Do this task: Tube Repair, TASK 20-10-51-300-805.

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SUBTASK 20-10-51-420-017

CAUTION: USE TWO WRENCHES TO TIGHTEN THE TUBE COUPLING NUTS. USE ONE TO HOLD THE NIPPLE, AND THE OTHER TO TIGHTEN THE COUPLING NUT. IF YOU DO NOT USE TWO WRENCHES, DAMAGE TO THE TUBES AND NIPPLES CAN OCCUR.

- (2) 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.

SUBTASK 20-10-51-420-018

- (3) Tighten flareless fittings with BACS13BX, welded-on, or NAS1760-type sleeves as follows:
 - (a) Tighten the fitting to the applicable torque shown in (Table 409).
 - (b) Loosen the fitting to release the torque.
 - (c) Tighten the fitting to the torque shown in (Table 409).

Table 409/20-10-51-993-850 Installation Torques

Tube Size	Titanium Cres Tube Pound-Inches (Newton-meters)	Aluminum Pound-Inches (Newton-meters)
0.250	210 (23.73)	170 (19.21)
0.375	400 (45.19)	250 (28.25)
0.500	750 (84.74)	420 (47.45)
0.625	1050 (118.6)	540 (61.01)
0.750	1350 (152.5)	675 (76.26)
1.000	1800 (203.4)	1125 (127.1)
1.250	2400 (271.2)	1350 (152.5)
1.500	3000 (339)	1350 (152.5)

SUBTASK 20-10-51-760-007

- (4) If you install flareless fittings in the fuel tanks, do this task: Electrical Resistance Specifications in the Fuel Tank Check, TASK 20-10-51-760-801.

SUBTASK 20-10-51-790-002

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

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

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SUBTASK 20-10-51-710-003

- (6) 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, go back and verify that the connections are correct:

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

- (a) After verifying the connections, do the post-installation test of one or more of the components to which the tubes are connected as a check.

SUBTASK 20-10-51-710-004

- (7) 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, go back and verify that the connections are correct:

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

- (a) After verifying the connections, do the post-installation test of one or more of the components to which the wires are connected as a check.

————— **END OF TASK** —————

TASK 20-10-51-200-801

6. Tubing Clearances Check

A. General

- (1) This task gives you the minimum clearances necessary between tubes and all other components (hoses, fittings, structure, and other tubes). These clearances prevent tube damage in all positions of operation.

B. Procedure

SUBTASK 20-10-51-420-019

- (1) Install the hydraulic tubes with a minimum of force on the clamps or the tubing.

SUBTASK 20-10-51-220-013

- (2) Where the tubes are held by clamps to an adjacent structure, do these checks:
- (a) Make sure the tubes are clear of the adjacent structure. The minimum clearance is 0.10 in. (2.54 mm).
- (b) Where the tube is attached directly with a clamp to the structure, the clearance can be the thickness of the clamp.

SUBTASK 20-10-51-220-014

- (3) Where the tubes are not held by clamps to an adjacent structure, do this check:
- (a) Make sure all tubes are clear of the adjacent structure, equipment installations, and other items.

NOTE: The minimum clearance is 0.25 in. (6.35 mm). The minimum clearance from electrical wiring installations is 0.50 in. (12.70 mm)."

SUBTASK 20-10-51-220-015

- (4) Make sure the tubes are clear of any mechanism that operates. The minimum clearance is 0.38 in. (9.65 mm).

NOTE: This minimum clearance can be 0.25 in. (6.35 mm) where the tubes are attached by clamps to adjacent structure.

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SUBTASK 20-10-51-220-016

- (5) If one tube goes across a tube or if two tubes are parallel, make sure there are sufficient clamps attached.

NOTE: The clearance must be 0.25 in. (6.35 mm) minimum. The clearance can also be equal to the thickness caused when you attach two clamps side-by-side. You can add side-by-side clamps to get the necessary clearance.

SUBTASK 20-10-51-420-020

- (6) For loop-type clamps do these checks:

NOTE: Do not use NAS42 or NAS43 spacers on hydraulic tubes.

- (a) To get the necessary clearances with the loop-type clamps, use BACS18AF3 or BACS18AF4 spacers to get the necessary height.

NOTE: On the U-type clamps, use BACS18AN spacers.

- 1) Do not use more than four spacers together. If more than four spacers are necessary, find the cause and correct the problem.

SUBTASK 20-10-51-220-017

- (7) Make sure the tubes are clear of the control cables between the break points or the fairleads and the control cable linkage.

NOTE: The minimum clearance is 0.060 in. (1.524 mm).

SUBTASK 20-10-51-220-018

- (8) Make sure the minimum clearance between the tubes in the clampblocks and the channels on the clampblocks is 0.060 in. (1.524 mm).

NOTE: If this clearance is less, correct the spacer tube length (NAS43003-) or correct the force on the tubes in the clamp block.

————— END OF TASK —————

TASK 20-10-51-200-802

7. Space Between Tubing Clamps Check

A. Procedure

SUBTASK 20-10-51-220-019

- (1) Make sure the space between the tubing clamps is within the limits shown in (Table 410), unless it is specified differently.

Table 410/20-10-51-993-851 Maximum Space Between Tubing Clamps

TUBE OD Inch (mm)	MATERIAL	CLAMP SPACE - VISUAL Inches (cm)	CLAMP SPACE - SPECIAL *T1]
1/4 (6.35)	Steel, Titanium	16.0 (40.6)	12.0 (30.4)
3/8 (9.53)	Steel, Titanium	20.0 (50.8)	15.0 (38.1)
3/8 (9.53)	Aluminum	16.5 (41.9)	12.0 (30.5)
1/2 (12.7)	Steel, Titanium	23.0 (58.4)	17.0 (43.2)
1/2 (12.7)	Aluminum	19.0 (48.3)	14.0 (35.6)
5/8 (15.88)	Steel, Titanium	22.0 (55.9)	18.5 (47.0)

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(Continued)

TUBE OD Inch (mm)	MATERIAL	CLAMP SPACE - VISUAL Inches (cm)	CLAMP SPACE - SPECIAL ^{*[1]}
5/8 (15.88)	Aluminum	22.0 (55.9)	16.5 (41.9)
3/4 (19.05)	Steel, Titanium	27.5 (69.9)	20.5 (52.1)
3/4 (19.05)	Aluminum	24.0 (61.0)	18.0 (45.7)
1.0 (25.4)	Steel, Titanium	30.0 (76.2)	22.5 (57.2)
1.0 (25.4)	Aluminum	26.5 (67.3)	19.5 (49.5)
1-1/4 (31.75)	Steel, Titanium	31.5 (80.0)	23.5 (59.7)
1-1/4 (31.75)	Aluminum	28.5 (72.4)	21.0 (53.3)

*[1] Special: Wing Rear Spar, Engine Strut, Engine Aft Fairing.

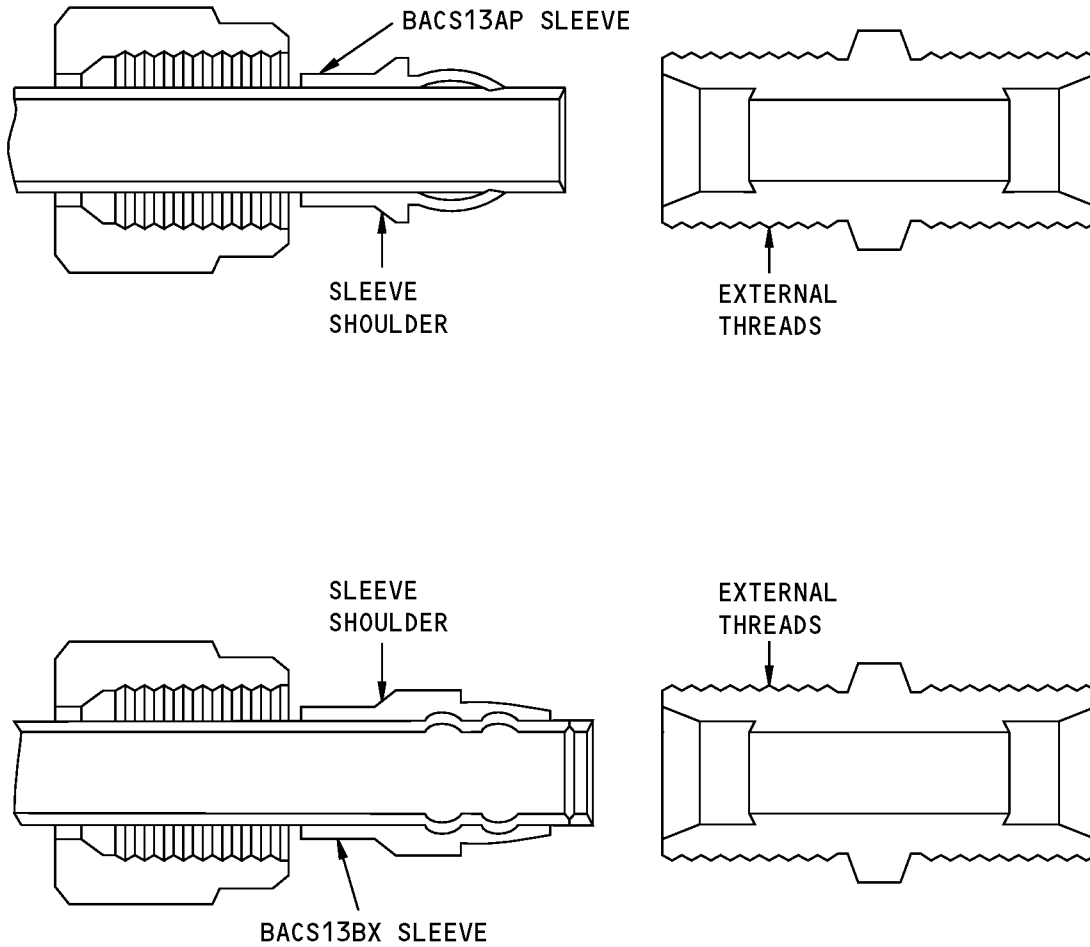
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LUBRICATION POINTS

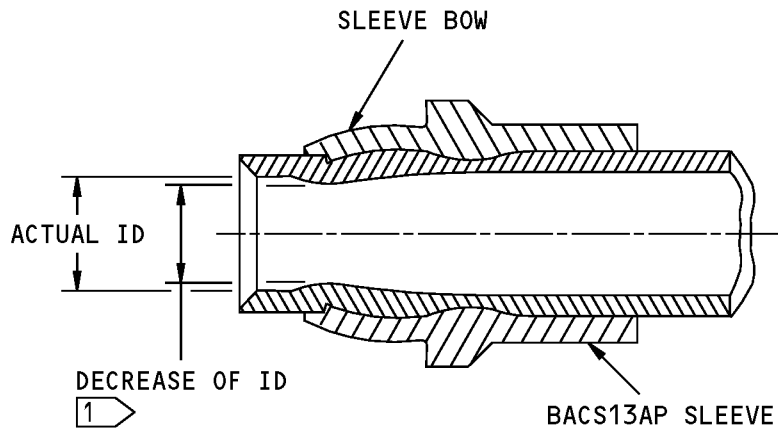
**Flareless Tubing Assembly Lubrication Points
Figure 401/20-10-51-990-838**

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1 MAKE SURE THE DECREASE OF ID IS NOT MORE THAN 0.005 INCH AFTER PRESET OR 0.015 INCH AFTER MANY TIGHTENINGS

**Maximum Collapse of Preset Flareless Sleeve
Figure 402/20-10-51-990-839**

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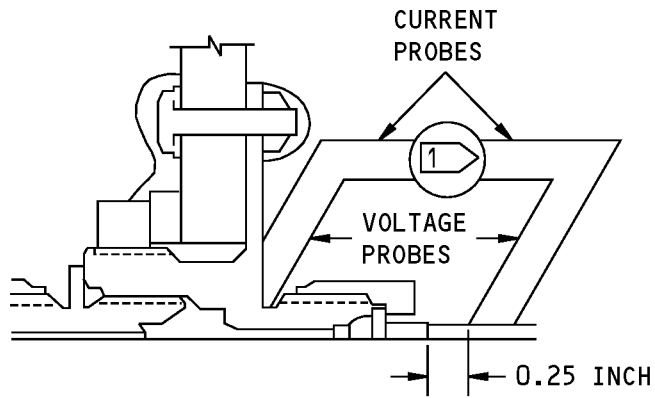
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SCREW TOGETHER WELD-ON BULKHEAD FITTING

1 MICRO-OHMMETER

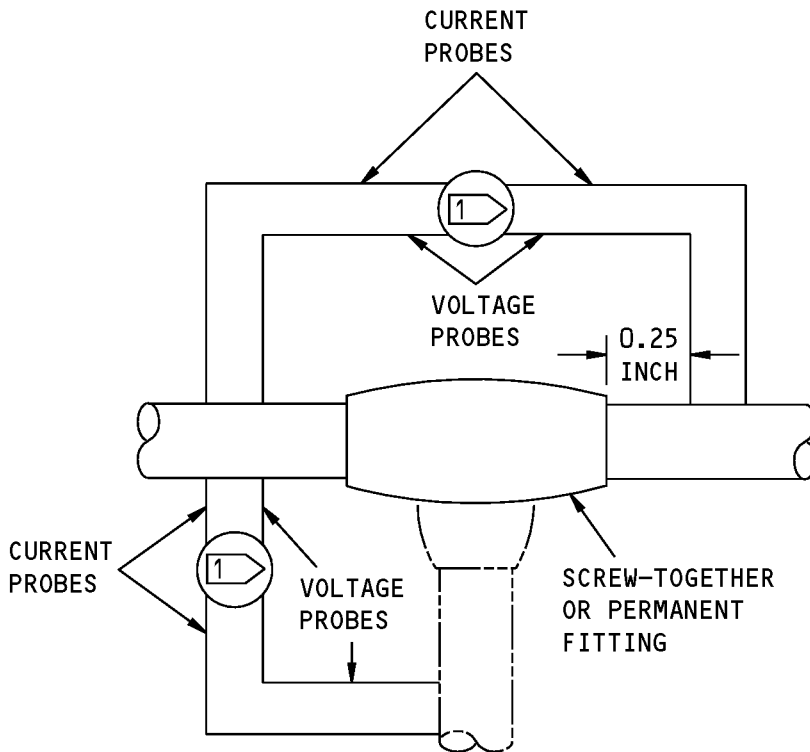
Bulkhead Fittings
Figure 403/20-10-51-990-840


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 MICRO-OHMMETER

Union/Tee Fittings
Figure 404/20-10-51-990-841

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FLARELESS TUBING ASSEMBLY - REPAIRS

1. General

- A. The customer must consult Boeing before conducting any repairs to oxygen system tubing.
- B. This procedure has these tasks:
- (1) Tube repair
 - (2) Installation of the 921721 Cryolive flareless sleeve assembly.
 - (3) Swaging with Harrison Elastomer Swagers (models 5175, 5570, and 5720) for BACS13BX flareless sleeves
 - (4) Installation of Harrison 35211 sleeves and 35212 unions using the Harrison 6777 Roller Swaging Machine
 - (5) Swaging with a Harrison Roller Swaging Kit (model 6633K01) for BACS13BX flareless sleeves
 - (6) Preset for BACS13AP flareless sleeves
 - (7) Installation of BACC42W H-couplings
 - (8) Installation of 3P02111 or 3PHS111 Cryofit couplings
 - (9) Installation of permaswage fittings
- NOTE: The use of permaswage fitting to repair potable water line tubes is not recommended because of possible microbe growth in the cavity of the fitting.
- (10) Installation of Rynglok union
 - (11) Hydraulic tube repair with flexible hoses.
 - (12) Repair 6061-T4 or T6 aluminum tubing (hydraulic or pitot-static tubing)
 - (13) Aluminum fuel tubes, temporary weld repair method.
 - (14) Retightening of fitting joints with persistent hydraulic leaks.
- C. This procedure has repairs for hydraulic, pneumatic, fire extinguishers, water, fire extinguisher, electrical rigid conduit, and other tube assemblies. The repair procedures include the replacement of defective tube ends or the replacement of small damaged tube parts. You can use flareless tubes and sleeves, H-Coupling assemblies, Cryofit couplings, Permaswage fittings, or Rynglok unions.
- D. For the approved repair of aluminum fuel system tubes, refer to the Aluminum Fuel Tubes - Temporary Weld Repair Method, TASK 20-10-51-300-811.
- E. You can repair 6061-T4 aluminum tubes using 6061-T4 or 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 tube in place of 6061-T6 aluminum tube.
- F. You can use approved 304-1/8 Hard or 21-6-9 corrosion-resistant steel tube material for replacement or repair of titanium tube assemblies. You can also use approved 304-1/8 Hard corrosion-resistant steel tube material for replacement or repair of 21-6-9 corrosion-resistant steel tube assemblies. When a new tube is fabricated to replace an existing tube assembly, the replacement tube assembly should be marked with a part number similar to, but not the same, as the original tube. (Refer to the task for Part Marking of Flareless Tubing Assemblies.)
- CAUTION:** USE CADMIUM PLATED STEEL FITTINGS WHEN REPLACING ALUMINUM LINES WITH CORROSION RESISTANT STEEL LINES. GALVANIC CORROSION MAY OCCUR IF CADMIUM PLATED STEEL IS NOT USED.
- G. Replacements for aluminum lines may be made from corrosion resistant steel material.
- H. When you do repairs, the type of flareless tube sleeves will tell you the installation method to use.

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- (1) Use the 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 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 onto the tube end. Note that the size 10, 12, and 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.
- I. 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 (10342.1 kPa) or less.
 - J. 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.
 - K. 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.
 - L. 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 the repair of tubes installed in engines.

CAUTION: 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, BLOW-OFF, OR OTHER FAILURE.

- M. 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.
- N. Do a pressure test on completed repairs in all general areas. In pressurized areas, pressurize the system for 15 minutes minimum to do a leak test. To make sure there are no signs of hydraulic leakage, rub the area with a finger or a white cloth.
- O. 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 the 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 the 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 become possible that the tube will have too much stress. 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 components to which the tubes are connected as a check.

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- (4) If you disconnected electrical wires to get access to the hydraulic tube 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 components to which the wires are connected as a check.

P. Hydraulic system pressure specifications 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.

Q. B-Nut torquing:

- (1) The correct torquing can be applied to B-nut 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 gray drilube coating, a color-coded ring is applied on the back side of the B-nut.
- (3) If a steel or titanium B-nut connects to a aluminum tube or fitting, use the lower torque value (aluminum).

CAUTION: DO NOT ALLOW PUMPS, VALVES, ACTUATORS OR OTHER COMPONENTS TO HANG FROM KEVLAR HOSES. KEVLAR HYDRAULIC HOSES KINK EASILY AND MAY CAUSE LEAKAGE.

R. When you do repairs to Kevlar hydraulic hoses, remember Kevlar hoses kink more easily than CRES (steel) wire braided hoses.

TASK 20-10-51-300-805

2. Tube Repair

(Figure 801 through Figure 840)

A. General

CAUTION: DO NOT REPAIR COIL TUBES. NORMAL MOVEMENT OF COIL MAY BE RESTRICTED BY REPAIR.

- (1) You can repair tubes if you obey the permitted repair limits. When it is possible do the following:
- (a) Replace the damaged tube.
- (b) Replace the damaged part with a tube splice.
- (c) Repair the damaged tube with a fitting if the damaged area is sufficiently small.
- (d) Completely remove all corrosion and treat affected surface area as described in the Corrosion Prevention Manual.
- (2) When you remove, install or do work with hydraulic tube assemblies, obey the guidelines that follow:
- (a) When you remove tubes, make sure that the tubes and port fittings have tags that clearly identify the correct connection locations.

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- (b) Do not move or change the tube bends. If you move or change the bends 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-connection of the tubes can become possible.
 - 2) If you move or change the 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.
 - (c) If you must bend the tube assemblies to fit the installation, do not bend more than permitted by the ovality limits in Figure 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 Figure 801, and that the 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 Figure 803. It is not necessary for you to repair or replace the tubes with defect depth less than these values.
- (3) Electrical rigid conduit repair.
- (a) Smooth dents are permitted to the electrical rigid conduit with these limits (Figure 841).
 - 1) Dent depth damage is not more than 20 percent of outer diameter.
 - 2) The conduit is not dented or has a crack that causes it to have kinks, to rub, or to show the inner 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 (Figure 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 BACA14BP fitting, you must use another BACA14BP fitting. To install the new BACA14BP or D10203 fitting on the new tube section, use this procedure: Flareless Fittings in Pressurized Areas Installation, TASK 20-10-51-000-802. Refer to Electrical Resistance Specifications in the Fuel Tank Check, TASK 20-10-51-760-801 for verifying electrical resistance where required.
- 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 flareless screw-together ends on this fitting are prone to deformation and galling from repeated assembly and disassembly and may leak.
- (6) 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 Figure 807, Figure 808.
 - (7) To make tube repairs, use tube sections of the same material and use the fittings as shown in Figure 802. You can make splice a repair of 21-6-9 and Ti-3AL-2.5V tube with 304-1/8 Hard tube of the wall thickness shown in Figure 821, Figure 824 You can also make a splice repair of a Ti-3AL-2.5V tube with 21-6-9 tube of the wall thickness shown in Figure 821, Figure 824.

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- (8) The permitted limits of hydraulic line and fire extinguishing tubing damage caused by dents, chafes, or the corrosion removal process per the Corrosion Prevention Manual, are shown in Figure 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 (Figure 806).
 - (b) Replace a tube center section that has a short damaged segment with a single union (Figure 805).
 - (c) Replace a tube center section that has very much damage with an assembled tube and fitting assembly (Figure 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 or more of the 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 or more of the components to which the wires are connected as a check.

B. References

Reference	Title
20-10-51-000-802	Flareless Fittings in Pressurized Areas Installation (P/B 401)
20-10-51-760-801	Electrical Resistance Specifications in the Fuel Tank Check (P/B 401)
20-50-11-910-801	Standard Torque Values (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1794	Swager - Portable Tube, Hand Swaging, 1/4 - 1" Dia. Stainless Steel or Titanium Tubing (Part #: 6633K-01, Supplier: 08199, A/P Effectivity: 737-ALL)

D. Procedure

SUBTASK 20-10-51-350-009

- (1) For hydraulic tubing specifications and wall thicknesses, (Table 801).

NOTE: Table 801 applies to hydraulic tubing outside of the engine fire zones, and more than 18 inches (457 mm) from the engine firewall. For tubing inside the engine fire zones, and within 18 inches (457 mm) of the engine firewall, refer to the propulsion maintenance manual for tubing specifications.

NOTE: You can replace damaged titanium tubing or aluminum tubing with 21-6-9 CRES (BMS 7-185) or 304 1/8 Hard CRES (MIL-T-6845).

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Table 801/20-10-51-993-861 Tubing Specifications and Wall Thickness for 737 Hydraulic Tubes

	-4	-6	-8	-10	-12	-16	-20	-24
Aluminum 6061-T6 AMS 4083 (R) ^[1]	NU ^[1]	0.035 (.889)	0.035 (.889)	0.035 (.889)	0.035 (.889)	0.035 (.889)	0.049 (1.245)	0.049 (1.245)
CRES 21-6-9 BMS 7-185 (P,R) ^[1]	0.016 (.4064)	0.020 (.508)	0.026 (.6604)	0.033 (.8382)	0.039 (.9906)	0.052 (1.321)	NU	NU
TITANIUM 3AL-2.5V AMS 4945 (P,R) ^[1]	0.016 (.4046)	0.019 (.4826)	0.026 (.6604)	0.032 (.8128)	0.039 (.9906)	0.051 (1.295)	0.074 (1.880)	NU
CRES 304 1/8 HARD MIL-T-6845 (P,R) ^[1]	0.020 (.508)	0.028 (.7112)	0.035 (.889)	0.049 (1.245)	0.058 (1.473)	0.065 (1.651)	NU	NU

*[1] Inches, (millimeters) NU = This tubing size is "Not Used" in the 737 hydraulic systems. P = Use in pressure (3,000 psi or 20,684 kPa) lines . R = Use in return lines (600 psi or 4,137 kPa).

SUBTASK 20-10-51-800-007

(2) Use the tube materials shown in Table 802.

Table 802/20-10-51-993-862 Cross Reference of Tubing to BMS/MIL Specification

TUBING MATERIAL	BMS	MIL	OTHER
ALUMINUM 6061-T6, T4	---	WW-T-700/6 WW-T-7081 ^[1]	AMS4083
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

SUBTASK 20-10-51-800-008

(3) Use the Hydraulic System Design Pressure shown in (Table 803) during the repairs.

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Table 803/20-10-51-993-863 Hydraulic System Design Pressures

COMPONENT	Maximum Working Pressure Psi (kPa)	Proof Pressure Psi (kPa)	Burst Pressure Psi (kPa)
Pressure lines (including hoses and fittings) and units with air under full system pressure (such as accumulators).	3000 (20684.3)	6000 (41368.5)	12000 (82737.1)
Return and case drain lines, fittings and units	600 (4136.9)	900 (6205.3)	1500 (10342.1)
Return line hoses	600 (4136.9)	1500 (10342.1)	3000 (20684.3)
Pump Supply Reservoirs, units, lines, and fittings	65 (448.2)	100 (689.5)	200 (1378.9)
Airbleed Line (Upstream of the regulator)	250 (1723.7)	500 (3447.4)	1000 (6894.8)
Drains and vents open to the atmosphere	15 (103.4)	50 (344.7)	75 (517.1)

SUBTASK 20-10-51-940-016

- (4) Make a decision about the type of repair necessary.
 - (a) Use Figure 802 to make a decision about the group the repair is in.

SUBTASK 20-10-51-940-017

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

SUBTASK 20-10-51-420-025

- (6) 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 (Figure 806, Figure 809).
 - (b) Cut and trim the repair tube as follows (Figure 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.
 - 6) Cut the tube.
 - 7) Remove the tool.
 - 8) To deburr the tube use the correct stem subassembly and deburring tool.
 - a) To assemble the tool refer to Figure 804.
 - 9) Push down on the plunger and install the tool into the end of the tube.
 - 10) Release the plunger.
 - 11) Let the plug fill the inside of the tube.
 - 12) Rotate the deburring tool until the inside burr is removed.

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- 13) Remove the tool with the plug expanded

NOTE: The expanded plug should remove metal particles from the inside of the tube. Make sure no metal particles fall inside the tube.

- (c) Install the necessary flareless sleeves to the repair tube as told in the following applicable tasks:
- 1) (TASK 20-10-51-400-805)
 - 2) (TASK 20-10-51-300-806)
 - 3) (TASK 20-10-51-300-807)
 - 4) (TASK 20-10-51-300-808)
- (d) Assemble and tighten the flareless fittings which are part of the repair section.
- (e) Measure all of the tube assembly length (L1) (Figure 806, Figure 809).
- (f) To find the necessary cutout length (L2) as shown in Figure 806, Figure 807, use the procedure given in Figure 809, Figure 810, Figure 811.
- (g) Remove the pressure from the systems where you will do the repairs.
- (h) Cut out the damaged tube (L2).
- (i) Trim the tube ends as shown in Figure 804.
- (j) 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 this task: (TASK 20-10-51-300-806).
NOTE: Make sure the correct P dimension (position of the BACS13BX sleeve on the tube) is used. A different value applies to Size 20 and 24 sleeves when used with short flareless fittings.
 - 2) TASK 20-10-51-300-807 to use the tube swager, COM-1794 for installation of BACS13BX flareless sleeves.
 - 3) To use the Harrison 6777 Roller Swage Machine for installing 35211 sleeves or 35212 unions, refer to "Swage Harrison 35211 sleeves and 35212 unions with the Harrison 6777 Roller Swage Machine."
 - 4) To install the Cryolive flareless sleeve assembly, do this task: Install the CRYOLIVE Flareless Sleeve Assembly, TASK 20-10-51-400-805.
 - 5) To install the BACS13AP flareless sleeves, do this task: BACS13AP Flareless Sleeve Preset, TASK 20-10-51-300-808.
 - 6) To install H-couplings (BACC42W), do this task: BACC42W H-Coupling Installation, TASK 20-10-51-400-806.
 - 7) To install Cryofit unions (3P02111) or (3PHS111), do this task: 3P02111/3PHS111 Cryofit Coupling Installation, TASK 20-10-51-400-807.
 - 8) For installation of Permaswage fittings (BACU24BS), (TASK 20-10-51-400-808).
 - 9) For installation of Rynglok unions R80101T, do this task: Rynglok Union Installation, TASK 20-10-51-400-809.
- (k) Install the repair section.
- 1) To tighten the nuts, do this task: Standard Torque Values, TASK 20-50-11-910-801.
- (l) When you use a Cryofit union or an H-Coupling in the repair section, install it after you tighten the flareless fittings in their positions.

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- (m) When you use a Permaswage union in the repair section, you must make allowance for swage growth.

NOTE: Tighten the repair section in position after installation of the Permaswage union.

- (n) When you replace a tube bend section, make sure you keep the minimum straight length specifications for all fittings (Figure 812).
- (o) To install the Cryolive flareless sleeve assembly, do this task: Install the CRYOLIVE Flareless Sleeve Assembly, TASK 20-10-51-400-805

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. See (Figure 833) for approved Cryolive sleeve, coupling nut and plastic cap combinations.

- (p) When you use a Cryolive flareless sleeve/coupling nut in conjunction with a permanent Cryofit, H-Coupling, Permaswage, or Rynglok union, tighten the flareless coupling nut hand tight before installing the permanent fitting to minimize axial preload on the Cryolive sleeve.
- (q) To install the Rynglok union, do this task: Rynglok Union Installation, TASK 20-10-51-400-809.

SUBTASK 20-10-51-710-007

- (7) 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.

————— END OF TASK —————

TASK 20-10-51-300-809

3. Titanium Hydraulic Tubing, 3000 psi - Roll swaging Harrison 53211 Sleeves and 35212 Unions using the Harrison 6777 Swage Machine

A. General

- (1) The sleeves, unions, and nuts used for this repair are listed in (Figure 802, Figure 805).
- (2) Get the necessary tools and dies as listed in the operating manual with the Harrison 6777 Swage Machine.

NOTE: This procedure does not apply to repair of aluminum and CRES tubing.

B. Procedure

SUBTASK 20-10-51-300-002

- (1) Do the repair:
- (a) Cut and chamfer tubes as shown in (Figure 804). Length requirements are shown in (Figure 805, Figure 806, Figure 807, Figure 808, Figure 809, Figure 810) as applicable. Correct for swage growth according to data provided in the manufacturer's operating manual.
- (b) Clean the tube with Methyl Ethyl Ketone or an equivalent cleaning agent and blow air through the tube to remove particles.

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- (c) Use swage dies as illustrated in (Figure 813).
- (d) Use Swage Torques as shown in (Figure 817).
- (e) After swaging the tube ends, inspect the after-swage inside diameter of the tube end to the values specified in (). Also, inspect swage area for any signs of roller wear or defective rollers.
- (f) Make sure that there are no scratches or other damage on the seal areas of the sleeve and union.
- (g) Conduct a Proof Pressure Test of the tube assembly:
 - 1) Connect the Harrison sleeve and union of the tube assembly and torque it to the specified value.
 - 2) Pressurize the tube to 6000psi.
 - 3) There shall be no leakage in proof testing.
 - 4) If there is leakage, loosen and retighten the fitting. If leakage persists, remove the tube and inspect tube end and test fittings for defects.

————— **END OF TASK** —————

TASK 20-10-51-400-805

4. Install the CRYOLIVE Flareless Sleeve Assembly

A. General

WARNING: USE EXTREME CAUTION WHEN USING LIQUID NITROGEN. THE TEMPERATURE OF LIQUID NITROGEN IS 320 DEGREES BELOW ZERO (-195.5°C). PROVIDE PROPER VENTILATION AS LIQUID NITROGEN VAPORS CAN DISPLACE OXYGEN IN CONFINED AREAS. USE SAFETY GLASSES AND A FACE SHIELD WHEN USING LIQUID NITROGEN. MISSUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS.

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.

- (1) The CRYOLIVE flareless sleeve, shown in (Figure 802) and (Figure 832), is installed as part of an assembly consisting of the sleeve, a coupling and 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 assembly is removed from the liquid nitrogen, slipped onto 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.

NOTE: Do not use CRYOLIVE flareless sleeve assemblies on any oxygen lines or on fluid lines inside the fire zones on engines or APU's. The CRYOLIVE flareless sleeve assembly is not qualified for these applications.

- (2) The CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 can be used, as shown in (Figure 802) and (Figure 832), 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.

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- (3) The coupling nut used with the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 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. See (Figure 833) for approved Cryolive sleeve, coupling nut and plastic cap combinations.
- (4) Ensure that the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 is installed so that the joint will not be subjected to axial preload during final torquing of the joint.

B. References

Reference	Title
20-30-80-910-801	General Cleaning of Metal (Series 80) (P/B 201)
29-09-00-860-802	Hydraulic Reservoirs Depressurization (P/B 201)
29-11-01-860-802	Hydraulic Reservoirs Depressurization (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1355	Gloves - Insulated (Part #: EO-GLOVE-LINER- (S-M-L), Supplier: 30974, A/P Effectivity: 737-ALL) (Part #: OE-GLOVE, Supplier: 30974, A/P Effectivity: 737-ALL)
COM-1356	Work Box - Insulated (Part #: WB910825-01, Supplier: 30974, A/P Effectivity: 737-ALL)
STD-203	Container - Oil Resistant, 1 U.S.-Gal (3.8 l)
STD-1353	Assembly - Cryolive, Flareless Sleeve/Coupling Nut/Protective Cap
STD-1354	Tongs

D. Consumable Materials

Reference	Description	Specification
B01000	Solvent - General Cleaning Of Metal (AMM 20-30-801/201) - Series 80	
G00262	Nitrogen - Liquid	BB-N-411, Type II or MIL-PR~ F-27401, Type II

E. Procedure

SUBTASK 20-10-51-040-001

- (1) Remove pressure from the system where you will do repairs, do this task: Hydraulic Reservoirs Depressurization, TASK 29-11-01-860-802 or Hydraulic Reservoirs Depressurization, TASK 29-09-00-860-802 and allow the hydraulic fluid to drain into a suitable container, example 1 U.S.-gal (3.81 l) oil resistant container, STD-203.

SUBTASK 20-10-51-800-009

- (2) Make sure that the tube end where you will install the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 is round, smooth and free of scratches and burrs.

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SUBTASK 20-10-51-110-011

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 Series 80 solvent, B01000 (TASK 20-30-80-910-801) to clean the tube in the area where you will install the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353.

SUBTASK 20-10-51-800-010

- (4) Put on the insulated insulated gloves, COM-1355.

SUBTASK 20-10-51-880-001

WARNING: USE EXTREME CAUTION WHEN USING LIQUID NITROGEN. THE TEMPERATURE OF LIQUID NITROGEN IS 320 DEGREES BELOW ZERO (-195.5°C). PROVIDE PROPER VENTILATION AS LIQUID NITROGEN VAPORS CAN DISPLACE OXYGEN IN CONFINED AREAS. USE SAFETY GLASSES AND A FACE SHIELD WHEN USING LIQUID NITROGEN. MISSUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS.

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.

- (5) Put nitrogen, G00262, into a small, insulated insulated work box, COM-1356. Remove the CRYOLIVE flareless sleeve/coupling nut/protective cap cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 from the main storage container and put it into the liquid nitrogen. Make sure the assembly is fully covered by the liquid nitrogen.

SUBTASK 20-10-51-510-001

- (6) Move the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 which is in the liquid nitrogen to the repair location.

SUBTASK 20-10-51-420-026

- (7) Install the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353:
 - (a) Using tongs, STD-1354, remove the CRYOLIVE flareless sleeve cryolive flareless sleeve/coupling nut/protective cap assembly, STD-1353 from the liquid nitrogen and allow the excess liquid nitrogen to run off.

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

- (b) Grasp the CRYOLIVE flareless sleeve with the gloved hand and immediately slide it onto 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.

SUBTASK 20-10-51-880-002

- (8) Allow the CRYOLIVE flareless sleeve to warm and shrink on to the tube.

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SUBTASK 20-10-51-540-001

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.

- (9) 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. Refer to (Figure 833).

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

————— **END OF TASK** —————

TASK 20-10-51-300-806

5. BACS13BX Flareless Sleeve Swaging with the Harrison Swagers 5175, 5570, and 5720

(Figure 813)

A. References

Reference	Title
29-09-00-860-802	Hydraulic Reservoirs Depressurization (P/B 201)
29-11-01-860-802	Hydraulic Reservoirs Depressurization (P/B 201)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1388	Kit - Power Swaging, Stationary Automatic (1/4 - 3/4 Tube Size) (Part #: 5570, Supplier: 08199, A/P Effectivity: 737-ALL) (Part #: 6520, Supplier: 08199, A/P Effectivity: 737-ALL)
COM-1789	Kit - Hand Swaging, Portable (1/4-1/2 Inch Tube Size) (Part #: 5175K-200, Supplier: 08199, A/P Effectivity: 737-ALL)
COM-1790	Kit - hand Swaging, Portable (5/8 to 1-1/2 Tube Size) (Part #: 5720K-200, Supplier: 08199, A/P Effectivity: 737-ALL)
STD-203	Container - Oil Resistant, 1 U.S.-Gal (3.8 l)

C. Procedure

SUBTASK 20-10-51-040-002

- (1) Remove pressure from the system where you will do repairs, do this task: Hydraulic Reservoirs Depressurization, TASK 29-11-01-860-802 or Hydraulic Reservoirs Depressurization, TASK 29-09-00-860-802 and allow the hydraulic fluid to drain into a suitable container, example 1 U.S.-gal (3.81 l) oil resistant container, STD-203.

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SUBTASK 20-10-51-940-022

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.

- (2) Get the necessary tools as shown in the instruction manual supplied with portable (1/4-1/2 inch tube size) hand swaging kit, COM-1789, power swaging kit, COM-1388, or portable (5/8 to 1-1/2 tube size) hand swaging kit, COM-1790.

SUBTASK 20-10-51-640-003

- (3) Apply a light layer of anticorrosion lubricant to the outer surfaces of the bushings and expanders of the drawbar assemblies.

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

- (a) Make sure the tube and sleeve are clean and dry.

SUBTASK 20-10-51-340-002

- (4) Apply the necessary swage pressure, shown in (Figure 814), and hold the pressure for a minimum of two seconds.

SUBTASK 20-10-51-220-020

- (5) Do a check of the groove depth with a Tiplar or Mueller bore gage (Figure 816).

SUBTASK 20-10-51-220-021

- (6) Do a check on the external dimensions of the swaged fitting (Figure 815).

SUBTASK 20-10-51-220-022

- (7) Make sure the tooling die marks on the outside diameter of the tube do not have a height or depth larger than 10% of the tube wall specified thickness.

NOTE: Other permitted defects include marks or scratches on the outer tube which are less than 0.20 inch (5.08 mm) in length and 0.002 inch (.0508 mm) in depth.

SUBTASK 20-10-51-210-018

- (8) Make sure the seal areas of the sleeves and unions are not scratched or damaged during fabrication.

SUBTASK 20-10-51-210-019

- (9) Make sure each seal area keeps the usual finish specifications.

SUBTASK 20-10-51-220-023

- (10) 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 (5.08 mm) in height.

SUBTASK 20-10-51-220-024

- (11) Make sure the tool and die marks on the external skirt and shoulder areas of the sleeves and unions do not touch the nut.

————— **END OF TASK** —————

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TASK 20-10-51-300-807

6. BACS13BX Flareless Sleeve Swaging with the 6633K01 Harrison Roller Swaging Kit

A. References

Reference	Title
29-09-00-860-802	Hydraulic Reservoirs Depressurization (P/B 201)
29-11-01-860-802	Hydraulic Reservoirs Depressurization (P/B 201)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1794	Swager - Portable Tube, Hand Swaging, 1/4 - 1" Dia. Stainless Steel or Titanium Tubing (Part #: 6633K-01, Supplier: 08199, A/P Effectivity: 737-ALL)
STD-203	Container - Oil Resistant, 1 U.S.-Gal (3.8 l)

C. Procedure

SUBTASK 20-10-51-040-003

- (1) Remove pressure from the system where you will do repairs, do this task: Hydraulic Reservoirs Depressurization, TASK 29-11-01-860-802 or Hydraulic Reservoirs Depressurization, TASK 29-09-00-860-802 and allow the hydraulic fluid to drain into a suitable container, example 1 U.S.-gal (3.81 l) oil resistant container, STD-203.

SUBTASK 20-10-51-940-023

- (2) Get the necessary tools as told in the operating instruction manual supplied with the tube swager, COM-1794.

SUBTASK 20-10-51-350-010

- (3) Apply the necessary torque, shown in (Figure 817), to the expander mandrel.

SUBTASK 20-10-51-220-025

- (4) After you swage, make sure the BACS13BX sleeve and tube agree with the specifications of (Figure 817).
 - (a) Do not trim the tube after you roller swage.
 - (b) If it is necessary, remove the burrs with an approved deburring tool.

SUBTASK 20-10-51-210-020

- (5) Make sure the seal areas of the sleeves are not scratched or damaged during fabrication.

SUBTASK 20-10-51-210-021

- (6) Make sure each seal area keeps the 63 RHR (no annular tool marks) finish specifications of its standard.

SUBTASK 20-10-51-220-026

- (7) Make sure the die marks on the external skirt and shoulder areas of the sleeves are not more than 0.002 inch (.0508 mm) in height.

SUBTASK 20-10-51-220-027

- (8) Make sure the die marks on the external skirt and shoulder areas of the sleeves do not touch the nut.

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SUBTASK 20-10-51-210-022

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

————— **END OF TASK** —————

TASK 20-10-51-300-808

7. BACS13AP Flareless Sleeve Preset

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 (.0508 mm).

B. References

Reference	Title
29-09-00-860-802	Hydraulic Reservoirs Depressurization (P/B 201)
29-11-01-860-802	Hydraulic Reservoirs Depressurization (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1785	Gun - Lockbolt, 13/16 Inch Stroke and Minimum of 6500 Lb Pulling Capacity (Part #: G85D-S, Supplier: 11815, A/P Effectivity: 737-ALL) (Opt Part #: G85D, Supplier: 05693, A/P Effectivity: 737-ALL)
SPL-1589	Kit - Preset Tube Fitting, "Sleeve Set", (Not for Titanium Tubing) (Set fo 25 Ea. Dies, Mandrel, & Clamps) (Part #: ST878D, Supplier: 81205, A/P Effectivity: 737-100, -200, -200C, -300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: ST879A, Supplier: 81205, A/P Effectivity: 737-ALL)
SPL-1590	Holder - Tube Fitting, Preset (Part #: ST879AF, Supplier: 81205, A/P Effectivity: 737-100, -200, -200C, -300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)
STD-203	Container - Oil Resistant, 1 U.S.-Gal (3.8 l)

D. Procedure

SUBTASK 20-10-51-040-004

- (1) Remove pressure from the system where you will do repairs, do this task: Hydraulic Reservoirs Depressurization, TASK 29-11-01-860-802 or Hydraulic Reservoirs Depressurization, TASK 29-09-00-860-802 and allow the hydraulic fluid to drain into a suitable container, example 1 U.S.-gal (3.81 l) oil resistant container, STD-203.

SUBTASK 20-10-51-350-011

- (2) Do these steps to do the pressure preset with the Cherry 13/16 inch stroke and minimum of 6500 lb pulling capacity lockbolt gun, COM-1785:
 - (a) Attach the thrust sleeve and die holder to the Cherry 13/16 inch stroke and minimum of 6500 lb pulling capacity lockbolt gun, COM-1785.

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- (b) Install the mandrel and the preset die in the Cherry (Figure 818).
- (c) Connect the air pressure line and use the correct pressure (Figure 818).
- (d) Do several cycles of the Cherry 13/16 inch stroke and minimum of 6500 lb pulling capacity lockbolt gun, COM-1785 and make sure the pressure is set correctly.
- (e) Assemble the split-clamp die, the clamp nut, and the sleeve.
- (f) Put the assembly into the die holder.
- (g) Put the B-nut on the tube and make the tube end touch the bottom of the die holder.
- (h) Start the Cherry 13/16 inch stroke and minimum of 6500 lb pulling capacity lockbolt gun, COM-1785.
- (i) Hold the tube in its position while the die installs the sleeve on the tube.
- (j) Maintain the pressure while you preset the sleeve on the tube.
- (k) Unclamp the nut.
- (l) Remove the tube and die from the holder.
- (m) Open the die to show the preset sleeve.

SUBTASK 20-10-51-350-012

- (3) To preset the sleeve by hand, do these steps:
- (a) Use the correct mandrel for the preset tube sleeve set fitting kit, SPL-1589 and tube fitting holder, SPL-1590 (Figure 819).
 - (b) Lubricate the threads, sleeve shoulder, and conical seal area of the fitting.
NOTE: Do not lubricate the tube.
 - (c) Assemble the sleeve on the tube.
 - (d) Insert the tube into the preset tube sleeve set fitting kit, SPL-1589 and tube fitting holder, SPL-1590 union.
 - (e) Tighten the nut as shown in (Figure 821).
 - (f) If the preset tube sleeve set fitting kit, SPL-1589 and tube fitting holder, SPL-1590 is not available, you can preset the sleeves with a carbon steel union and nut as shown in (Figure 821).

SUBTASK 20-10-51-220-028

- (4) After you preset, make sure the BACS13AP sleeve and tube joint have the properties that follow (Figure 820):
- (a) Corrosion resistant steel tubing (MIL-T-6845):
 - 1) Make sure the sleeves have a maximum of 0.005 inch (.127 mm) longitudinal end play.
 - 2) 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 (.381 mm) 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 (.127 mm) (Figure 820).

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- 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.

————— END OF TASK —————

TASK 20-10-51-400-806

8. BACC42W H-Coupling Installation

(Figure 822)

A. General

WARNING: DO NOT USE BACC42W H-COUPPLINGS 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.

- (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) (20684.3 kPa) 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 (10342.1 kPa) 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 (9.52 mm). 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 (11.43 cm) (Figure 806).

B. References

Reference	Title
20-30-80-910-801	General Cleaning of Metal (Series 80) (P/B 201)
29-09-00-860-802	Hydraulic Reservoirs Depressurization (P/B 201)
29-11-01-860-802	Hydraulic Reservoirs Depressurization (P/B 201)

C. Tools/Equipment

Reference	Description
STD-203	Container - Oil Resistant, 1 U.S.-Gal (3.8 l)
STD-1357	Assembly - Tube Coupling

D. Consumable Materials

Reference	Description	Specification
B01000	Solvent - General Cleaning Of Metal (AMM 20-30-801/201) - Series 80	

E. Procedure

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.

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(CAUTION PRECEDES)

SUBTASK 20-10-51-860-006

- (1) Remove pressure from the system where you will do repairs, do this task: Hydraulic Reservoirs Depressurization, TASK 29-11-01-860-802 or Hydraulic Reservoirs Depressurization, TASK 29-09-00-860-802 and allow the hydraulic fluid to drain into a suitable container, example 1 U.S.-gal (3.81 l) oil resistant container, STD-203.

SUBTASK 20-10-51-110-012

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 Series 80 solvent, B01000 (TASK 20-30-80-910-801) to clean the tube in the area where you will install the H-coupling tube coupling assembly, STD-1357.

NOTE: The number after the W in the part number gives the size of the coupling in sixteenths. For example, BACC42W56 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 Ti-3AL-2.5V.

SUBTASK 20-10-51-350-013

- (3) Cut the tube.

SUBTASK 20-10-51-110-013

- (4) Chamfer and remove the burrs from the inside diameter and outside diameter edges. Clean the edges with Series 80 solvent, B01000 (TASK 20-30-80-910-801).

SUBTASK 20-10-51-110-014

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.

- (5) Clean the edges with Series 80 solvent, B01000 (TASK 20-30-80-910-801).

SUBTASK 20-10-51-940-024

- (6) Install tape on the nut side of the clearance with a minimum of 0.56 inch (14.22 mm) from the tube end and a maximum of 0.675 inch (17.14 mm) from the center of the clearance (Figure 822).

SUBTASK 20-10-51-940-025

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

SUBTASK 20-10-51-940-026

- (8) Find and make a mark (marking dots) on the nut and coupling side of the tube (Figure 822).

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

SUBTASK 20-10-51-420-027

- (9) Install the tube coupling assembly, STD-1357 over the coupling side of the tube.

SUBTASK 20-10-51-210-023

- (10) Make sure the large radius and the large diameter end of the sleeve are toward the center of the union.

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SUBTASK 20-10-51-420-028

(11) Install the nut and sleeve over the tape on the nut side of the tube.

SUBTASK 20-10-51-210-024

(12) Make sure the sleeve large bore is toward the clearance.

SUBTASK 20-10-51-820-012

(13) Align the tubes and move the union until it touches the tape on the nut side on the tube.

SUBTASK 20-10-51-210-025

(14) Make sure the union meets or cover the index line on the coupling side of the tube.

SUBTASK 20-10-51-940-027

(15) Install tape on the coupling side of the tube, with the tape edge even with the end of the union.

SUBTASK 20-10-51-420-029

(16) 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.

SUBTASK 20-10-51-420-030

(17) Engage the threads of the nut with the coupling body and tighten the nut handtight.

SUBTASK 20-10-51-420-031

(18) Hold the coupling body with a wrench and tighten the coupling assembly nut to the stop.

SUBTASK 20-10-51-210-026

(19) Examine the completed repair to make sure you can see the two marking dots (Figure 822).

- (a) 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.

SUBTASK 20-10-51-210-027

(20) Make sure dimension "C" did not increase.

SUBTASK 20-10-51-200-003

(21) Do an inspection as follows:

- (a) Remove the nut.
- (b) Make sure the slide and coupling are no more than 0.015 inch (.381 mm) 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 (.381 mm), install the nut and tighten it until you get the necessary clearance (Figure 822).
- (e) Install the nut again and tighten the nut. See BACC42W Standard.
- (f) If the union does not touch the tape, you must remove the coupling and a sufficient tube length. Install a new repair section.

————— **END OF TASK** —————

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TASK 20-10-51-400-807

9. 3P02111/3PHS111 Cryofit Coupling Installation

(Figure 823)

A. General

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.

WARNING: USE EXTREME CAUTION WHEN USING LIQUID NITROGEN. THE TEMPERATURE OF LIQUID NITROGEN IS 320 DEGREES BELOW ZERO (-195.5°C). PROVIDE PROPER VENTILATION AS LIQUID NITROGEN VAPORS CAN DISPLACE OXYGEN IN CONFINED AREAS. USE SAFETY GLASSES AND A FACE SHIELD WHEN USING LIQUID NITROGEN. MISSUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS.

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.

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

B. References

Reference	Title
20-30-80-910-801	General Cleaning of Metal (Series 80) (P/B 201)
29-09-00-860-802	Hydraulic Reservoirs Depressurization (P/B 201)
29-11-01-860-802	Hydraulic Reservoirs Depressurization (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1355	Gloves - Insulated (Part #: EO-GLOVE-LINER- (S-M-L), Supplier: 30974, A/P Effectivity: 737-ALL) (Part #: OE-GLOVE, Supplier: 30974, A/P Effectivity: 737-ALL)
COM-1356	Work Box - Insulated (Part #: WB910825-01, Supplier: 30974, A/P Effectivity: 737-ALL)
STD-203	Container - Oil Resistant, 1 U.S.-Gal (3.8 l)
STD-1354	Tongs
STD-4058	Kit - Cryofit Repair, Model FRK3P02111-001

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D. Consumable Materials

Reference	Description	Specification
B01000	Solvent - General Cleaning Of Metal (AMM 20-30-801/201) - Series 80	
G00262	Nitrogen - Liquid	BB-N-411, Type II or MIL-PR~ F-27401, Type II
G00270	Tape - Scotch Flatback Masking 250	ASTM D6123 (Supersedes A-A-883)

E. Procedure

SUBTASK 20-10-51-860-007

- (1) Remove pressure from the system where you will do repairs, do this task: Hydraulic Reservoirs Depressurization, TASK 29-11-01-860-802 or Hydraulic Reservoirs Depressurization, TASK 29-09-00-860-802 and allow the hydraulic fluid to drain into a suitable container, example 1 U.S.-gal (3.81 l) oil resistant container, STD-203.

SUBTASK 20-10-51-110-015

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 Series 80 solvent, B01000 (TASK 20-30-80-910-801) to clean the tube in the area where you will install the Cryofit coupling cryofit repair kit, STD-4058.

SUBTASK 20-10-51-420-032

- (3) Use Scotch Flatback Masking Tape 250, G00270 to make a mark on the tube to make sure you put the Cryofit coupling over the center of the tube repair.

SUBTASK 20-10-51-320-002

- (4) Cut the tube.

SUBTASK 20-10-51-350-014

- (5) Chamfer and remove burrs from the inside diameter and outside diameter edges.

SUBTASK 20-10-51-110-016

- (6) Clean the edges with Series 80 solvent, B01000 (TASK 20-30-80-910-801).

SUBTASK 20-10-51-110-017

- (7) Apply a thin layer (one to two drops) of Loctite 290 around the tube circumference in the area under the serrations.

NOTE: Be careful not to let the Loctite into the tube.

SUBTASK 20-10-51-500-001

- (8) Put on insulated gloves, COM-1355.

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SUBTASK 20-10-51-110-018

WARNING: USE EXTREME CAUTION WHEN USING LIQUID NITROGEN. THE TEMPERATURE OF LIQUID NITROGEN IS 320 DEGREES BELOW ZERO (-195.55°C). PROVIDE PROPER VENTILATION AS LIQUID NITROGEN VAPORS CAN DISPLACE OXYGEN IN CONFINED AREAS. USE SAFETY GLASSES AND A FACE SHIELD WHEN USING LIQUID NITROGEN. MISSUSE OF LIQUID NITROGEN CAN CAUSE INJURY TO PERSONS.

- (9) Put nitrogen, G00262 into a small, insulated work box, COM-1356.

SUBTASK 20-10-51-110-019

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.

- (10) Remove the Cryofit coupling from the main storage container and put it into the small container of liquid nitrogen.

- (a) Make sure the fitting is fully covered by nitrogen, G00262.

SUBTASK 20-10-51-940-028

- (11) Move the Cryofit coupling in the nitrogen, G00262 (-320° F) (-195.55°C) to the repair location.

SUBTASK 20-10-51-420-033

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

SUBTASK 20-10-51-480-004

- (13) Position the test coupling so that both tubes are visible in the coupling window. For 3PO2111 couplings, ensure that a gap of less than 0.120 inch (3.048 mm) exists between the tube ends. For 3PHS111 couplings, ensure that the gap is less than 0.300 inch (7.620).

SUBTASK 20-10-51-080-002

- (14) 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. following the same procedure to mark the remaining tube end.

SUBTASK 20-10-51-480-005

- (15) Place an installation stop ("O" ring) or SNAP-ON coupling in the middle of the mark on one of the tube ends.

SUBTASK 20-10-51-480-006

- (16) 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.

SUBTASK 20-10-51-820-013

- (17) Adjust the tubes and installation stop as necessary. Remove the test coupling.

SUBTASK 20-10-51-420-034

- (18) Make sure that the tube ends within half the coupling length of the end are free of scratches.

SUBTASK 20-10-51-840-005

- (19) 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 serration. Be careful not to let the Loctite into the tube. No Loctite application is required for tube ends without scratches.

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SUBTASK 20-10-51-840-006

- (20) For a 3PO2111, remove a Cryofit coupling from the liquid nitrogen and immediately place it into a pre-chilled, extended time tool. Close the tool and immediately return the coupling/tool to liquid nitrogen. This step is omitted for 3PHS111 couplings since they are preassembled in the tool and furnished in Lexan Plastic Packaging from the manufacturer.

SUBTASK 20-10-51-840-007

- (21) 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 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.

SUBTASK 20-10-51-420-035

- (22) Install the coupling and following the steps below in rapid sequence:

- (a) Remove the chiller.
- (b) Using the cooled tongs, STD-1354, 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 the tube, realign the tubes and slide the coupling against the installation stop.
- (e) Make sure 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.

SUBTASK 20-10-51-200-004

- (23) 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.

————— END OF TASK —————

TASK 20-10-51-400-808

10. Externally Swaged (Permaswage) Fittings Installation

A. General

- (1) To do the externally swaged fitting (Permaswage) repair procedure, use the DLT series swaging tool and the BACU24BS or D10282 in-line tube unions (sizes 04, 06, 08, 10, 12, 16 and 20). You can use CRES externally swaged fittings (Permaswage) fittings, as shown in Figure 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 fittings with D suffix in the basic part number.

NOTE: The use of permaswage fitting to repair potable water line tubes is not recommended because of possible microbe growth in the cavity of the fitting.

- (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 (Figure 826)

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- (3) 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 Figure 829(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 (7.62 mm) less than the cut-out. This permits tube gaps (not more than 0.150 inch (3.81 mm)) as shown in(Figure 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.

- (4) DMC Permaswage Lightweight series (DLT Series) - Tool numbers are listed in Figure 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 Figure 825 (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 (20684.3 kPa) Application.
- (b) SOPG-01-05 - Instructional Manual for 3,000 psi Systems
- (c) DMC-1320 - DLT - Tools Prevention Maintenance

B. References

Reference	Title
20-10-51-760-801	Electrical Resistance Specifications in the Fuel Tank Check (P/B 401)
29-09-00-860-802	Hydraulic Reservoirs Depressurization (P/B 201)
29-11-01-860-802	Hydraulic Reservoirs Depressurization (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-541	Kit - Tube Repair, 3000 PSI (Part #: DLTFRPSKT3300, Supplier: 14798, A/P Effectivity: 737-ALL)
STD-203	Container - Oil Resistant, 1 U.S.-Gal (3.8 l)

D. Consumable Materials

Reference	Description	Specification
B00138	Abrasive - Silicon Carbide Coated Cloth	ANSI B74.18
C00064	Coating - Aluminum Chemical Conversion	BAC5719, Type II, Class A (MIL-C-5541, Class A)
C00259	Primer - Chemical And Solvent Resistant Finish, Epoxy Resin	BMS10-11, Type I

E. Prepare Tube for Installation

SUBTASK 20-10-51-040-005

- (1) Remove pressure from the system where you will do repairs, do this task: Hydraulic Reservoirs Depressurization, TASK 29-11-01-860-802 or Hydraulic Reservoirs Depressurization, TASK 29-09-00-860-802 and allow the hydraulic fluid to drain into a suitable container, example 1 U.S.-gal (3.81 l) oil resistant container, STD-203.

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SUBTASK 20-10-51-940-029

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 EQUIPMENT OR INJURY TO PERSONS CAN OCCUR.

WARNING: DO NOT USE PERMASWAGE FITTINGS TO REPAIR THESE COMPONENTS. IF YOU USE PERMASWAGE FITTINGS FOR THESE COMPONENTS, INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (2) Boeing does not approve Permaswage fittings for these applications:
- (a) For the repair of tubing in the fuel system (such as fuel pressure sensing lines)
 - (b) On pneumatic ducts
 - (c) Fire extinguishing lines
 - (d) Potable water lines or waste water drain lines
 - (e) The repair of electrical conduits

SUBTASK 20-10-51-940-035

- (3) Use the tools, tube repair kit, SPL-541, shown in (Figure 825).

SUBTASK 20-10-51-940-030

- (4) 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 (Figure 826).
NOTE: 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 (3.81 mm) long.
NOTE: 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 0.500 in (12.7 mm)) or longer than 0.150 inch (3.81mm), use a tube splice and two fittings to make the repair (Figure 826).

SUBTASK 20-10-51-940-031

- (5) 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 (3.81 mm) for the union installation.

SUBTASK 20-10-51-110-020

- (6) Clean the tube in the swage area:
- (a) Use an applicable solvent, for example, ethyl alcohol to clean the not painted tube sections that you will repair.
 - (b) Make sure the sections are free of dirt, grease, and other unwanted material for a distance equal to the values shown in (Figure 826).
 - (c) Remove paint and anodize from the tubes in an area equal to the values shown in (Figure 826). Use the methods shown in (Figure 828).
 - (d) Make sure the cleaned surfaces are smooth, uniform, bright, and free of unwanted materials.
 - (e) Use a brush to apply coating, C00064 to the open surfaces of aluminum tubes.

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SUBTASK 20-10-51-940-032

- (7) Remove the 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 (Figure 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.

NOTE: 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 abrasive, B00138 to remove particles.

SUBTASK 20-10-51-940-033

- (8) Use one of these steps to apply witness marks:
- (a) Use a felt pen or equivalent to apply witness marks as shown in (Figure 829).

NOTE: Use DMC tools D12580-1, -2, -3 or equivalent.
 - (b) Make marks directly on the tube to show the minimum insertion depths as shown in (Figure 829).
 - (c) Swage fittings to the marks.

SUBTASK 20-10-51-370-004

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

SUBTASK 20-10-51-370-005

- (10) Apply coating, C00064 to open areas of aluminum and primer, C00259 to all other tubes and fittings.

F. Procedure

SUBTASK 20-10-51-860-008

- (1) Remove pressure from the system where you will do repairs, do this task: Hydraulic Reservoirs Depressurization, TASK 29-11-01-860-802 or Hydraulic Reservoirs Depressurization, TASK 29-09-00-860-802 and allow the hydraulic fluid to drain into a suitable container, example 1 U.S.-gal (3.81 l) oil resistant container, STD-203.

SUBTASK 20-10-51-940-034

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

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

SUBTASK 20-10-51-350-015

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

SUBTASK 20-10-51-110-021

- (4) Clean the tube as shown in (Figure 828), then cut the tube.

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

SUBTASK 20-10-51-210-028

- (5) Examine the unions for silicone seals (Figure 824).

SUBTASK 20-10-51-420-036

- (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.

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SUBTASK 20-10-51-350-016

WARNING: MAKE SURE YOU MAKE NO PUMP ADJUSTMENT THAT CAN CAUSE THE SWAGE TOOL HYDRAULIC PRESSURE TO BE MORE THAN THE MANUFACTURERS RECOMMENDATIONS. DLT SERIES TOOLS ARE 10,000 ± 250 PSI (68,948 ± 1724 KPA) 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.

SUBTASK 20-10-51-350-017

(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.

SUBTASK 20-10-51-110-022

(9) Lubricate the head and lower die block regularly.

SUBTASK 20-10-51-210-029

(10) Examine the end plates for loose retaining screws.

SUBTASK 20-10-51-220-029

(11) Examine the finished swage as shown in the manufacturer's recommended procedure or measure with Vernier caliper for dimensions as shown in (Figure 830).

SUBTASK 20-10-51-760-008

(12) In the fuel tanks and vapor areas, do a check of the electrical resistance specifications across each tube/fitting interface (TASK 20-10-51-760-801).

SUBTASK 20-10-51-760-009

(13) Make resistance measurements for all Permaswage repair installations in wing tanks and fuel vapor areas (TASK 20-10-51-760-801).

SUBTASK 20-10-51-790-003

(14) For Permaswage fitting repairs in general areas, do a leak test as follows:

- (a) Pressurize the system for 15 minutes minimum.
- (b) Make sure there is no sign of hydraulic leaks. Use your finger or a white cloth to do a check for leaks.

SUBTASK 20-10-51-210-030

(15) 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.

SUBTASK 20-10-51-370-006

(16) Apply primer, C00259 to the Alodine areas of the finished tube joint where the bare metal is open.

SUBTASK 20-10-51-820-014

(17) 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.

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SUBTASK 20-10-51-820-015

- (18) 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.

————— END OF TASK —————

TASK 20-10-51-400-809

11. Rynglok Union Installation

(Figure 836)

A. General

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 TO REPAIR THESE COMPONENTS. IF YOU USE RYNGLOK FITTINGS FOR THESE COMPONENTS, INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT CAN OCCUR.

- (1) Boeing does not approve Rynglok fittings for these applications:
 - (a) For the repair of tubing in the fuel system (such as fuel pressure sensing lines) or fuel tanks
 - (b) On pneumatic ducts
 - (c) Fire extinguishing lines
 - (d) Potable water lines or waste water drain lines
 - (e) The repair of electrical conduits
- (2) The Rynglok in-line tube unions Fig 837, sizes 04, 06, 08, 10, 12, and 16, are used with 304 1/8 hard CRES tube to repair Ti-3AL-2.5 and 21-6-9 CRES. The same unions plus a size 20 are used with 6061-T6 aluminum tube, provided the bare areas of the tubing are painted after swaging to limit the possibility for galvanic corrosion to occur.

NOTE: Do not use Rynglok tube to tube fittings 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.

- (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 Fig 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. References

Reference	Title
29-09-00-860-802	Hydraulic Reservoirs Depressurization (P/B 201)
29-11-01-860-802	Hydraulic Reservoirs Depressurization (P/B 201)

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C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1803	Swager - Hydraulic Fitting (Part #: RTSK8-02-006, Supplier: 00624, A/P Effectivity: 737-ALL)
STD-203	Container - Oil Resistant, 1 U.S.-Gal (3.8 l)

D. Consumable Materials

Reference	Description	Specification
B00068	Alcohol - Ethyl (Denatured)	AMS 3002F (MIL-E-51454, Type II)
C00064	Coating - Aluminum Chemical Conversion	BAC5719, Type II, Class A (MIL-C-5541, Class A)
C00259	Primer - Chemical And Solvent Resistant Finish, Epoxy Resin	BMS10-11, Type I

E. Procedure

SUBTASK 20-10-51-860-009

- (1) Remove pressure from the system where you will do repairs, do this task: Hydraulic Reservoirs Depressurization, TASK 29-11-01-860-802 or Hydraulic Reservoirs Depressurization, TASK 29-09-00-860-802 and allow the hydraulic fluid to drain into a suitable container, example 1 U.S.-gal (3.81 l) oil resistant container, STD-203.

SUBTASK 20-10-51-360-001

- (2) Use the tools (Figure 837) contained in swager hydraulic fitting, COM-1803.

SUBTASK 20-10-51-360-002

- (3) Cut out the damaged section of the tube using a chipless tube cutter (Figure 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 (Figure 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 (Figure 805). If the damage is within the dimensions, the cut can be through the center of the damaged section.

SUBTASK 20-10-51-150-001

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

SUBTASK 20-10-51-110-023

- (5) Clean the non-painted tube sections that you will repair with alcohol, B00068.

SUBTASK 20-10-51-370-007

- (6) Use a brush to apply coating, C00064 to the cut ends of the tube.

SUBTASK 20-10-51-360-003

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

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SUBTASK 20-10-51-360-004

- (8) Apply positioning and inspection marks on the tube to be repaired using the appropriate gage from the swager hydraulic fitting, COM-1803 and a Sanford Sharpie (or equivalent) felt tip pen with a fine or extra fine point (Figure 838, Figure 839, Figure 840). Bottom the gage on the cut edge of the tube before making the marks.

SUBTASK 20-10-51-360-005

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

SUBTASK 20-10-51-360-006

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

SUBTASK 20-10-51-360-007

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 (55158 TO 58605 KPA). IF PRESSURE IS GREATER THAN THIS VALUE, INJURY AND DAMAGE CAN OCCUR.

- (11) Swage the union to the tube as shown in the Aeroquip Rynglok Installation Guide supplied with the swager hydraulic fitting, COM-1803.

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

SUBTASK 20-10-51-360-008

- (12) Examine the finished installation for correct ring advancement using the appropriate size inspection gage from the swager hydraulic fitting, COM-1803. The inspection gage should fit over the ring area as shown in (Figure 840) so that the ring is flush with the center portion of the union.

SUBTASK 20-10-51-780-001

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

SUBTASK 20-10-51-790-004

- (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.

SUBTASK 20-10-51-370-008

- (15) Apply coating, C00064 to bare areas of the aluminum tubing where paint was removed, followed by a coat of primer, C00259.

————— **END OF TASK** —————

TASK 20-10-51-350-802

12. Hydraulic Tubing Repair 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.
 - (c) Make sure the installation stays an airworthy repair until the system is put back to its initial configuration.

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- (d) Make a procedure to make sure that flexible hoses, installed as temporary repairs, are replaced as soon as possible.

NOTE: 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 tube or coiled tube.
- (4) hydraulic tubing repair kit, SPL-5276 or equivalent

B. References

Reference	Title
20-10-52-400-801	Flexible Hose Installation (P/B 401)
29-09-00-860-802	Hydraulic Reservoirs Depressurization (P/B 201)
29-11-01-860-802	Hydraulic Reservoirs Depressurization (P/B 201)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-5276	Repair Kit, Hydraulic Tubing (Temp. Repairs Only) (Approved for Titanium) (Part #: 65-92528-1, Supplier: 81205, A/P Effectivity: 737-ALL)

D. Install the Flexible Hose

(Figure 831)

CAUTION: DO NOT ALLOW PUMPS, VALVES, ACTUATORS OR OTHER COMPONENTS TO HANG FROM KEVLAR HOSES. KEVLAR HYDRAULIC HOSES KINK EASILY AND MAY DEVELOP LEAKAGE.

NOTE: Kevlar hydraulic hoses kink more easily than CRES (steel) wire braided hoses.

NOTE: Kevlar fibers are usually not damaged by kinking. After the hose is pressurized, all signs of kinking may disappear. However, the inner Teflon tube may be damaged and eventually leak. Kinking is especially critical for larger hoses such as the ADP pressure hoses (1 1/4 inches) (31.75 mm).

SUBTASK 20-10-51-220-030

- (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.

NOTE: The 737 airplanes use the new kevlar reinforced hydraulic hose. This hose may be used provided the guidelines of (Table 804) are met.
 - (b) Make sure the new flexible hose has a minimum of the same inner diameter as the damaged tube.

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- (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 in (Figure 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 804).

Table 804/20-10-51-993-864 Minimum Hose Bend Radius

HOSE	HOSE INNER DIAMETER INCH (mm)	MINIMUM HOSE BEND RADIUS MEASURED AT INNER BEND INCH (mm)
AS115-04	1/4 (6.35)	1.50 (38.1)
AS115-06	3/8 (9.53)	2.50 (63.5)
AS115-08	1/2 (12.7)	2.88 (73.15)
AS115-10	5/8 (15.87)	3.25 (82.55)
AS115-12	3/4 (19.05)	4.00 (101.6)
AS4568-16	1 (25.4)	7.50 (190.5)
AS4568-20	1-3/4 (44.45)	15.00 (381)

- 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 805).

Table 805/20-10-51-993-865 Minimum Hose Bend Clearance

HOSE CLEARANCE TO	MINIMUM CLEARANCE INCH (mm)
Control Cables and Linkages	1.0 ^{*[1]} (25.4)
Cable at Pulleys	0.5 (12.7)
Cable at Mid-span	2.0 (50.8)
Electrical Wiring	0.5 (12.7)
Hydraulic Tubes or Hoses	0.2 (5.08)

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

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- 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.

SUBTASK 20-10-51-860-010

- (2) For the hydraulic system where you will do the repair, do this task: Hydraulic Reservoirs Depressurization, TASK 29-11-01-860-802 or Hydraulic Reservoirs Depressurization, TASK 29-09-00-860-802.

SUBTASK 20-10-51-960-003

- (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.

SUBTASK 20-10-51-960-004

- (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.

SUBTASK 20-10-51-420-037

- (5) Do this task: Flexible Hose Installation, TASK 20-10-52-400-801.

SUBTASK 20-10-51-860-011

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

SUBTASK 20-10-51-210-031

- (7) Examine the hose and connections for leaks.

SUBTASK 20-10-51-220-031

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

————— END OF TASK —————

TASK 20-10-51-300-810

13. Repair 6061-T4 or 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 and T6 hydraulic aluminum tubes in Sizes 16 (1 inch) and 20 (1-1/4 inch). 6061-T6 material may be used as an 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.

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- (3) Repair is accomplished using only the BACS13BX sleeve, the elastomer swaging process, and other applicable methods specified in this procedure for flareless tube repairs.
- (4) No tube-to-tube fitting repairs are approved for 6061-T4 or T6 aluminum tube.

B. References

Reference	Title
20-10-09-400-801	Control Cable Pulleys Installation (P/B 401)
20-50-11-910-801	Standard Torque Values (P/B 201)

C. Procedure

SUBTASK 20-10-51-300-003

(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 (Figure 806, Figure 809).
 - 2) Cut and trim the repair tube as follows: (Figure 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 (Figure 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 the 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 (TASK 20-10-09-400-801).
 - 5) Measure all of the tube assembly length with BACS13BX sleeves (L1) (Figure 806, Figure 809).

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- 6) To find the necessary cutout length (L2) as shown in (Figure 806, Figure 809), use the procedure given in (Figure 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 shown in (Figure 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, do this task: Standard Torque Values, TASK 20-50-11-910-801.

END OF TASK

TASK 20-10-51-300-811

14. Aluminum Fuel Tubes - Temporary Weld Repair Method

A. General

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

- (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. References

Table with 2 columns: Reference, Title. Rows include 20-30-80-910-801 (General Cleaning of Metal), 20-30-88-910-801 (Final Cleaning of Metal), and SOPM 20-20-02 (Penetrant Methods of Inspection).

C. Consumable Materials

Table with 3 columns: Reference, Description, Specification. Rows include B01000 (Solvent - General Cleaning Of Metal) and B01008 (Solvent - Final Cleaning Of Metal Prior To Non-Structural Bonding).

D. Location Zones

Table with 2 columns: Zone, Area. Row includes 100 (Lower Half of Fuselage).

E. Aluminum Fuel Tube Repair

SUBTASK 20-10-51-010-002

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

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SUBTASK 20-10-51-110-024

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 Series 80 solvent, B01000, do this task: General Cleaning of Metal (Series 80), TASK 20-30-80-910-801.

SUBTASK 20-10-51-350-018

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

SUBTASK 20-10-51-120-001

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

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

SUBTASK 20-10-51-110-025

- (5) Rub or rinse the tubing with Series 88 solvent, B01008 to remove all the residue, do this task: Final Cleaning of Metal Prior to Non-structural Bonding (Series 88), TASK 20-30-88-910-801.

SUBTASK 20-10-51-300-004

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.

SUBTASK 20-10-51-230-001

- (7) Penetrant check welded area. (SOPM 20-20-02)

SUBTASK 20-10-51-110-026

- (8) Rinse with Series 88 solvent, B01008.

SUBTASK 20-10-51-790-005

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

SUBTASK 20-10-51-370-009

- (10) Finish repaired area with appropriate protective coating as required to meet original tube finish requirements.

SUBTASK 20-10-51-420-038

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

————— **END OF TASK** —————

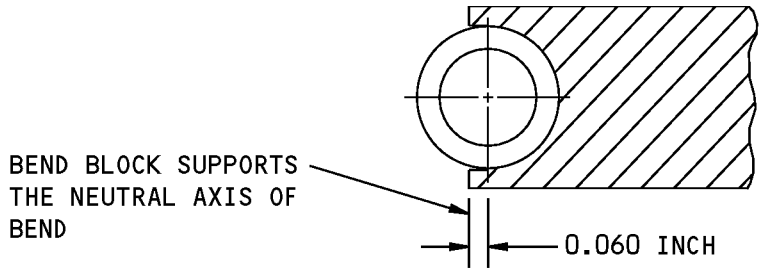
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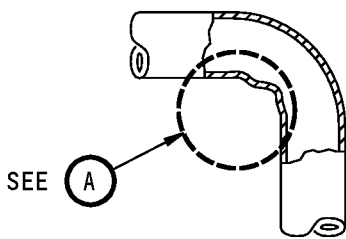
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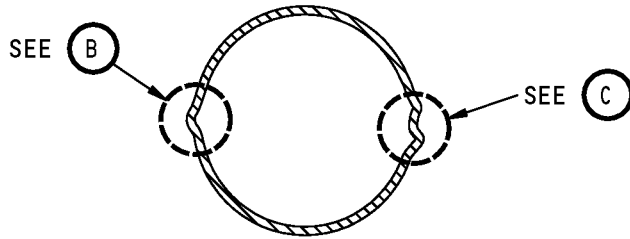


NOTE: IF THE OVALITY OF ANY PART OF THE BEND IS MORE THAN THE MAXIMUM PERMITTED OVALITY, DISCARD THE TUBE.

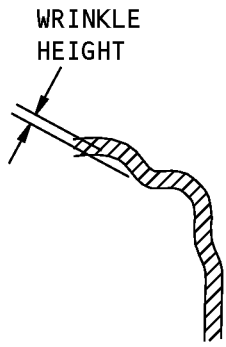
TUBE BEND BLOCK



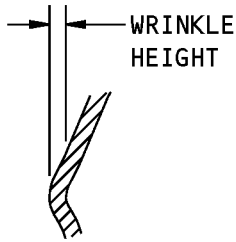
**RADIAL
WRINKLE**



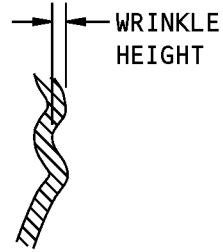
**LONGITUDINAL
WRINKLE**



(A)



(B)



(C)

WRINKLE MEASUREMENTS

**Permitted Ovality and Wrinkle of Hydraulic and Fire Extinguishing Tube Bends
Figure 801 (Sheet 1 of 2)/20-10-51-990-801**

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
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SYSTEM OPERATING PRESSURE	TUBE OD	TUBE MATERIAL	ALLOWABLE WRINKLE HEIGHT (Inches)	ALLOWABLE OVALITY (Percent of Specified OD)* 
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

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

(NOTE: OD MEASURED IN SAME PLANE.)

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

**Permitted Ovality and Wrinkle of Hydraulic and Fire Extinguishing Tube Bends
Figure 801 (Sheet 2 of 2)/20-10-51-990-801**

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CAUTION: DO NOT USE CADMIUM PARTS ON TITANIUM TUBES. CORROSION WILL OCCUR IF YOU USE CADMIUM PARTS ON TITANIUM TUBES.				
TUBE JOINING		TUBE MATERIAL	REF TABLE C FOR TOOLS REQUIRED	APPROVED SIZES
ILLUSTRATION	PART NUMBER*			
	BACS13AP (BITE-Type) 	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) 	6061T6	A	06, 08, 10, 12, 16, 20 , 24
		304 ANN.	A	16, 20
		304 1/8 Hard	A	06, 08, 10, 12, 16, 20 , 24
		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, 20

REPAIR METHOD - RECONNECTABLE WITH FLARELESS FITTING SLEEVES
TABLE A

Tube Material and Fitting Selection Tables
Figure 802 (Sheet 1 of 8)/20-10-51-990-802

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CAUTION: DO NOT USE CADMIUM PARTS ON TITANIUM TUBES. CORROSION WILL OCCUR IF YOU USE CADMIUM PARTS ON TITANIUM TUBES.				
TUBE JOINING		TUBE MATERIAL 	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, 20
	35212 UNION (Roller Swage)	Ti-3Al-2.5V	D(1)	04, 06, 08, 10, 12, 16, 20
	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 of 8)/20-10-51-990-802**

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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, 12, 16
		304 ANN.	G	04, 06, 08, 10
		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
	3P02111 or 3PHS111 Cryofit	Ti-3Al-2.5V	F	04, 06, 08, 10, 12, 16
	Permaswage D10282-D (AL) Permaswage D10282 - (Cres)	6061T6	E	04, 06, 08, 10, 12, 16
		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, 20
		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 of 8)/20-10-51-990-802

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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: <ul style="list-style-type: none"> • DLT Series <ul style="list-style-type: none"> - 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: <ul style="list-style-type: none"> • 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**

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**Tube Material and Fitting Selection Tables
Figure 802 (Sheet 4 of 8)/20-10-51-990-802**

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PART NUMBER	ASSOCIATED APPROVED FITTINGS	
	FITTING NUTS	UNIONS
BACS13AP (BITE-Type) BACS13BX (Elastomer Swage) BACS13BX (Roller Swage)	For <u>Aluminum</u> tubes less than size 20, use: <ul style="list-style-type: none"> • BACN10YL-Alum • MS21921-Alum or Steel • BACN10CS-Alum or Steel For size 20 and 24 Aluminum tubes used with short flareless fittings, use: <ul style="list-style-type: none"> • AS4660-Alum 	For <u>Aluminum</u> tubes less than size 20, use: <ul style="list-style-type: none"> • MS21902-Alum or Steel • M21924-Alum or Steel For size 20 and 24 Aluminum tubes used with short flareless fittings, use: <ul style="list-style-type: none"> • AS4663-Alum
	For <u>Cres</u> tubes, use: <ul style="list-style-type: none"> • BACN10YE-Cres • MS21921-Cres, Steel or Ti • BACN10CS-Cres, Steel • BACN10YA-Ti 	For <u>Cres</u> tubes, use: <ul style="list-style-type: none"> • MS21902-Cres, Steel or Ti • MS21924-Cres, Steel or Ti
	For <u>Ti</u> tubes, use: <ul style="list-style-type: none"> • BACN10YA-Ti • BACN10YE-Cres • MS21921-Ti, Cres • AS4660-Ti (sizes 20 and 24 only) 	For <u>Ti</u> tubes, use: <ul style="list-style-type: none"> • MS21902-Cres or Ti • MS21924-Cres or Ti • AS4660-Ti (sizes 20 and 24 only) • 35212 swaged union
35211 Sleeve (Roller Swage)	For <u>Ti</u> tubes, use: <ul style="list-style-type: none"> • BACN10YA-Ti • BACN10YE-Cres • MS21921-Ti, Cres • AS4660-Ti (sizes 20 and 24 only) 	For <u>Ti</u> tubes, use: <ul style="list-style-type: none"> • 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 <u>Aluminum</u> tubes, use: <ul style="list-style-type: none"> • 921721W- (sizes 04 thru 12 only) For <u>Cres</u> tubes, use: <ul style="list-style-type: none"> • 921721J- For <u>Ti</u> tubes, use: <ul style="list-style-type: none"> • 921721T- 	For <u>Ti</u> tubes, use: <ul style="list-style-type: none"> • MS21902-Cres or Ti • MS21924-Cres or Ti

ASSOCIATED APPROVED FITTINGS
TABLE D

Tube Material and Fitting Selection Tables
Figure 802 (Sheet 5 of 8)/20-10-51-990-802

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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 of 8)/20-10-51-990-802**

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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 of 8)/20-10-51-990-802**

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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 BACS13BD20H.HP AND BACS13BD24H.HP HAVE BEEN SUPERSEDED BY BAC13BX20H.HP AND BAC13BX24H.HP.
- 4 THE BACSBX SLEEVE CAN BE USED TO REPAIR SIZE 20 AND 24 ALUMINUM TUBES WITH SHORT FLARELESS FITTINGS. IT CAN ALSO BE USED TO REPAIR SIZE 20 ALUMINUM TUBES AND SIZE 20 AND 24 CRES TUBES WITH STANDARD FLARELESS FITTINGS. MAKE SURE YOU DETERMINE THE APPLICATION BEFORE SWAGGING. SHORT FLARELESS FITTINGS REQUIRE A SHORTER "Z₁" 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 10, 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 BACN10- AND MS21921 COUPLING NUTS.
- 8 WHEN PERFORMING A HYDRAULIC TUBE REPAIR WITH THE SAME TUBE MATERIAL, THE ALTERNATE TUBE WALL THICKNESSES LISTED IN FIG. 802 (SHEET 6) MAY BE USED IN PLACE OF WALL THICKNESSES DELIVERED WITH THE AIRPLANE WHEN PERFORMING A REPAIR ON TUBES IN SYSTEMS WITH 3000 PSI OR LESS OPERATING PRESSURE.

**Tube Material and Fitting Selection Tables
Figure 802 (Sheet 8 of 8)/20-10-51-990-802**

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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), and Fire Extinguishing Pressure (1000 PSI)
Figure 803/20-10-51-990-803**

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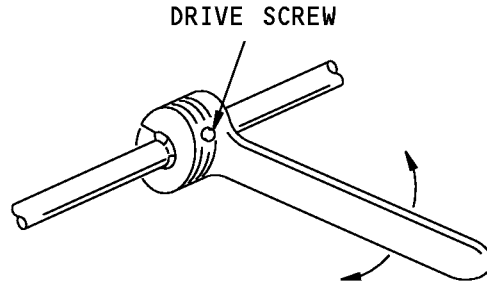
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CUTTER TOOL

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**

F15969 S0006561964_V2

**DMC Tools
 Figure 804 (Sheet 1 of 2)/20-10-51-990-804**

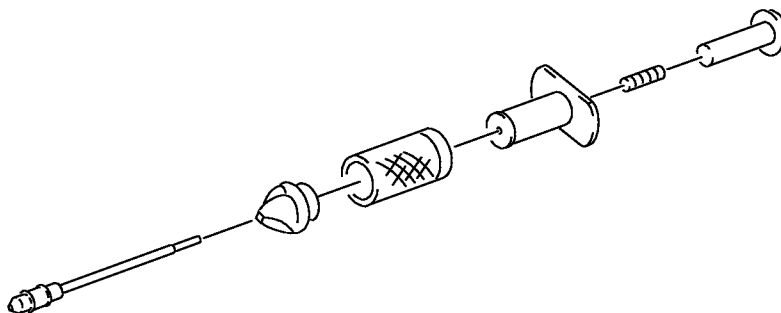
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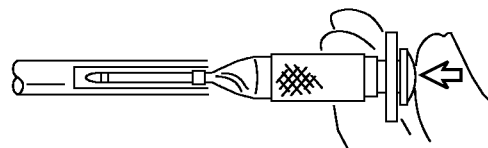
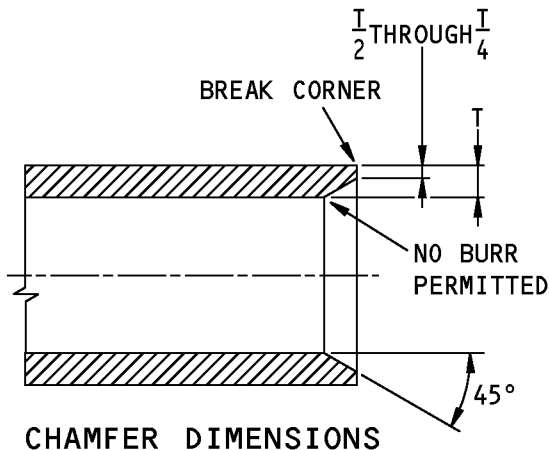
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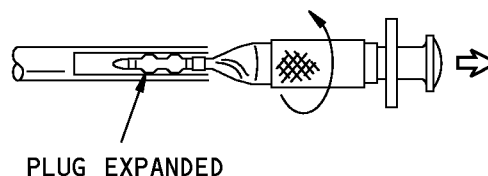
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DEBURRING TOOL ASSEMBLY



DEBURRING TOOL INSERTION



PLUG EXPANDED

DEBURRING TOOL EXTRACTION

TUBE SIZE	TUBE WALL THICKNESS - INCHES (mm)	STEM SUBASSEMBLY PART NUMBER	DEBURRING TOOL PART NUMBER
04	0.016-0.028 (0.406-0.711)	D9851-13-04	D9851
04	0.028-0.050 (0.711-1.270)	D9851-13-03	D9851
06	0.016-0.035 (0.406-0.889)	D9851-13-06	D9851
06	0.035-0.058 (0.889-1.473)	D9851-13-07	D9851
08	0.016-0.042 (0.406-1.067)	D9850-13-08	D9850
10	0.016-0.058 (0.406-1.473)	D9850-13-10	D9850
12	0.016-0.058 (0.406-1.473)	D9850-13-12	D9850
16	0.016-0.058 (0.406-1.473)	D9849-13-16	D9849
20	0.016-0.058 (0.406-1.473)	D9849-13-20	D9849

**DMC STEM SUBASSEMBLIES, DEBURRING TOOLS, AND
REQUIRED CHAMFER DIMENSIONS**

TABLE B

F15970 S0006561965_V2

DMC Tools

Figure 804 (Sheet 2 of 2)/20-10-51-990-804

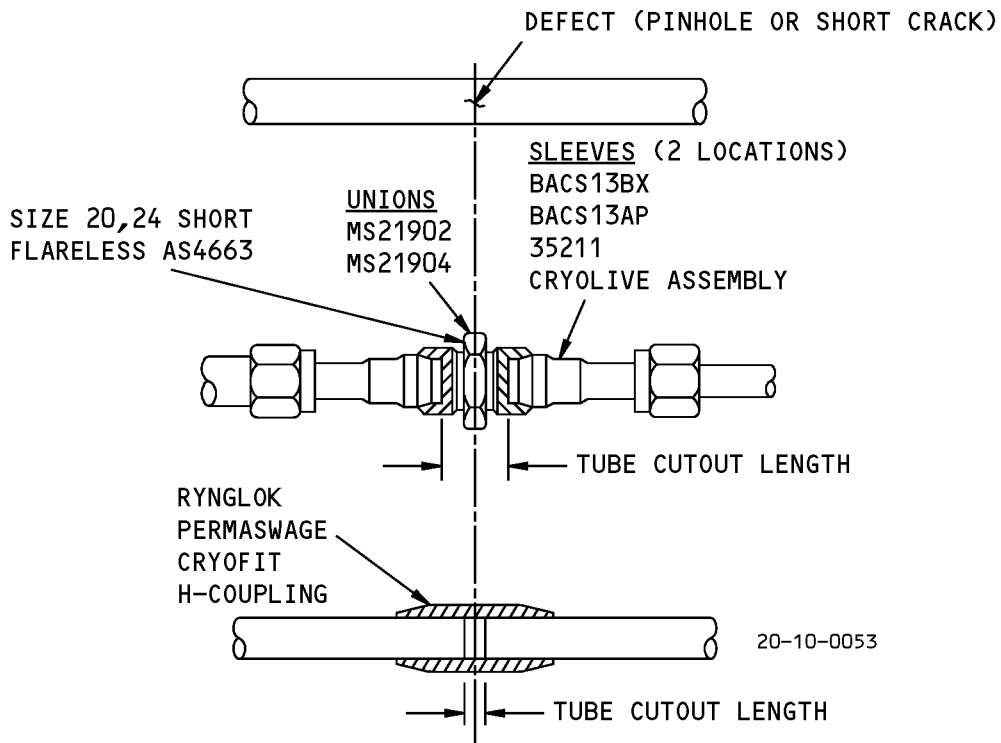
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NOTE: FITTING NUTS NOT SHOWN.

**Tubing Repair with Unions - Short Damage
Figure 805 (Sheet 1 of 2)/20-10-51-990-805**

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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		0.300	N/A	0.300	0.350	0.350	0.350	0.400	0.400	N/A	
Permaswage Cryofit H-Coupling	None Necessary	← 0.150 INCH MAXIMUM →									

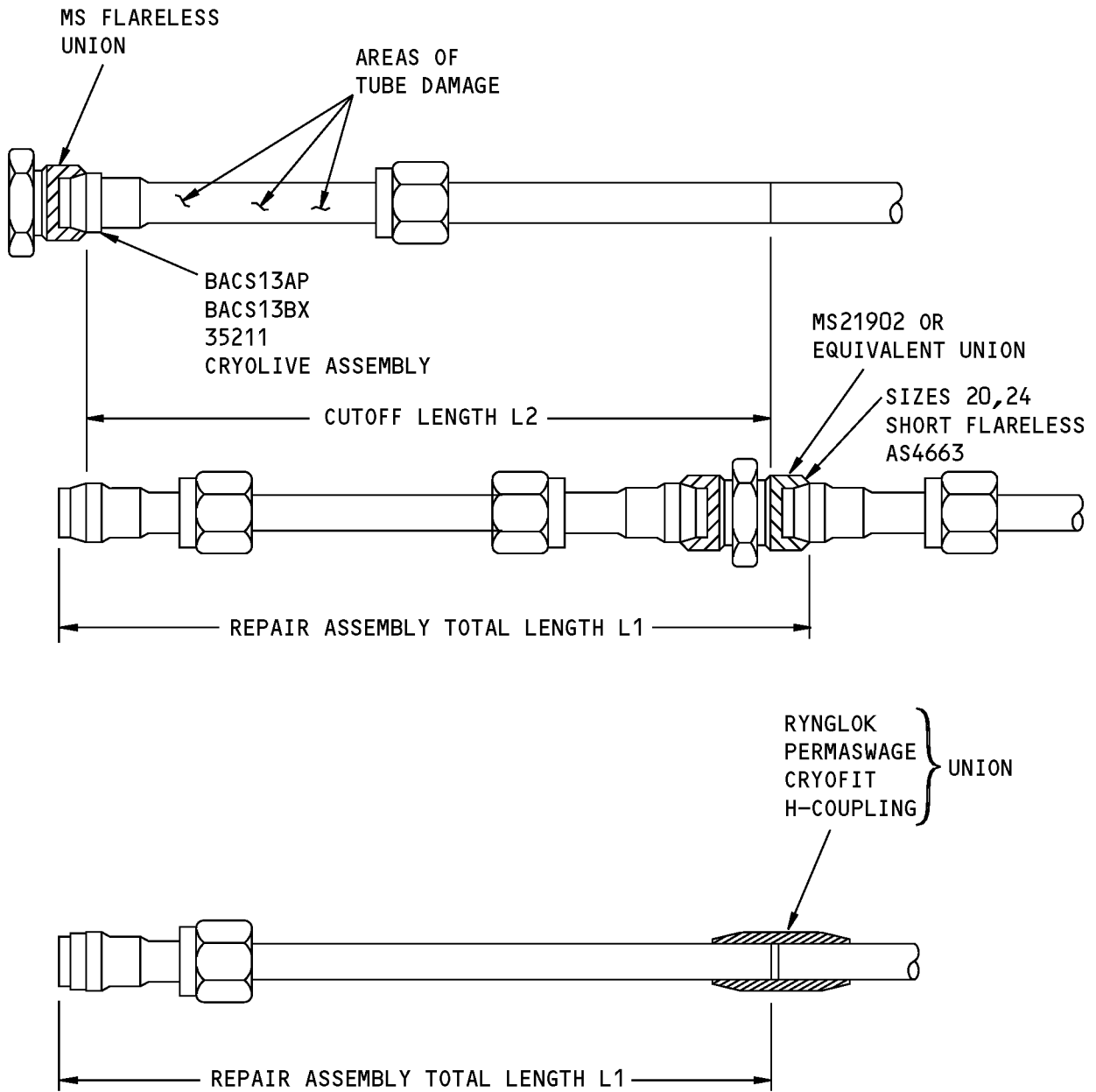
TUBE CUTOUT LENGTHS IN INCHES

**Tubing Repair with Unions - Short Damage
Figure 805 (Sheet 2 of 2)/20-10-51-990-805**

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

**Tubing Repair by End Replacement
Figure 806/20-10-51-990-806**

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TUBE CUTOUT LENGTH TO USE

ROLLER SWAGE AND BACS13BX SLEEVE

SEE (A)

TUBE CUTOUT LENGTH TO USE

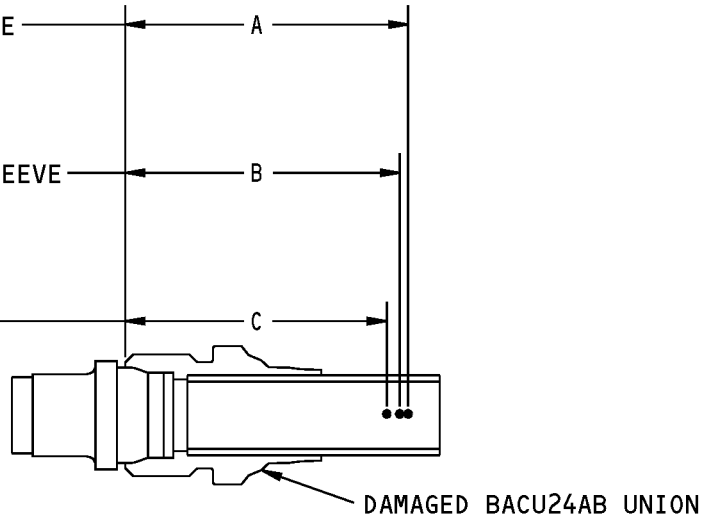
ELASTOMER SWAGE AND BACS13BX SLEEVE

SEE (B)

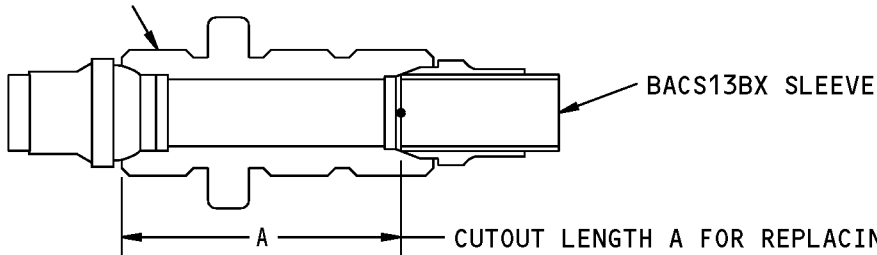
TUBE CUTOUT LENGTH TO USE

PRESET BACS13AP SLEEVE

SEE (C)



MS21924 OR
EQUIVALENT
BULKHEAD UNION



(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 of 2)/20-10-51-990-807**

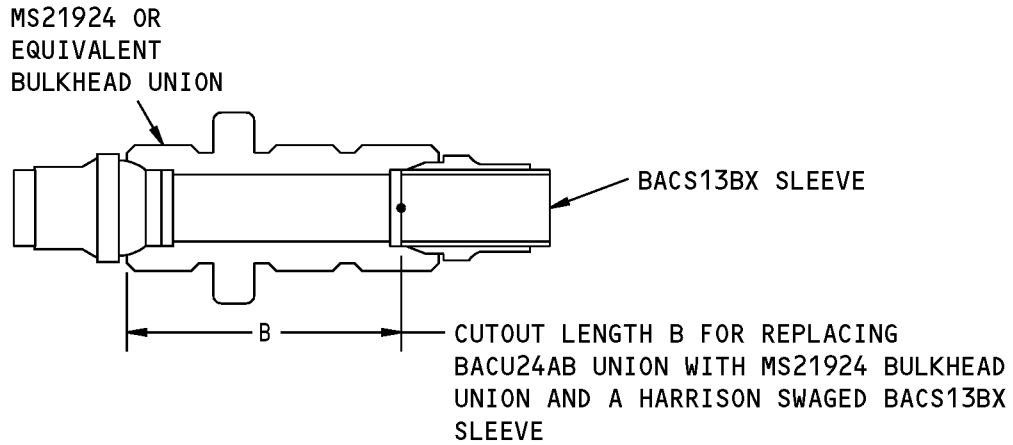
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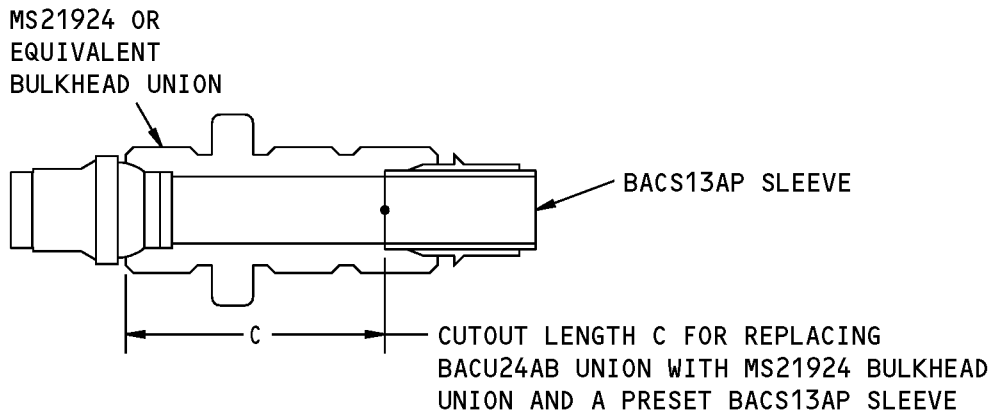
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(B)



(C)

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 2 of 2)/20-10-51-990-807**

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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 damaged 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):

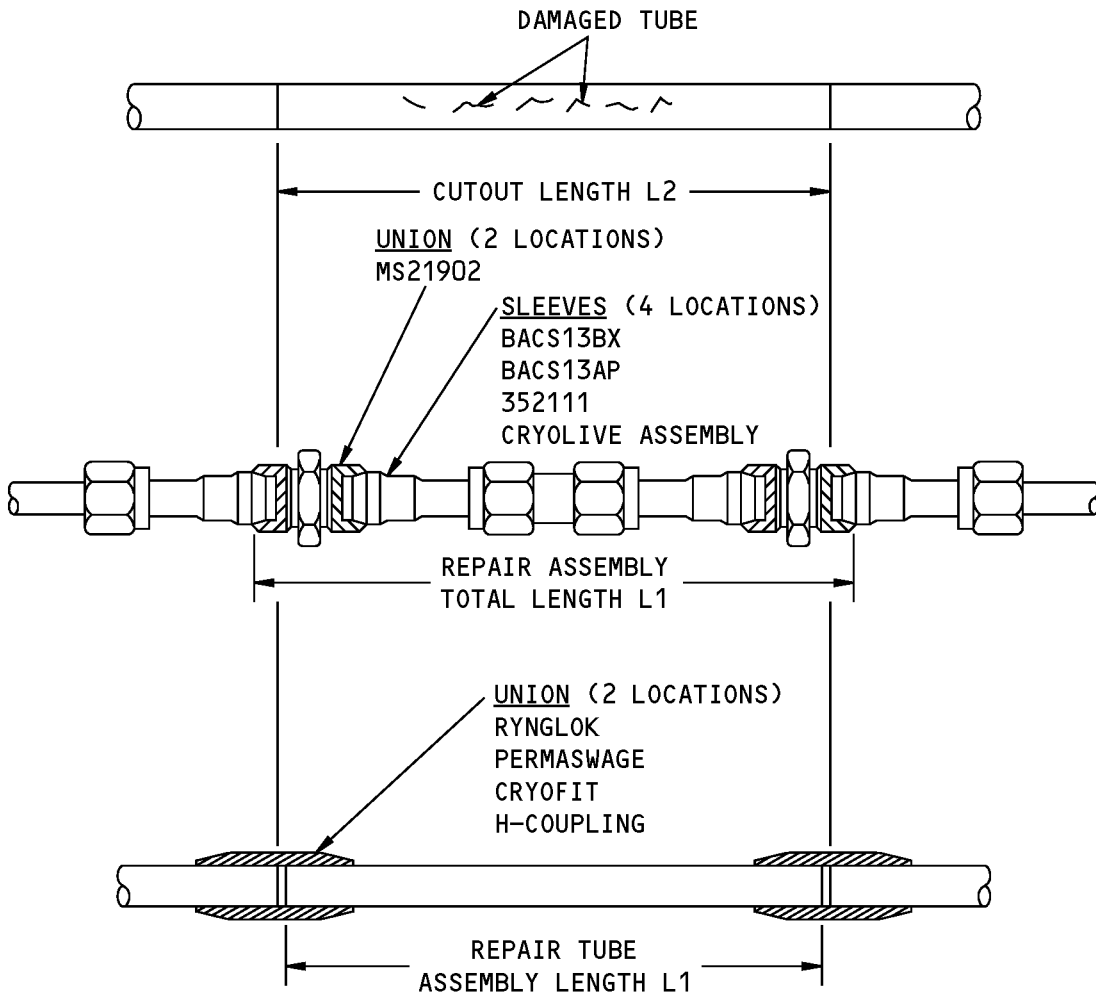
- Step 1: Cut the tube adjacent to the damaged union - to dimension A, B, or C depending on the sleeve and sleeve installation method you plan to use.
- Step 2: Slide a flareless coupling nut on to the tube. Follow the procedures for presetting a BACS13AP sleeve or swaging a BACS13BX sleeve to the tube end.
- Step 3: Install the MS21924 flareless bulkhead union between the two tube ends and tighten the nuts.

**Procedure to Replace BACU24AB Union
Figure 808/20-10-51-990-808**

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

**Tubing Repair by Section Replacement, Straight or Bend - Extensive Damage
Figure 809/20-10-51-990-809**

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FITTINGS USED FOR REPAIR TUBE ASSEMBLY			L2 CUTOUT LENGTH FORMULA	
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 of 2)/20-10-51-990-810**

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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 them to one end of a MS21902 flareless union.

Step 1: Measure the repair tube assembly total length L_1 (Fig. 806).

Step 2: Observe the cutout length L_2 formula (L_1 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 L_1 for cutout length L_2 .

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

Procedure to Find the Tube Cutout Length L_2
Figure 810 (Sheet 2 of 2)/20-10-51-990-810

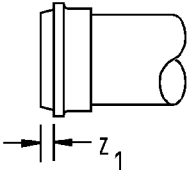
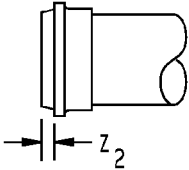
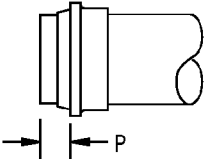
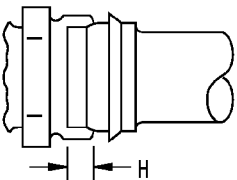
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FLARELESS SLEEVE JOINT TYPE	TUBE SIZES								
	04	05	06	08	10	12	16	20	24
BACS13BX (Roller Swaged) 	0.140	N/A	0.137	0.190	0.195	0.195	0.195	N/A	N/A
35211 (Harrison Roller Swaged) 	0.210	N/A	0.207	0.250	0.255	0.255	0.255	N/A	N/A
BACS13BX (Elastomer 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

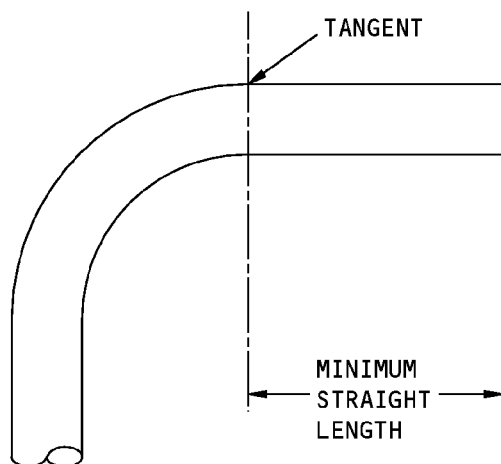
**Flareless Sleeve Tube End Values
Figure 811/20-10-51-990-811**

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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

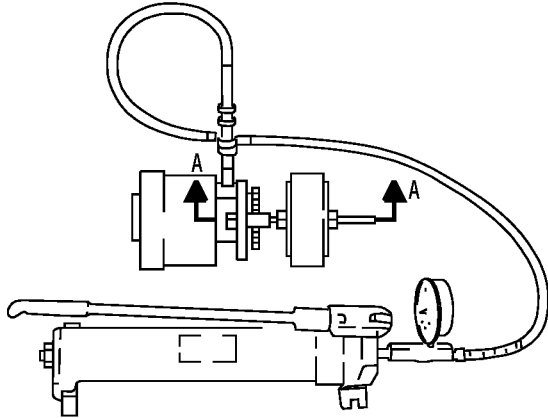
**Minimum Straight Length Specifications for Repair Fitting Installations Adjacent to Tube Bends
Figure 812/20-10-51-990-812**

EFFECTIVITY
HAP ALL

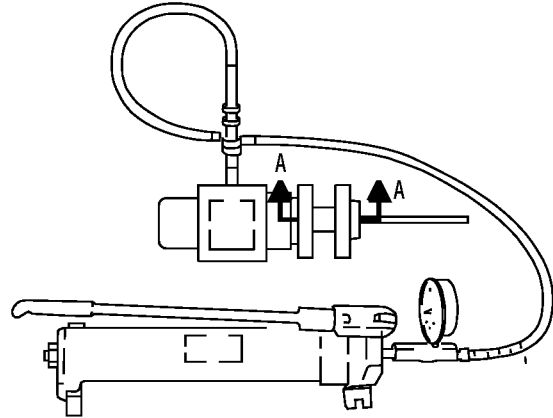
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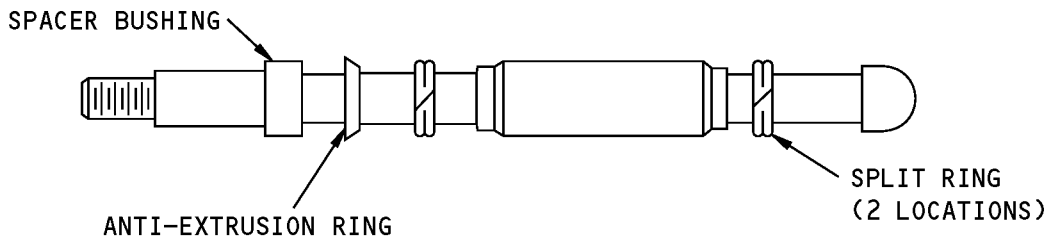
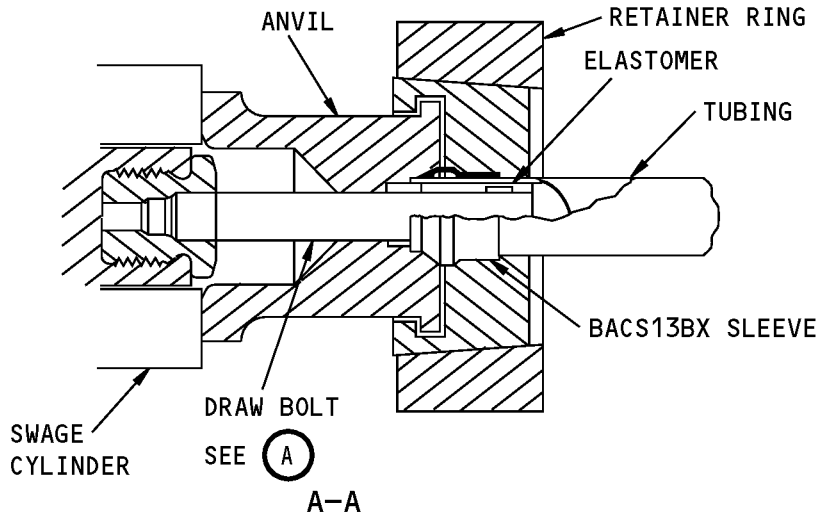
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HARRISON MODEL 5720



HARRISON MODEL 5175



**DRAW BOLT ASSEMBLY
(SHOWN EXTENDED)**



**Harrison Portable Swagers for BACS13BX Sleeves
Figure 813 (Sheet 1 of 5)/20-10-51-990-813**

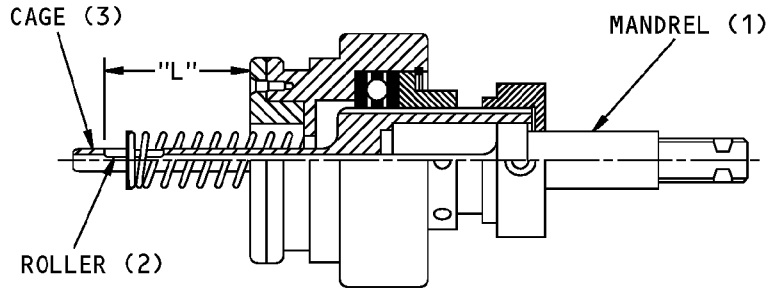
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SIZE	EXPANDER ASSEMBLY	MANDREL (1)	ROLLERS (2)	CAGE (3)
-04	7320-04016	7321-04016	7322-04016	7323-04016
-06	7320-06019	7321-06019	7322-06019	7323-06019
-08	7320-08026	7321-08026	7322-08026	7323-08026
-10	7320-10032	7321-10032	7322-10032	7323-10032
-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) ±.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 of 5)/20-10-51-990-813**

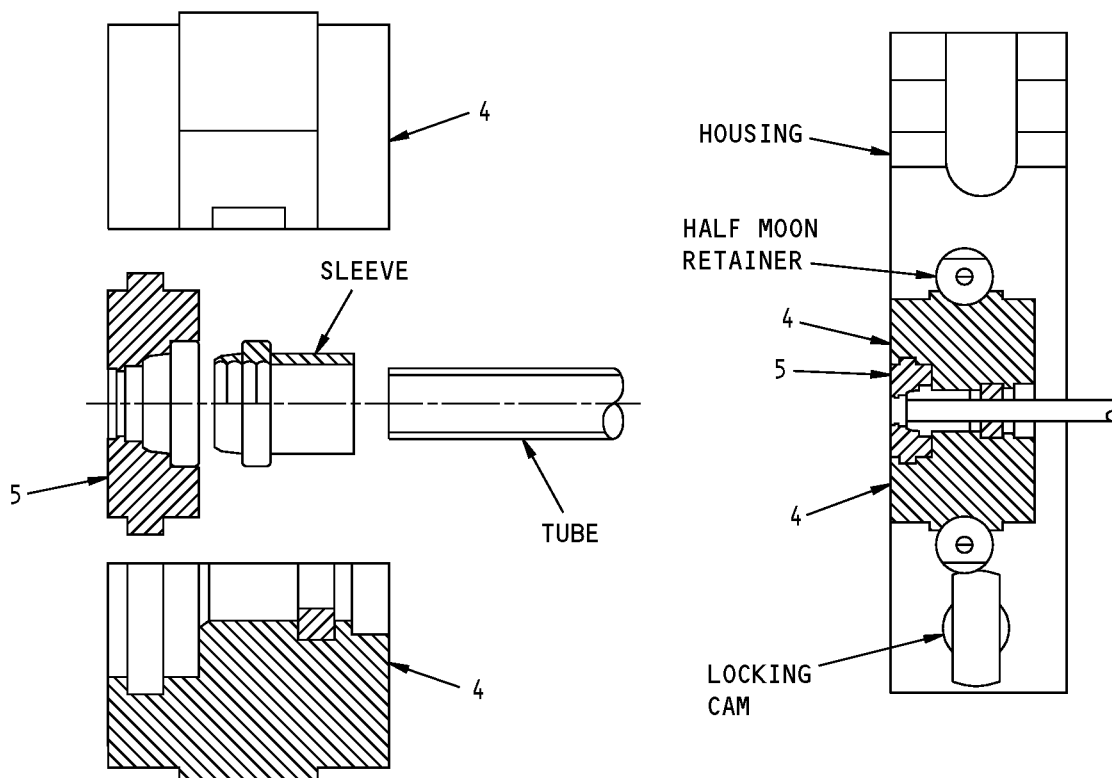
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TUBE AND SLEEVE DIA.	TWO HALF JAWS (4)	RETAINER (5)
INCHES		
1/4	6884-04	6885-104
3/8	6884-06	6885-106
1/2	6884-08	6885-108
5/8	6884-10	6885-110
3/4	6884-12	6885-112
1	6884-16	6885-116

HARRISON 6777 MACHINE

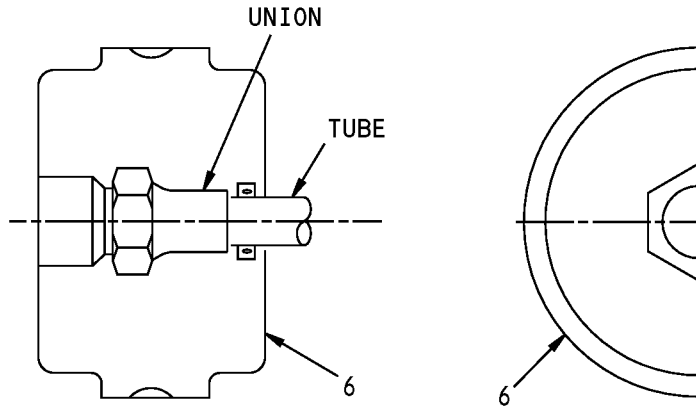
**Harrison Portable Swagers for BACS13BX Sleeves
 Figure 813 (Sheet 3 of 5)/20-10-51-990-813**

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TUBE AND UNION DIA.	TWO HALF JAWS (6)
INCHES	
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 of 5)/20-10-51-990-813

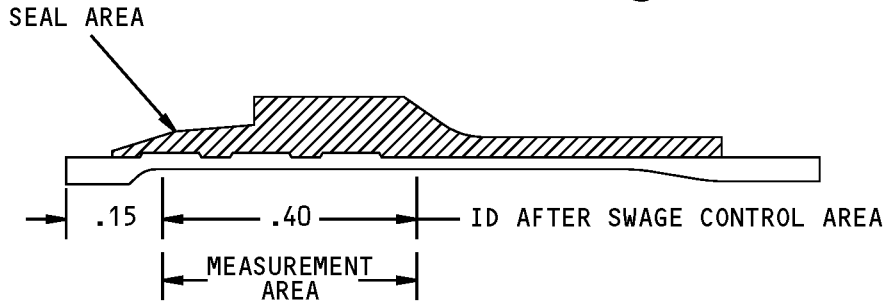
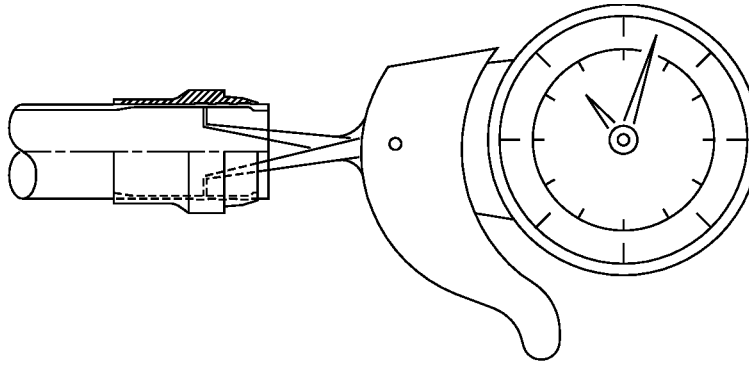
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NOTE: I.D. AFTER SWAGE REQUIREMENTS—MEASURING METHOD FOR 35211 SLEEVE AND 35212 UNION

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 of 5)/20-10-51-990-813**

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AIRCRAFT MAINTENANCE MANUAL

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) ±5% BACS13BX	WALL (IN.)	SWAGE PRESSURE (PSI) ±5% BACS13BX	WALL (IN.)	SWAGE PRESSURE (PSI) ±5% BACS13BX	WALL (IN.)	SWAGE PRESSURE (PSI) ±5% 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	500	N/A	N/A	0.035	940 1
08		0.026	2000	0.035	950	N/A	N/A	0.035 2	1150* 2
				0.035		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.

Swage Pressures for Elastomer Swaging Flareless Sleeves
Figure 814 (Sheet 1 of 2)/20-10-51-990-814

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AIRCRAFT MAINTENANCE MANUAL

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) ±5% BACS13BX	WALL (IN.)	SWAGE PRESSURE (PSI) ±5% BACS13BX	WALL (IN.)	SWAGE PRESSURE (PSI) ±5% BACS13BX	WALL (IN.)	SWAGE PRESSURE (PSI) ±5% BACS13BX
10	5570	0.033	850	0.020	250	N/A	N/A	0.035	450 1
	5720			0.028 0.035	325 375			0.049 2	850* 2
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
								0.065 2	3050* 2
			0.052	3050	0.035	950	0.035	0.035 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

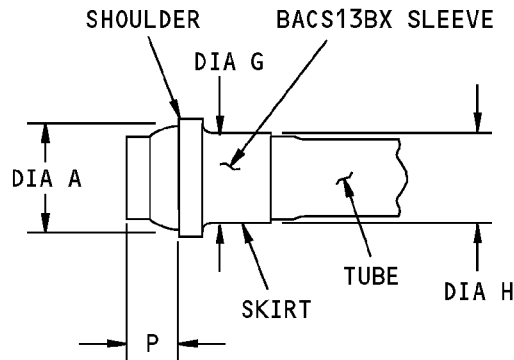
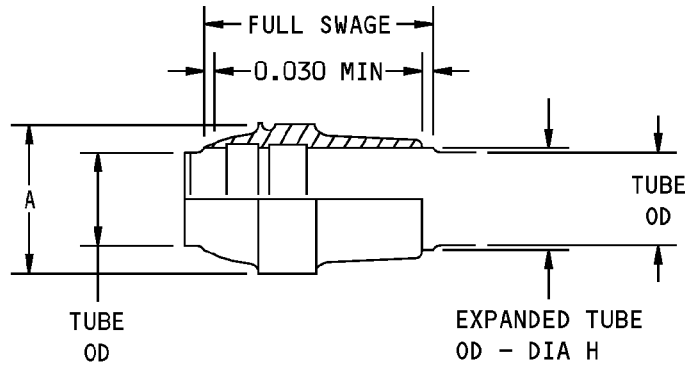
Swage Pressures for Elastomer Swaging Flareless Sleeves
Figure 814 (Sheet 2 of 2)/20-10-51-990-814

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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

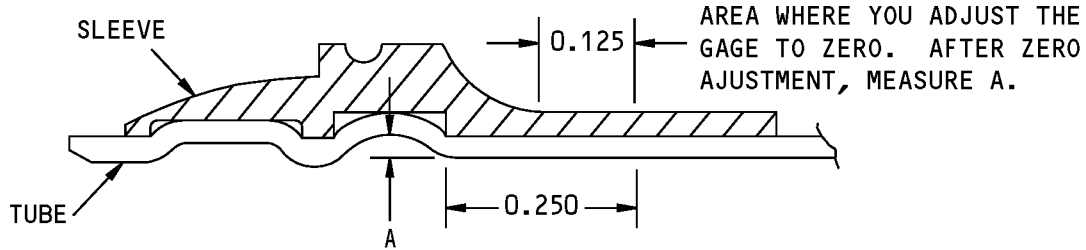
**BACS13BX Flareless Sleeve Dimensions After Elastomeric Swaging
Figure 815/20-10-51-990-815**

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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 816/20-10-51-990-816**

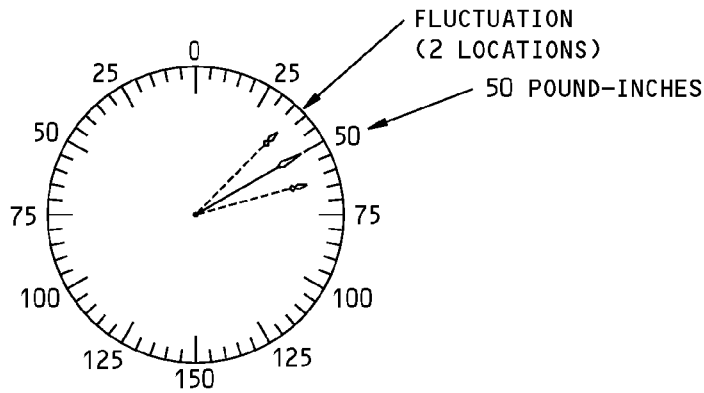
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TORQUE WRENCH DIAL - PROCEDURE TO READ TORQUE

TUBE SIZE	MATERIAL		SWAGE TORQUE (POUNDS-INCH)	
	WALL THICKNESS - INCHES		MIN	MAX
	3AL-2.5V TITANIUM 1	21Cr-6Ni-9Mn CRES 2		
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

**SWAGE 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 of 3)/20-10-51-990-817**

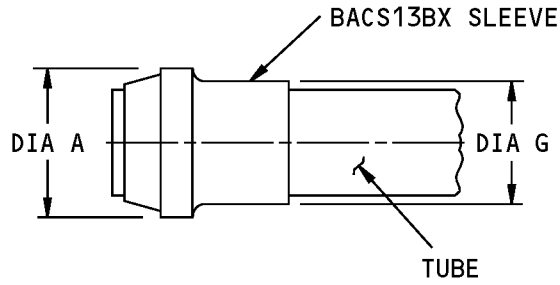
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DIAMETER	TUBE SIZE					
	04	06	08	10	12	16
A MAX	0.374	0.493	0.673	0.789	0.964	1.214
G MAX	0.298	0.423	0.550	0.686	0.822	1.070

MAXIMUM PERMITTED SHOULDER AND SKIRT DIAMETERS (INCH)

**Swage Torques, Sleeve Dimensions, and Wall Thicknesses for Roller Swaging
Figure 817 (Sheet 2 of 3)/20-10-51-990-817**

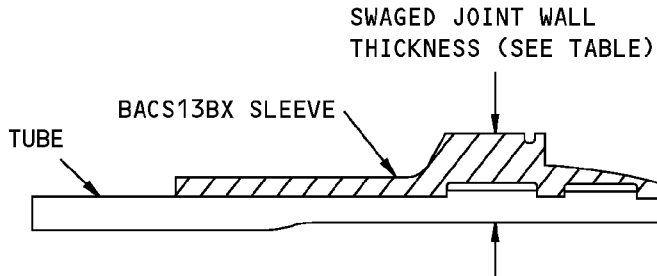
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SECTION OF ROLLER SWAGED JOINT

TUBE SIZE	TUBE DIMENSIONS		SWAGED JOINT WALL THICKNESS FOR "NOMINAL" TUBE WALLS - INCHES ¹
	"NOMINAL" WALL THICKNESS - INCHES ²		
	Ti-3AL-2.5V	21-6-9 CRES	
04	0.016	0.016	0.068
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

↑
 TOLERANCE
 +0.002
 -0.003
 ↓

SWAGED JOINT WALL THICKNESS SPECIFICATION ¹ ²

- ¹ "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.
- ² 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 of 3)/20-10-51-990-817**

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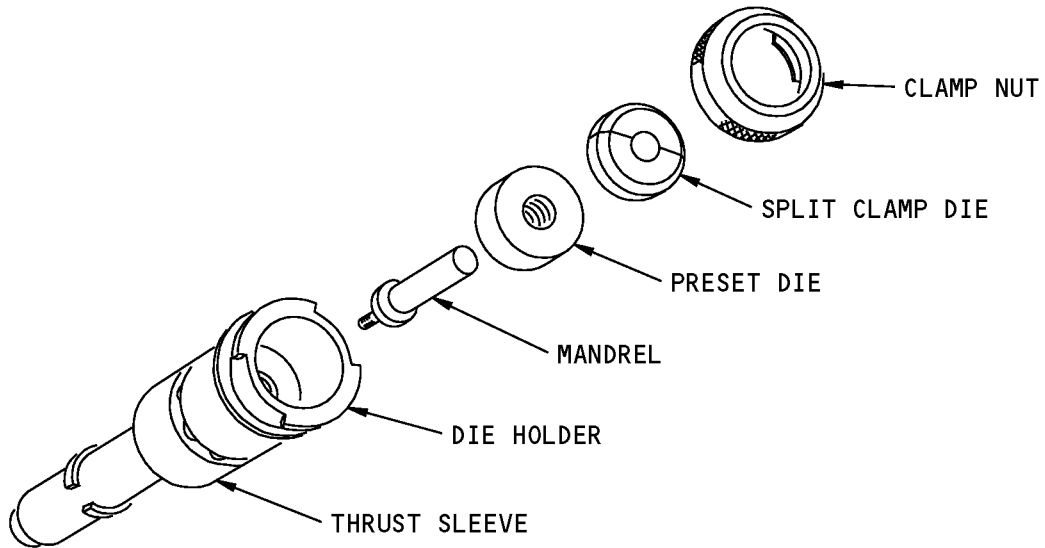
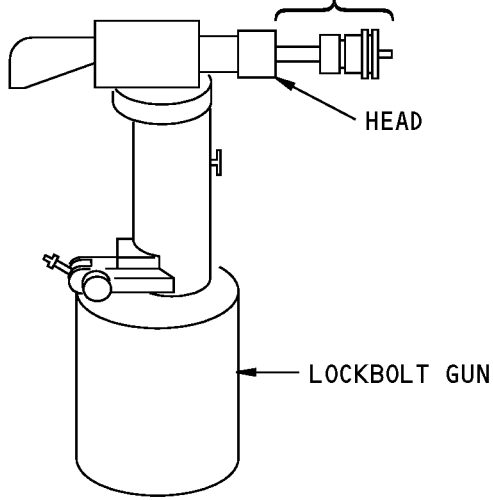
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ST878D TOOL ASSEMBLY

SEE (A)



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 of 2)/20-10-51-990-818

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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 of 2)/20-10-51-990-818**

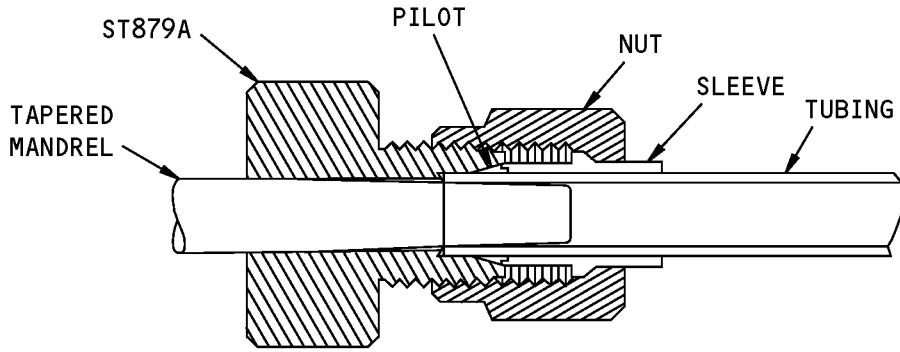
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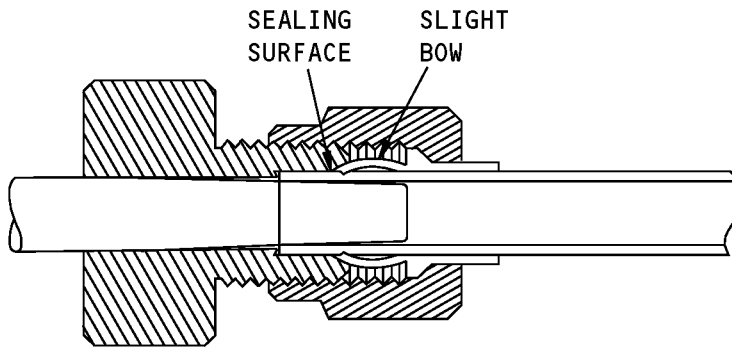
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BEFORE PRESET BY HAND



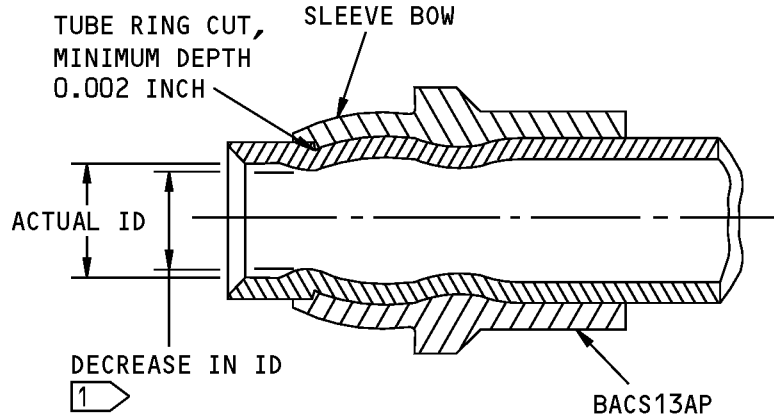
AFTER PRESET BY HAND

**Preset by Hand with Preset Tool ST879A
Figure 819/20-10-51-990-819**

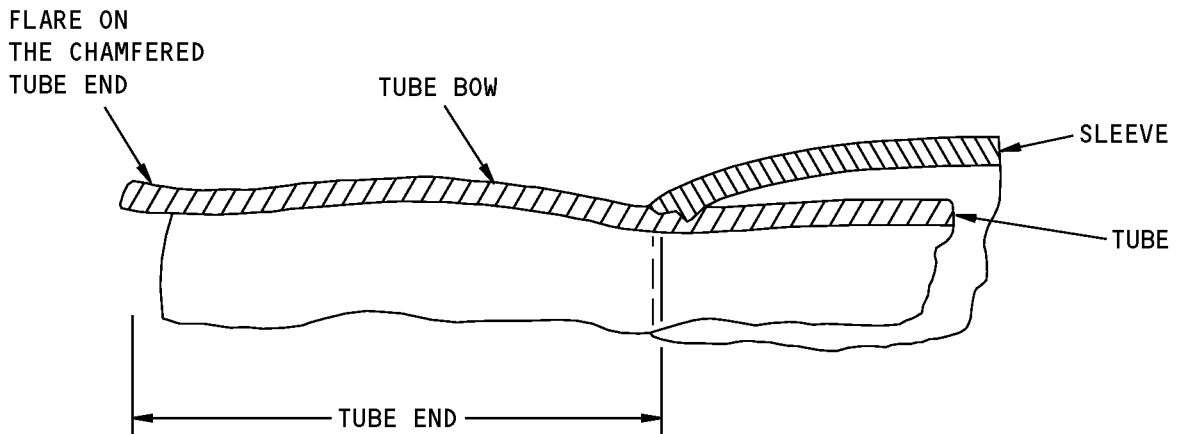
EFFECTIVITY
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AIRCRAFT MAINTENANCE MANUAL



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 820/20-10-51-990-820**

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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) ³ Pound-Inches	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 1

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) ³ Pound-Inches	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 2

- 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 821/20-10-51-990-821**

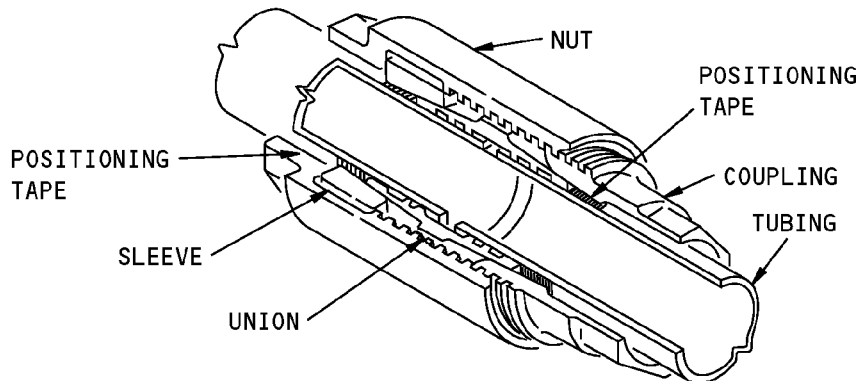
EFFECTIVITY
HAP ALL

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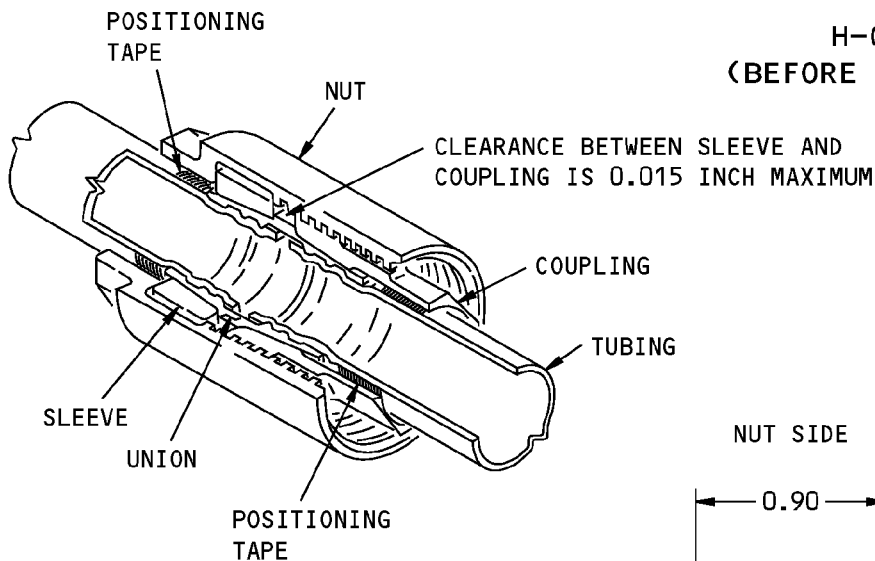
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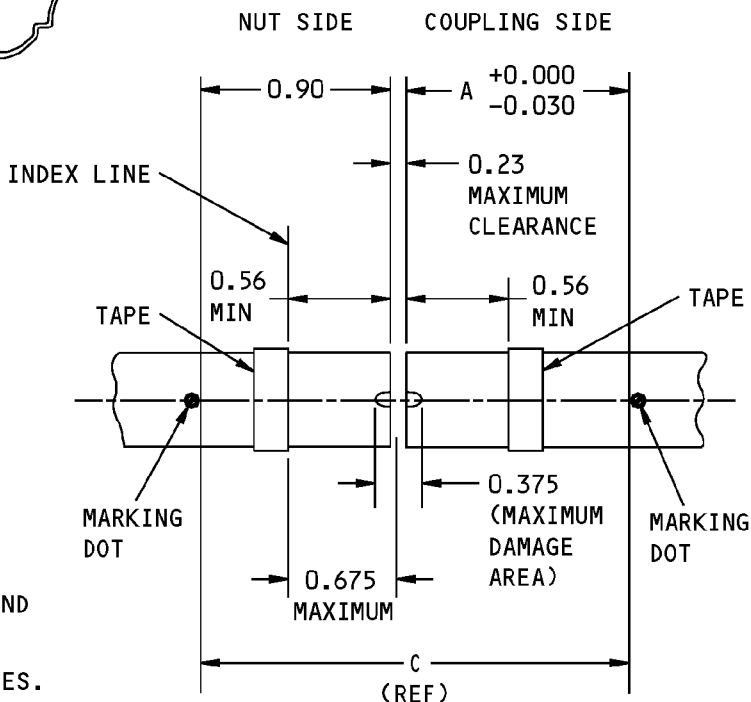
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H-COUPLING
(BEFORE INSTALLATION)



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.

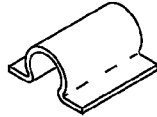
ALL DIMENSIONS ARE IN INCHES.

H-Coupling Installation
Figure 822/20-10-51-990-822

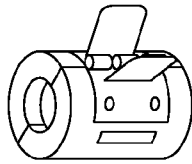
EFFECTIVITY
HAP ALL

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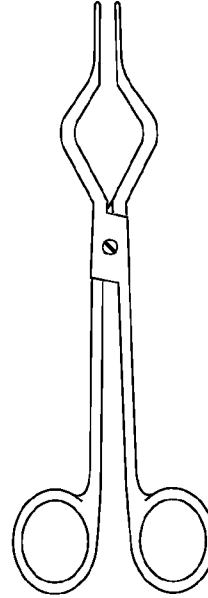
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**SNAP-ON
INSTALLATION STOP**



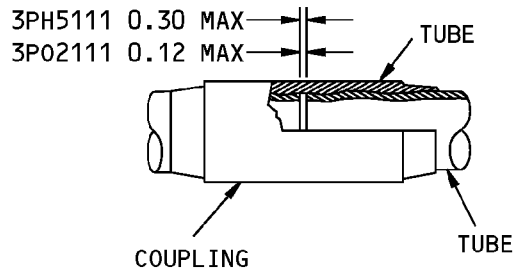
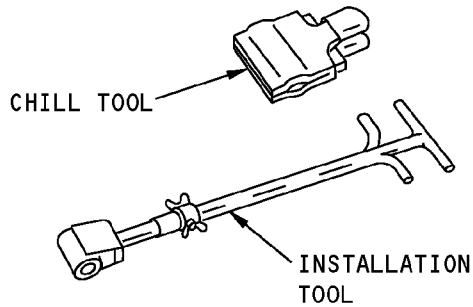
EXTENDED TIME TOOL



TONGS



O-RINGS INSTALLATION STOP



CRYOFIT COUPLING INSTALLATION

NOTE: CRYOFIT KITS INCLUDE ADDITIONAL ITEMS.

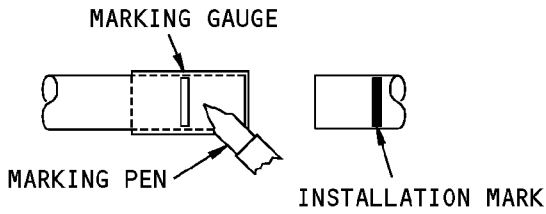
**Cryofit Coupling 3P02111 and 3PH5111 Repair
Figure 823 (Sheet 1 of 2)/20-10-51-990-823**

EFFECTIVITY
HAP ALL

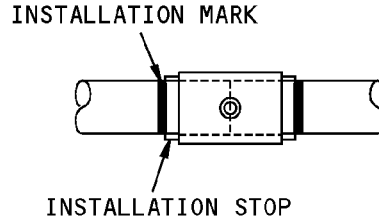
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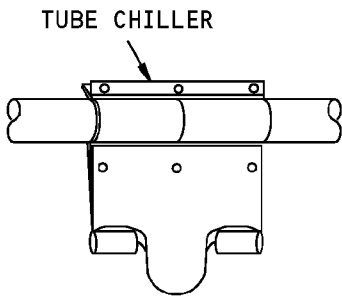
AIRCRAFT MAINTENANCE MANUAL



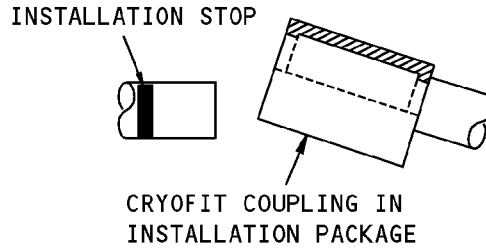
APPLICATION OF INSTALLATION MARK



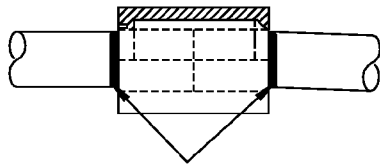
INSTALLATION STOP



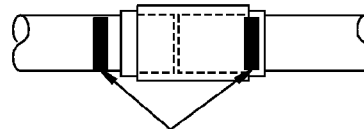
TUBE CHILLER APPLICATION



**CORRECT POSITIONING OF
CROFIT FITTING ON TUBE**



ACCEPTABLE



UNACCEPTABLE

POSITION OF INSTALLED FITTING ON TUBE

NOTE: CRYOFIT KITS INCLUDE ADDITIONAL ITEMS.

**Cryofit Coupling 3P02111 and 3PH5111 Repair
Figure 823 (Sheet 2 of 2)/20-10-51-990-823**

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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	0.070
		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	0.040

TABLE 1

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	0.070
		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	0.040

TABLE 2

F16070 S0006561997_V2

Approved Fitting/Tube Material Combinations for Repair with Permaswage Unions
Figure 824 (Sheet 1 of 2)/20-10-51-990-824

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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 grooves 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) PERMASWAGE 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.

F16073 S0006561998_V2

Approved Fitting/Tube Material Combinations for Repair with Permaswage Unions
Figure 824 (Sheet 2 of 2)/20-10-51-990-824



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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

**DMC LIGHTWEIGHT TOOLS
TABLE 1**

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

- DTLO2MAPP1000 pneumatic pump 10,000 psi
- DLT05MAPM1000 manual pump 10,000 psi

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**Swage and Inspection Tool Part Numbers
Figure 825/20-10-51-990-825**

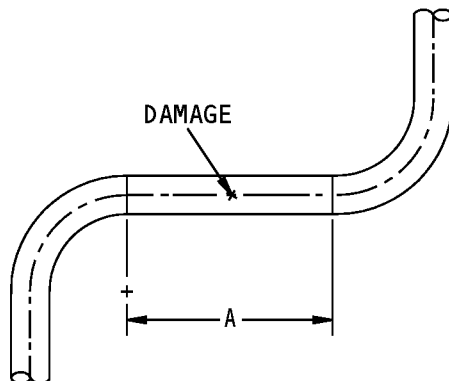
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SIZE	TUBE SIZE						
	04	06	08	10	12	16	20
Fitting length	1.540/ 1.530	1.690/ 1.680	2.700/ 2.686	2.780/ 2.766	2.920/ 3.906	3.209/ 3.195	3.664/ 3.650
A tube length (min)	2.15	2.30	3.30	3.40	3.55	3.80	4.30

NOTE: ALL DIMENSIONS ARE IN INCHES.

**Minimum Straight Length for Permaswage Fitting Installation
Figure 826/20-10-51-990-826**

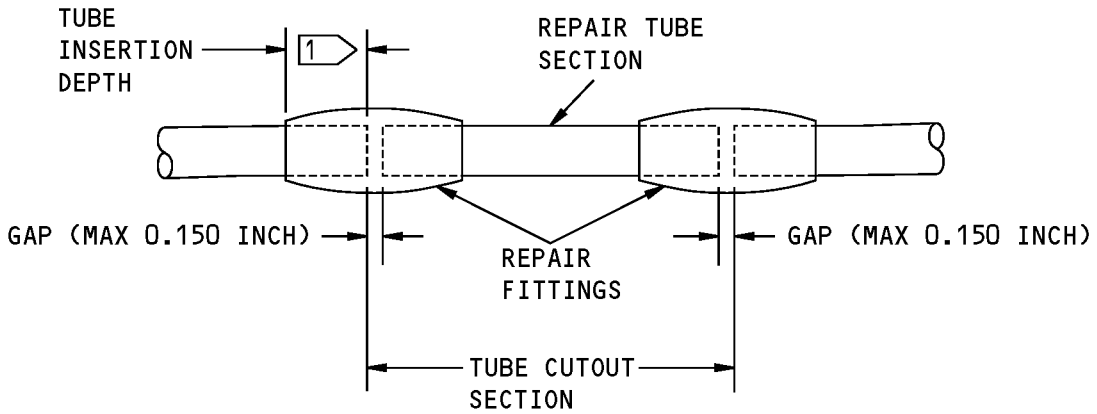
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MATERIAL	TUBE SIZE						
	04	06	08	10	12	16	20
Cres/Ti	0.02	0.02	0.03	0.04	0.057	0.049	0.05
AL	None	0.04	0.06	0.06	0.061	0.048	0.06

SWAGE GROWTH VALUES (INCH)

THE A DIMENSION IS SHOWN IN FIG. 829.

**Tube Splice Repair
Figure 827/20-10-51-990-827**

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MATERIAL SURFACE	PROCEDURE TO CLEAN TUBE
Bare or alodine	Solvent clean
Anodize	Hand apply abrasive material, 180-grit or finer: <ul style="list-style-type: none">• Fed Spec P-P-121• Fed Spec P-C-451• Abrasive Scotch Brite, Type A
Primer/paint	<ol style="list-style-type: none">1. Hand apply abrasive material, 240-grit or finer2. 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 828/20-10-51-990-828**



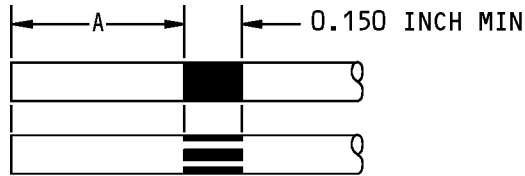
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DIMENSION (FIG. 827)	TUBE SIZE AND INSERTION DEPTH - INCHES					
	04	06	08	10	12	16
A	0.69	0.77	1.27	1.31	1.38	1.52

MARK FOR THE MINIMUM TUBE INSERTION DEPTHS

Witness Mark Location and Usual Marking Procedures
Figure 829/20-10-51-990-829

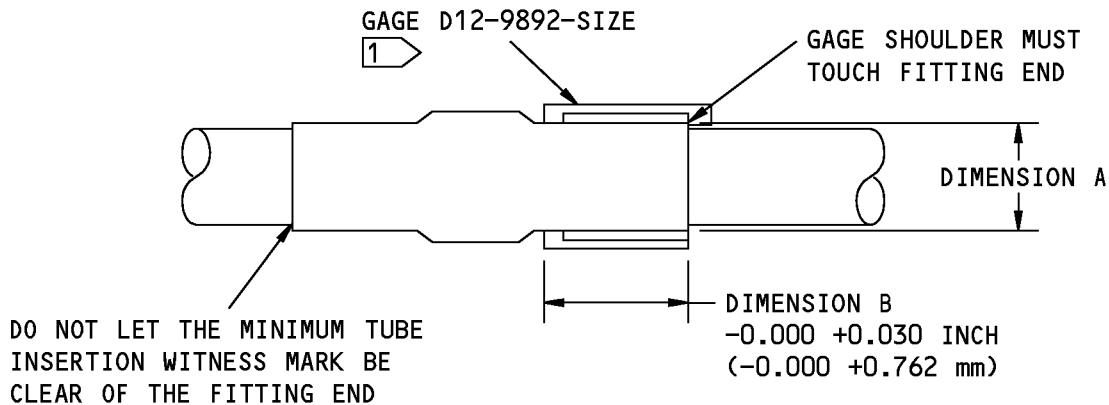
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TUBE DIAMETER - INCHES (TUBE SIZE)	SWAGED DIAMETER MAX DIMENSION A - INCHES (mm)	SWAGED LENGTH MIN DIMENSION B - INCHES (mm)
1/4 (04)	0.315 (8.00)	0.46 (11.68)
3/8 (06)	0.447 (11.35)	0.53 (13.46)
1/2 (08)	0.606 (15.39)	1.02 (25.91)
5/8 (10)	0.735 (18.67)	1.02 (25.91)
3/4 (12)	0.863 (21.92)	1.02 (25.91)
1 (16)	1.181 (30)	1.406 (35.71)
1-1/4 (20)	1.390 (35.31)	1.406 (35.71)

AFTER SWAGE DIMENSIONS

1 USE DNR9892-016 FOR SIZE 16.

F16098 S0006562004_V2

**Final Swage Dimensions
Figure 830/20-10-51-990-830**

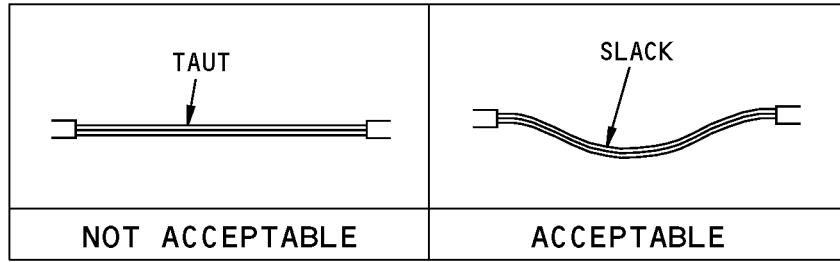
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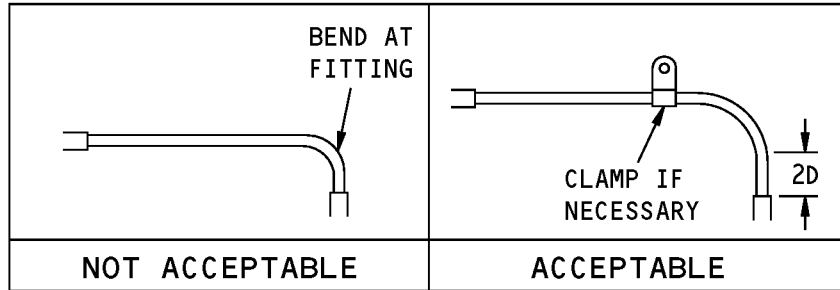
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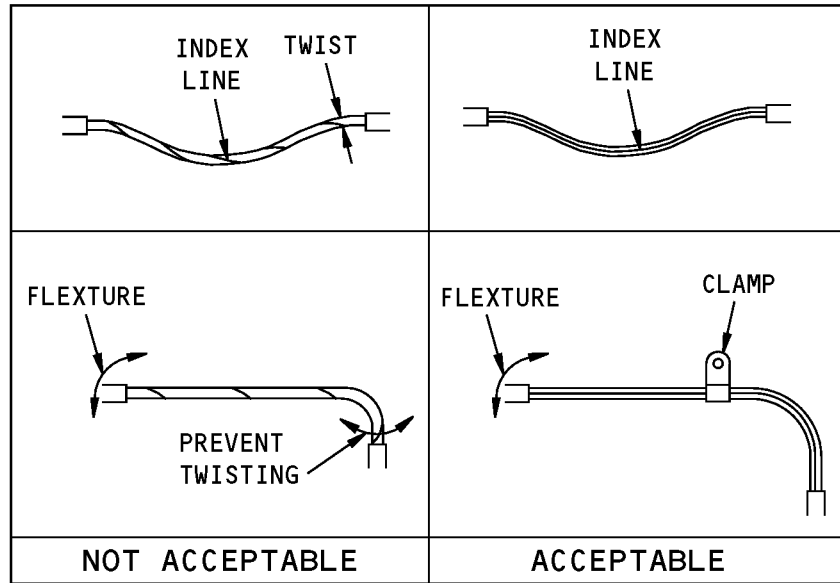
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SLACK



FLEX



TWISTING

Hydraulic Tubing Repair with Flexible Hose
Figure 831 (Sheet 1 of 2)/20-10-51-990-831

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NOT ACCEPTABLE	ACCEPTABLE

ELBOW OR HOSE WITH ELBOW END FITTING

BENDING

NOT ACCEPTABLE	ACCEPTABLE

CLEARANCE

Hydraulic Tubing Repair with Flexible Hose
Figure 831 (Sheet 2 of 2)/20-10-51-990-831

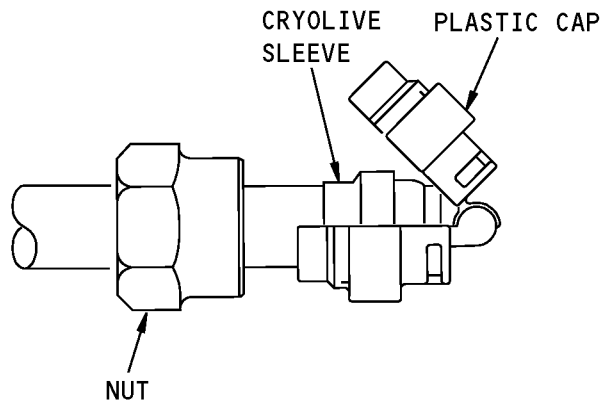
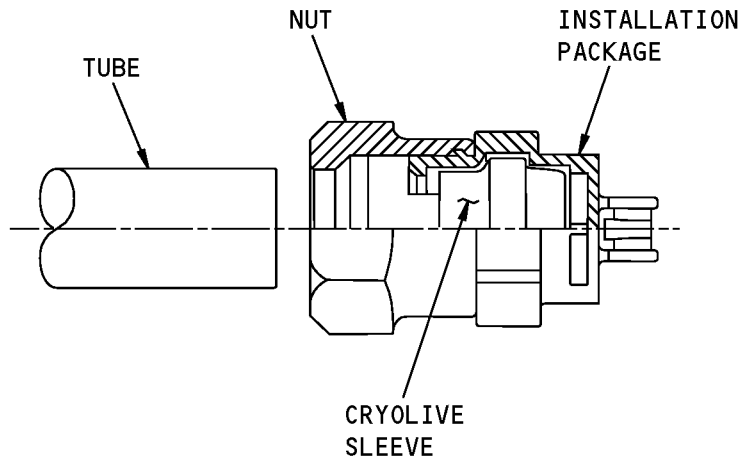
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NOTE: REMOVAL OF PLASTIC CAP AFTER INSTALLATION.

**CRYOLIVE Flareless Sleeve Assembly
Figure 832/20-10-51-990-832**

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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.

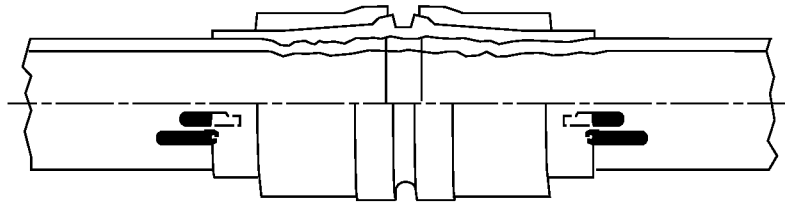
Approved CRYOLIVE Flareless Sleeve/Coupling Nut/Plastic Cap Combinations
Figure 833/20-10-51-990-833

EFFECTIVITY
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**Rynglok Tube to Tube Union
Figure 834/20-10-51-990-852**

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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 835/20-10-51-990-853**

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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 836/20-10-51-990-854**

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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)**

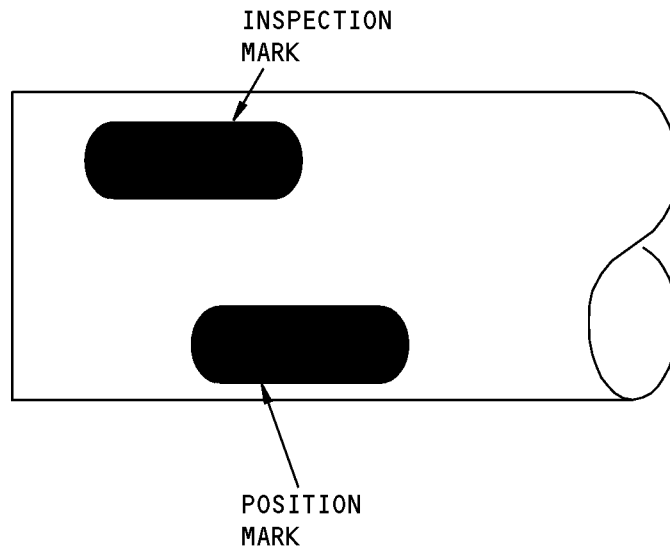
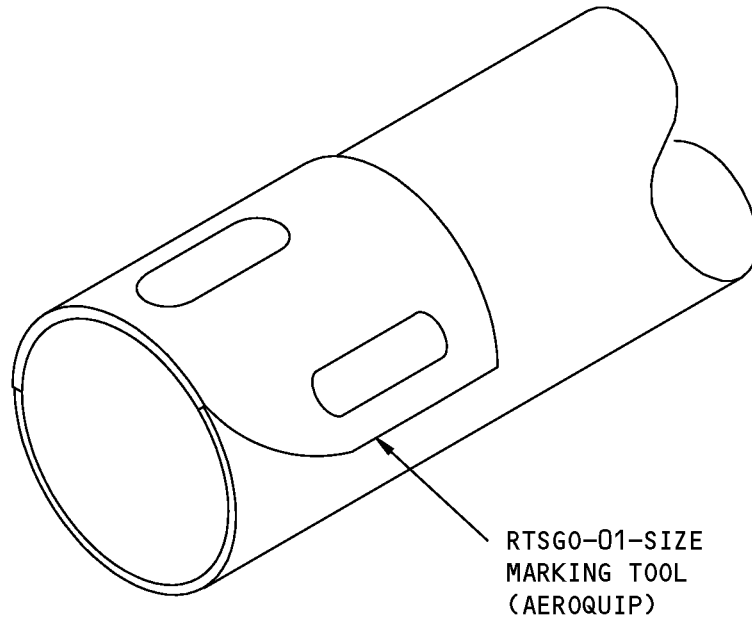
**Rynglok Repair Fittings Swage and Inspection Tool Part Numbers
Figure 837/20-10-51-990-855**

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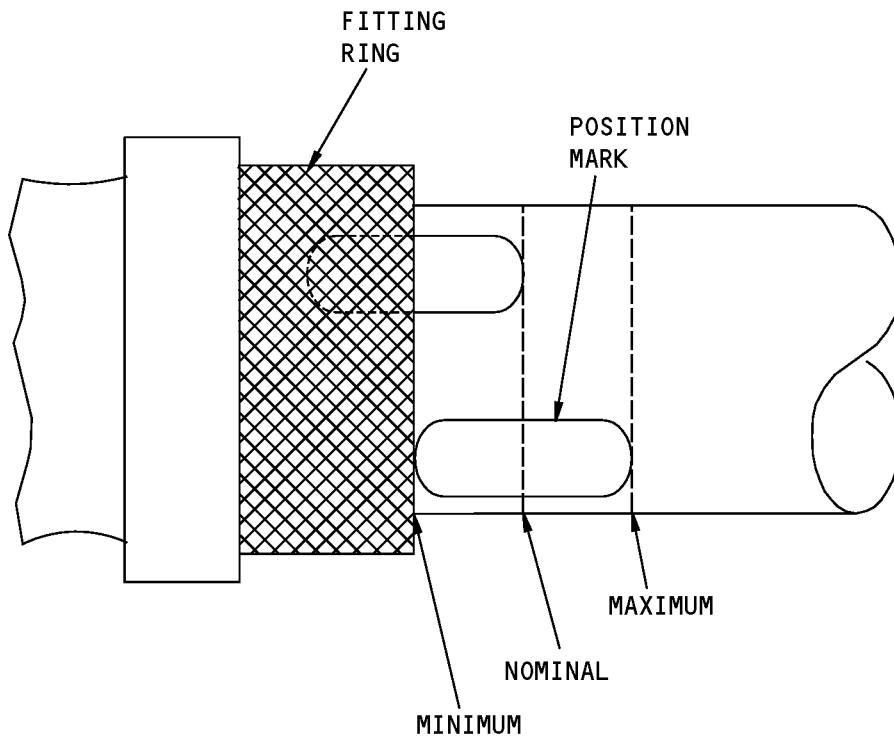
**Mark Location During Rynglok Fitting Installation
Figure 838/20-10-51-990-856**

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**Fitting Position for Tube Insertion
Figure 839/20-10-51-990-857**

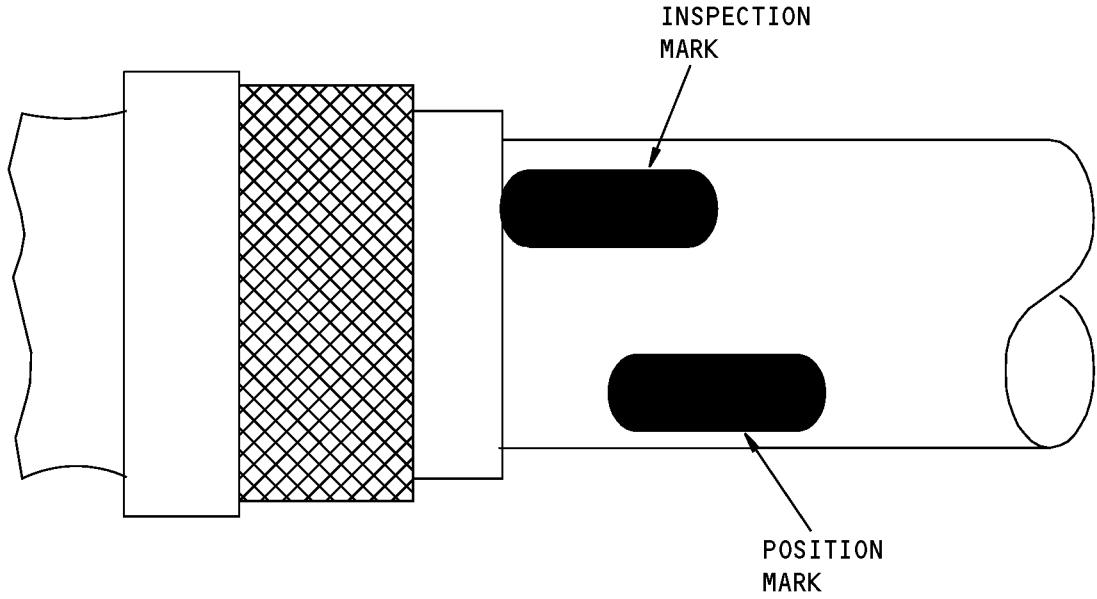
EFFECTIVITY
HAP ALL

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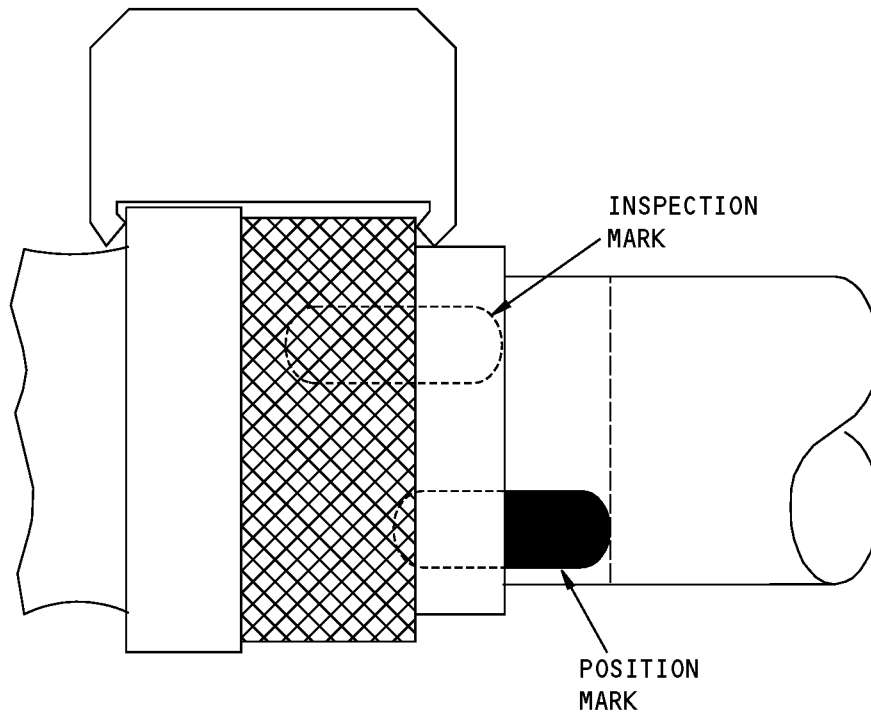
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AIRCRAFT MAINTENANCE MANUAL



MINIMUM INSPECTION MARK AFTER SWAGING



MAXIMUM INSPECTION MARK AFTER SWAGING

Use of Inspection Gage After Swage of Rynglok Fittings
Figure 840/20-10-51-990-858

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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 841/20-10-51-990-859**

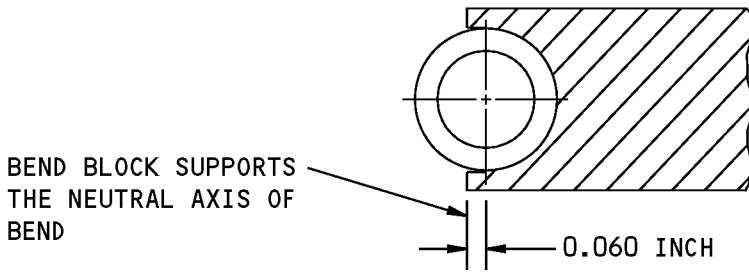
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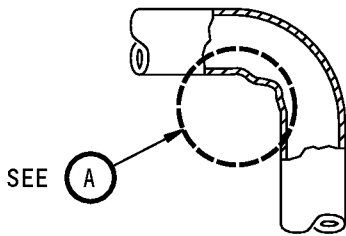
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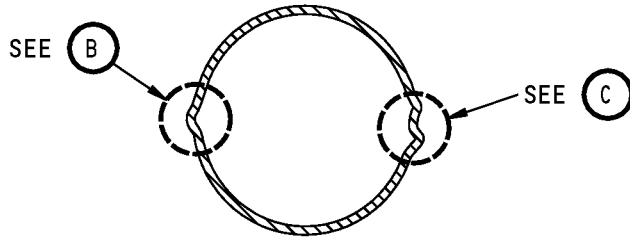


NOTE: IF THE OVALITY OF ANY PART OF THE BEND IS MORE THAN THE MAXIMUM PERMITTED OVALITY, DISCARD THE TUBE.

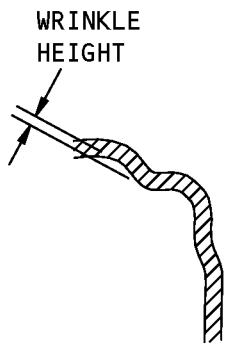
TUBE BEND BLOCK



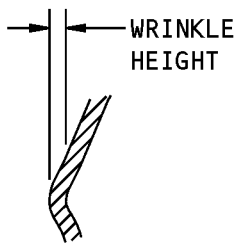
**RADIAL
WRINKLE**



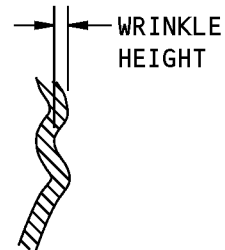
**LONGITUDINAL
WRINKLE**



A



B



C

WRINKLE MEASUREMENTS

**Permitted Forming Limits for Electrical Rigid Conduits
Figure 842 (Sheet 1 of 2)/20-10-51-990-860**

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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 of 2)/20-10-51-990-860**

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TASK 20-10-51-930-801

15. Part Marking of Flareless Tubing Assemblies

A. General

- (1) Use this task to part-mark the hydraulic tubes that do not have part-numbers.
 - (a) Use one of the methods that follow to apply the original tube part-number on the installed hydraulic-tubes that have lost identification.
 - (b) Use one of the methods that follow to apply a NEW part-number on a field-manufactured replacement-tube. First, select a NEW tube part-number. This new tube part-number will include the data to let you easily identify and find the part for future use (65C26841-1002REPL). For example, if the tubes require repair or replacement, the new tube part-number will help you find the tubes..
 - (c) Do one of these steps to identify hydraulic tubes.

B. Consumable Materials

Reference	Description	Specification
B50095	Solvent	BAC5750
C00033	Coating - Exterior Protective Enamel, Flexibility Use	BMS10-60, Type II
C50066	Coating - Exterior Protective Enamel, Clear	BMS10-60, Type I, Class A
G00251	Abrasive - Mat, Non-Woven, Non-Metallic	A-A-58054
G02061	Marker - Permanent, Felt Tip Pen	
G50393	Tape - Adhesive, Label	BAC5307 Type III, Polyester (Mylar)
G50395	Ink - Laundry Marking	TT-I-542
G50396	Ink - Marking, Silk Screen	Standard Overhaul Practices Manual (SOPM) 20-50-10
G50410	Stamp Pad (Commercially Available)	

C. Procedure

SUBTASK 20-10-51-930-001

(1) Rubber Stamp Method

- (a) Clean the tube surface with solvent, B50095. Remove oxide from the tubing surface with abrasive mat, G00251.
- (b) Select an ink, G50396 (see SOPM 20-50-10) that is applicable to the tube material and visible on the tube surface.
- (c) Hand Stamp the new tube part-number on the tube. Apply liquid ink, G50396 to a stamp pad, G50410. Then apply the part-number to the tube surface with the stamp.

NOTE: For tubes longer than 24 inches mark the new part-number at:

6 inches or less of each end

The newest straight area that is not in a clamp area.

- (d) Apply a clearcoating, C00033.

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SUBTASK 20-10-51-930-002

(2) Hand letter Method

- (a) Clean the tube surface with solvent, B50095. Remove oxide from the tubing surface with abrasive mat, G00251.
- (b) Use a ink, G50395 or marker, G02061 to mark the part-number on the tube.

NOTE: For tubes longer than 24 inches mark the new part-number at:
 6 inches or less of each end
 The newest straight area that is not in a clamp area.

SUBTASK 20-10-51-930-003

(3) Tape or Adhesive Label Method

- (a) Cut the adhesive tape, G50393 length to encircle the tube a minimum of two times on a 0.250 inch to 0.500 inch diameter tube. Tubes with diameters of 0.625 inch or more, encircle the tube two times with the adhesive tape, G50393.
- (b) Attach the adhesive tape, G50393 with the part number.

NOTE: For tubes longer than 24 inches mark the new part-number at:
 6 inches or less of each end
 The newest straight area that is not in a clamp area.

NOTE: Use the original identification tapes, part-number BACT11Y-() () to mark replacement tubes. But, the BACT11Y tapes require special handling equipment.

- (c) Apply a clear coating, C50066.

————— END OF TASK —————

TASK 20-10-51-360-801

16. Retightening of Fitting Joints with Persistent Hydraulic Leaks

A. General

- (1) Use this procedure to help resolve a persistent hydraulic leak at a tube joint that is not located in a pressurized area, a strut, a fuel tank, or a cargo area.
 - (a) For joints located in a pressurized area, a strut, a fuel tank, or a cargo area, use this tightening procedure: Flareless Fittings in Pressurized Areas Installation, TASK 20-10-51-000-802.
- (2) Use this procedure only for flareless joints that have continual leakage that cannot be resolved.
 - (a) Do not use this procedure as a routine torque tightening method for flareless fittings.
- (3) For repairs and replacements of the flareless tubing assemblies, refer to the applicable flareless tubing assembly approved repairs above.

B. References

Reference	Title
20-10-51-000-802	Flareless Fittings in Pressurized Areas Installation (P/B 401)
20-10-51-200-802	Space Between Tubing Clamps Check (P/B 401)
20-10-51-400-804	Flareless Tubing Assembly Installation (P/B 401)
20-10-51-993-842	Table: Thread Compounds (P/B 401)
20-10-51-993-845	Table: Installation Torque (P/B 401)
20-10-51-993-850	Table: Installation Torques (P/B 401)

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C. Procedure

SUBTASK 20-10-51-280-001

- (1) Do a leak check to confirm the location of the leak.
 - (a) Pressurize the system for a minimum of 15 minutes.
 - (b) With the system pressurized, do a check of the tube-to-fitting interface for signs of hydraulic leakage.
 - 1) Use a clean white cloth to find hydraulic leakage.
 - 2) Record the location of the leak.

SUBTASK 20-10-51-864-001

- (2) Depressurize the system.

SUBTASK 20-10-51-211-001

- (3) Do a visual inspection of the tube installation that is the source of the leakage.
 - (a) Check for the external damage that follows:
 - 1) Worn clamps.
 - 2) Missing clamps.
 - 3) Interference.
 - 4) Dents.
 - (b) If external damage is found, replace the tube assembly.
 - 1) Use this procedure: Flareless Tubing Assembly Installation, TASK 20-10-51-400-804.

SUBTASK 20-10-51-030-001

- (4) Loosen the flareless fittings to check for preload on the tube assembly.
 - (a) Check for side-to-side or end-to-end preload in the line.
 - 1) If there is preload, adjust the tube assembly. Do this procedure: Space Between Tubing Clamps Check, TASK 20-10-51-200-802.
 - a) If the preload cannot be relieved, replace the tube assembly.
 - < 1 > Use this procedure: Flareless Tubing Assembly Installation, TASK 20-10-51-400-804.

SUBTASK 20-10-51-020-005

- (5) Remove the tube assembly that is the source of the leakage to check for sealing surface damage on mating fittings.
 - (a) Check the mating surfaces of the tube-to-fitting interface for damage.
 - 1) Examples of such damage are as follows:
 - a) Machining flaws.
 - b) Galling or scratches.
 - c) Dimples.
 - d) Cracks.
 - (b) If damage is found, replace the damaged part.
 - 1) Use this procedure: Flareless Tubing Assembly Installation, TASK 20-10-51-400-804.

SUBTASK 20-10-51-430-001

- (6) If flareless fittings with BACS13AP preset sleeves are used (Figure 843), do the steps that follow.
 - (a) Apply the appropriate lubricant to the BACS13AP sleeves, found in Table 20-10-51-993-842.

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- (b) Tighten the flareless fittings with BACS13AP sleeves two times (tighten, loosen, and tighten again) to nominal torque shown in Table 20-10-51-993-845

SUBTASK 20-10-51-430-002

- (7) If the flareless fittings with internally swaged BACS13BX (Figure 844), internally swaged BACS13BD (Figure 844), or welded-on NAS1760-type sleeves (Figure 845) are used, do the steps that follow.
 - (a) Apply the appropriate lubricant to the BACS13BX, BACS13BD, or welded-on NAS1760-type sleeves, found in Table 20-10-51-993-842.
 - (b) Tighten the flareless fittings with BACS13BX, BACS13BD, or welded-on NAS1760-type sleeves as follows:
 - 1) Tighten the fitting to the torque shown in Table 20-10-51-993-845.
 - 2) Loosen the fitting to release the torque.
 - 3) Tighten the fitting to the torque value specified in Table 20-10-51-993-850.

SUBTASK 20-10-51-280-002

- (8) Do a leak test on the installations of the flareless fittings.
 - (a) Pressurize the system for 15 minutes minimum.
 - (b) With the system pressurized, do a check at the tube-to-fitting interface for signs of hydraulic leakage.
 - 1) Use a clean white cloth to find hydraulic leakage.
 - 2) If you find leakage, do the steps that follow.
 - a) De-pressurize the system.
 - b) Loosen the fitting.
 - c) Check the mating surfaces of the tube-to-fitting interface for signs of damage.
 - < 1 > Examples of such damage are as follows:
 - < a > Machining flaws.
 - < b > Galling or scratches.
 - < c > Dimples.
 - < d > Cracks.
 - < 2 > If damage is found, replace any damaged assemblies.
 - < a > Use this procedure: Flareless Tubing Assembly Installation, TASK 20-10-51-400-804.
 - d) If no signs of damage are found on the mating surfaces of flareless fittings with BACS13AP sleeves, retighten the fittings using the steps that follow.
 - < 1 > Use the appropriate lubricant found in Table 20-10-51-993-842.
 - < 2 > Tighten the fittings two times (tighten, loosen, and tighten) to nominal torque shown in Table 20-10-51-993-845.
 - < 3 > Re-pressurize the system.
 - < 4 > Repeat the leak test.
 - < 5 > If you find leakage, replace one or both of the mating fittings and tube assemblies.
 - < a > Use this procedure: Flareless Tubing Assembly Installation, TASK 20-10-51-400-804.

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- e) If no signs of damage are found on the mating surfaces of flareless fittings with BACS13BX, BACS13BD, or welded-on NAS1760-type sleeves, retighten the fittings using the steps that follow.
- <1> Use the appropriate lubricant found in Table 20-10-51-993-842.
 - <2> Tighten the fitting to the torque shown in Table 20-10-51-993-845.
 - <3> Loosen the fitting to release the torque.
 - <4> Tighten the fitting to the torque value specified in Table 20-10-51-993-850.
 - <5> Re-pressurize the system.
 - <6> Repeat the leak test.
 - <a> If you find leakage, replace one or both of the mating fittings and tube assemblies. Use this procedure: Flareless Tubing Assembly Installation, TASK 20-10-51-400-804.

————— **END OF TASK** —————

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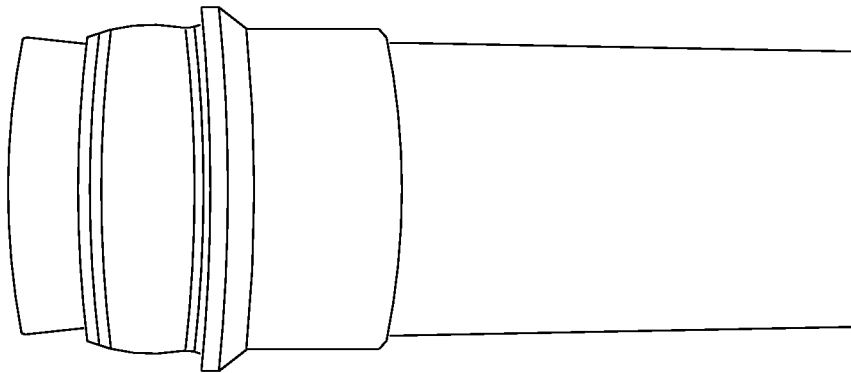
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BACS13AP Flareless Preset Sleeve
Figure 843/20-10-51-990-861

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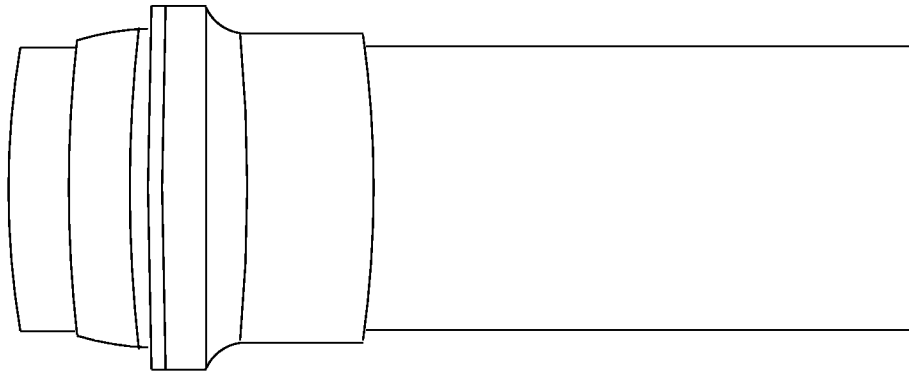
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1847485 S0000328863_V1

BACS13BX/BACS13BD Flareless Internally Swaged Sleeve
Figure 844/20-10-51-990-862

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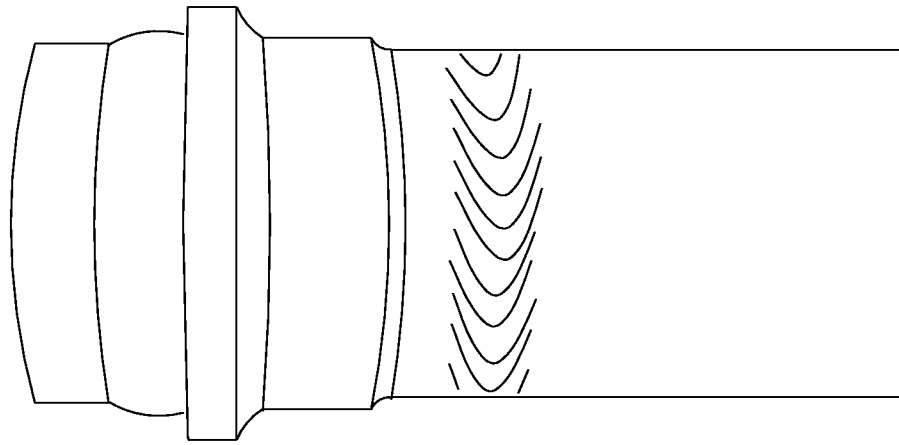
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1847486 S0000328865_V1

NAS1760 Flareless Weld Sleeve
Figure 845/20-10-51-990-863

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FLEXIBLE HOSE - REMOVAL/INSTALLATION

1. General

- A. You must consult with Boeing before conducting any repairs to oxygen tubing system.
- B. This procedure has these tasks:
 - (1) A removal of the flexible hose.
 - (2) An installation of the flexible hose.
- C. This procedure gives general instructions for the installation of flexible hoses. If there is a special procedure for a specified system, use the special procedure.
- D. Flexible hoses do not have a specified life limit. Inspect flexible hoses to the applicable operator's standard.

TASK 20-10-52-000-801

2. Flexible Hose Removal

(Figure 401)

A. Procedure

SUBTASK 20-10-52-480-001

CAUTION: PUT CAPS ON THE HOSES AND FITTINGS. UNWANTED MATERIAL CAN CAUSE CONTAMINATION OF HOSES, DAMAGE TO SYSTEM COMPONENTS, AND LEAKAGE OF FLUID. SOME FLUID CAN CAUSE CORROSION OR OTHER DAMAGE.

- (1) Install caps on the hose assemblies and mating connections.

NOTE: Caps keep out moisture and unwanted material until the hose is again connected to its system.

SUBTASK 20-10-52-020-001

- (2) Remove the flexible hose.

- (a) 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.

————— **END OF TASK** —————

TASK 20-10-52-400-801

3. Flexible Hose Installation

(Figure 401)

A. References

Reference	Title
20-50-11-910-801	Standard Torque Values (P/B 201)

B. Procedure

SUBTASK 20-10-52-210-001

- (1) Make sure all the hose fittings are clean and free of defects.

NOTE: Hoses that look like they have been kinked must be replaced.

SUBTASK 20-10-52-640-001

- (2) Lubricate the external threads as necessary with the correct lubricant.

SUBTASK 20-10-52-420-001

- (3) Put the hose in position and tighten the fitting by hand.

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SUBTASK 20-10-52-420-002

(4) Install the clamps and adjust the slack.

SUBTASK 20-10-52-210-002

(5) Examine the installation for the correct alignment and length.

SUBTASK 20-10-52-420-003

CAUTION: USE THE INDEX LINE ON THE SIDE OF THE HOSE TO MAKE SURE THE HOSE IS NOT TWISTED. IF THE HOSE IS TWISTED, HOSE FAILURE OR HOSE COUPLING LEAKAGE CAN OCCUR.

(6) Tighten the B-nut to the correct torque, do this task: Standard Torque Values, TASK 20-50-11-910-801.

SUBTASK 20-10-52-420-004

(7) Tighten the coupling-type ends, do this task: Standard Torque Values, TASK 20-50-11-910-801.

NOTE: Use two wrenches, one on each end, to prevent twisted flexible tubing.

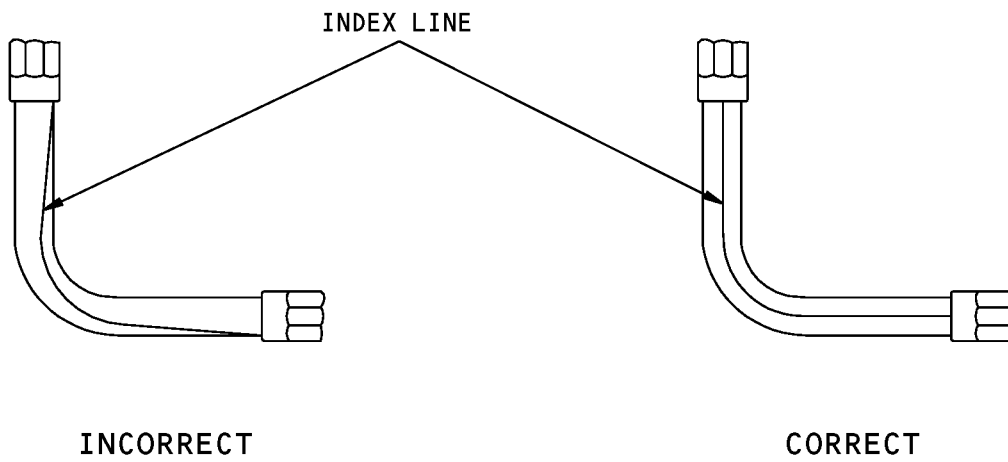
————— **END OF TASK** —————

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**Flexible Hose Installation
Figure 401/20-10-52-990-801**

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FLEXIBLE HOSE - REPAIRS

1. General

- A. This procedure contains one task. The task gives instructions for repair of hydraulic, pneumatic, water, and other tube assemblies. The repair is replacement of unserviceable rigid tubes with flexible hoses as a temporary repair.
- B. If there are other instructions in other procedures or manuals for a specified system, obey those instructions.

CAUTION: PUT CAPS ON HOSES AND FITTINGS WHEN THEY ARE NOT CONNECTED. IF YOU DO NOT USE CAPS, CONTAMINATION OF THE HOSES, AND DAMAGE TO THE SYSTEM COMPONENTS AND LEAKAGE OF HYDRAULIC FLUID COULD OCCUR. YOU MUST REMOVE ALL HYDRAULIC FLUID THAT CAME OUT OF THE HOSE AND FELL ON THE AIRPLANE. HYDRAULIC FLUID CAN CAUSE CORROSION AND DAMAGE TO THE AIRPLANE.

- C. Keep caps on hoses and connections to keep moisture or other contamination out of the system until the hose is connected again.

TASK 20-10-52-300-801

2. Hydraulic Tubing Repair

(Figure 801)

A. General

- (1) You can use many possible repair procedures. The airline must make a decision if a procedure is applicable and safe. This procedure is not applicable to engine hydraulic tube repair or for replacement of coiled flexible tubing.

B. References

Reference	Title
20-10-51-000-802	Flareless Fittings in Pressurized Areas Installation (P/B 401)
29-09-00-860-802	Hydraulic Reservoirs Depressurization (P/B 201)
29-11-01-860-802	Hydraulic Reservoirs Depressurization (P/B 201)

C. Procedure - Flexible Hose Installation

SUBTASK 20-10-52-860-001

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

SUBTASK 20-10-52-200-001

- (2) Make a schedule for regular inspections of the flexible hose installation. Do this to make sure the installation stays an airworthy repair until the system is put back to its initial configuration.

SUBTASK 20-10-52-800-001

- (3) Make a procedure to make sure that you replace flexible hoses as soon as possible. This must not be later than an operator-scheduled time check that has been approved by the assigned principal maintenance inspector.

SUBTASK 20-10-52-220-001

- (4) Use a flexible hose that has these properties:

- (a) The pressure and the fluid properties of the hose must be applicable and correct for the system it will be used on.
- (b) The inner diameter of the hose must not be less than the inner diameter of the damaged tube.

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- (c) The length of the hose must be sufficient to keep the slack, flex, twisting, bending, clearance, and support acceptable, see (Figure 801).
 - 1) Slack - Do not install 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. Give sufficient slack or bend to let the length change.
 - 2) Flex - When very much vibration or flexing occurs to hose assemblies, there must be sufficient slack between the rigid fittings. Install the hose to prevent flexing at the end fitting(s). The hose must stay straight for at least two hose diameters from the end fitting(s). Avoid clamp locations that will limit or prevent hose flexing.
 - 3) Twisting - Install hoses without twists. Twists can cause the hose to break or the nuts to loosen. Use swivel connections at one of the two ends to prevent twist stresses.
 - 4) Bending - To prevent sharp bends in the hose assembly, use elbow fittings, a hose with elbow-type end fittings, or the appropriate bend radii from (Table 801).
 - 5) Clearance - The hose assembly must be clear of all other lines, equipment, and adjacent structure under every operating condition. Hoses must have the minimum clearance shown in (Table 802).

Table 801/20-10-52-993-802 Minimum Hose Bend Radius

AS 115 HOSE	HOSE INSIDE DIAMETER INCHES (mm)	MINIMUM HOSE BEND RADIUS MEASURED INSIDE OF BEND INCHES (mm)
-04	1/4 (6.350)	1.50 (38.1)
-06	3/8 (9.53)	2.50 (63.5)
-08	1/2 (12.7)	2.88 (73.2)
-10	5/8 (15.9)	3.25 (82.6)
-12	3/4 (19.1)	4.00 (101.6)

Table 802/20-10-52-993-803 Minimum Clearance

HOSE CLEARANCE TO	MINIMUM CLEARANCE INCH (mm)
CONTROL CABLE LINKAGES	1.0 ^{*[1]} (25.4)
CABLE AT PULLEYS	0.5 (12.7)
CABLE AT MIDSPAN	2.0 (50.8)
ELECTRICAL WIRING	0.5 (12.7)
HYDRAULIC TUBES OR LINES	0.2 (5.08)

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

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- 6) Support - Make sure the hose assembly is held by supports that will not cause deflection of rigid lines if movement occurs. Use sufficient clamps to follow the contour of the structure. This prevents hose abrasive wear, kinks, and entanglement during flexure. At a minimum, put clamps at locations where the tube clamps were. Make sure the hose is not rigidly held by tight, rigid clamps about its outer diameter. If the hose between the rigid connections must move longitudinally, make sure the clamps are of a type that will not cause wear on the hose casing. The supports must hold the connections at the tube, not the hose.

SUBTASK 20-10-52-860-002

- (5) Remove the pressure from the hydraulic system where you will do the repair. To remove the pressure, do this task: Hydraulic Reservoirs Depressurization, TASK 29-11-01-860-802 or Hydraulic Reservoirs Depressurization, TASK 29-09-00-860-802.

SUBTASK 20-10-52-350-001

- (6) If you will replace all of the damaged tube with a flexible hose, do these steps:
 - (a) Remove the damaged tube.
 - (b) If it is necessary, prepare the ends of the tubes to which you will install the flexible hose. For selection of the applicable fittings, do this task: Flareless Fittings in Pressurized Areas Installation, TASK 20-10-51-000-802.

SUBTASK 20-10-52-300-002

- (7) If the damaged tube is too long to be replaced by a flexible hose, do these steps:
 - (a) Cut the damaged tube section from the line.
 - (b) Install the applicable fittings on the tubes. To install them, do this task: Flareless Fittings in Pressurized Areas Installation, TASK 20-10-51-000-802.
 - (c) Install the tubing on the fittings.

SUBTASK 20-10-52-860-003

- (8) Supply the usual pressure to the line.

SUBTASK 20-10-52-210-003

- (9) Do a check of the hose and the connections for leaks.

SUBTASK 20-10-52-200-002

- (10) Do a check to make sure the slack, flex, twisting, bending, clearance, and support is correct.

————— **END OF TASK** —————

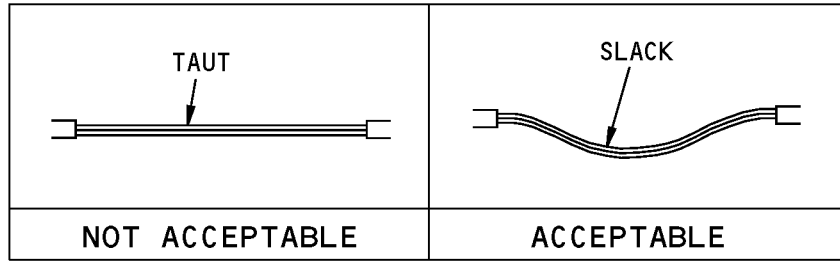
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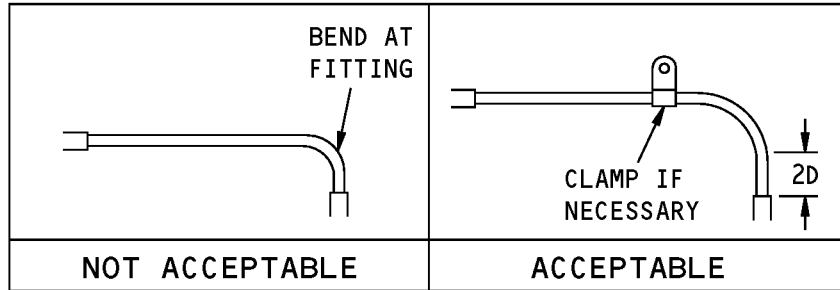
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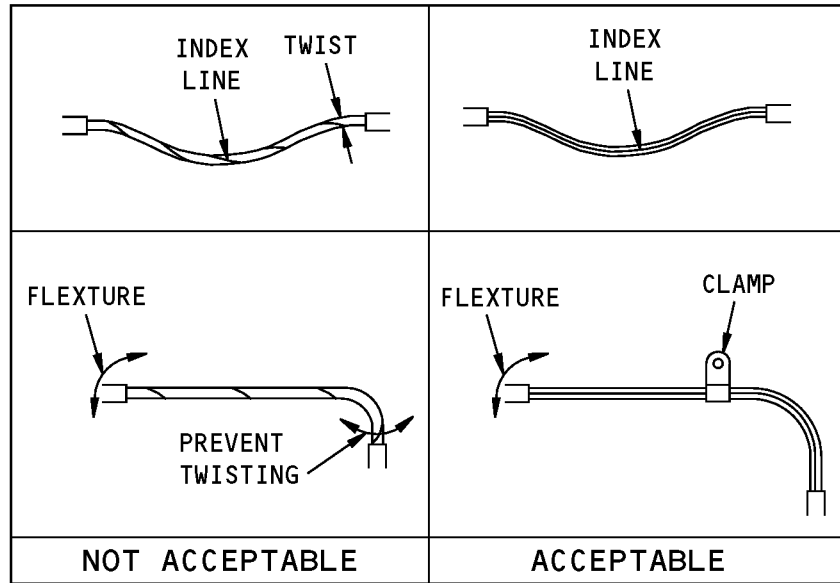
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SLACK



FLEX



TWISTING

Hydraulic Tubing Repair
Figure 801 (Sheet 1 of 2)/20-10-52-990-804

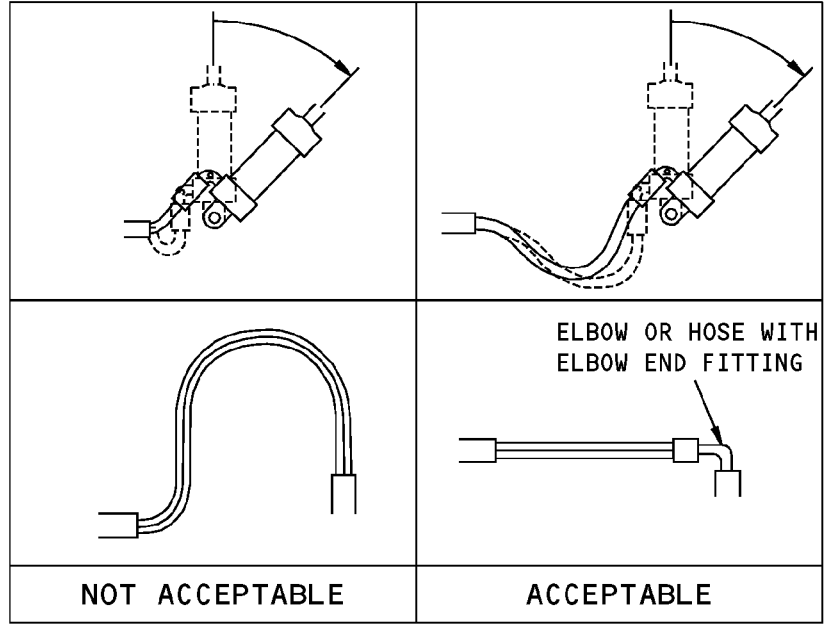
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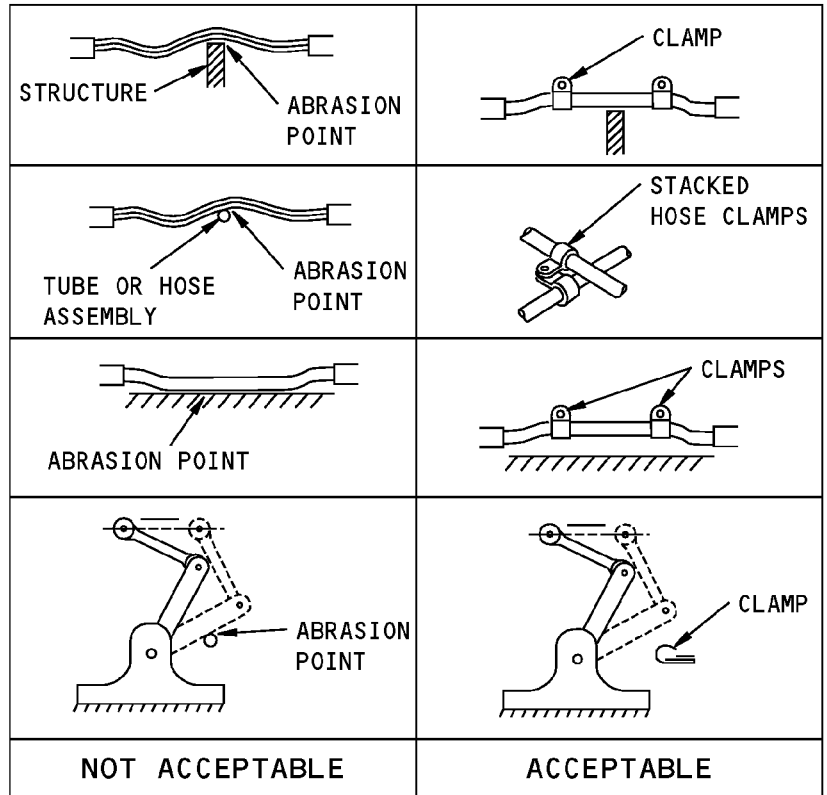
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BENDING



CLEARANCE

Hydraulic Tubing Repair
Figure 801 (Sheet 2 of 2)/20-10-52-990-804

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FLUID LINE TUBING CLAMPS - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
 - (1) A removal of the block clamps.
 - (2) An installation of the block clamps.
 - (3) A removal of P-clamps.
 - (4) A installation of P-clamps.
 - (5) Installation of protective lacing.
- B. Different types of clamps hold the fluid systems tubing:
 - (1) Loop or P-clamps where normal support is required.
 - (2) Saddle clamps where more support is required.
 - (3) Block clamps in the area of high vibration, or where a number of tubes or hoses must be supported in one location.
- C. Loop or saddle clamps holding hydraulic tubes or hoses must be cushioned metal clamps.

TASK 20-10-53-960-801

2. Block Clamps Removal

- A. Procedure
 - SUBTASK 20-10-53-020-001
 - (1) Remove the nuts, bolts and washers that hold the block clamp assembly together.
 - SUBTASK 20-10-53-020-002
 - (2) Remove the block clamp assembly.
 - SUBTASK 20-10-53-020-003
 - (3) If there is a tape under the clamp blocks, remove and discard used tape from the tube.

————— **END OF TASK** —————

TASK 20-10-53-400-801

3. Block Clamps Installation

A. Consumable Materials

Reference	Description	Specification
G00150	Tape - Teflon Film With Silicon Adhesive, 5 mil - Permacel P-421	

B. Procedure

- SUBTASK 20-10-53-020-004
 - (1) Remove and discard all used tape from the tube.
- SUBTASK 20-10-53-420-001
 - (2) At the location of the block clamps and tube overlap, apply three layers of Permacel P-421 tape, G00150 to the tube.
- SUBTASK 20-10-53-420-002
 - (3) Apply the Permacel P-421 tape, G00150 ±0.25 inch (6.4 mm) from each edge of the block.
- SUBTASK 20-10-53-420-007
 - (4) Put the tubes in the applicable notches in one-half of the block clamp assembly.

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SUBTASK 20-10-53-420-003

(5) Put the other half of the block clamp assembly in position.

SUBTASK 20-10-53-420-008

(6) Put the channel over the half of the block clamp assembly that the bolthead will touch.

SUBTASK 20-10-53-420-009

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

SUBTASK 20-10-53-420-010

(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 bolthead and the nut so the bolthead does not wear into the block clamp channel.

————— **END OF TASK** —————

TASK 20-10-53-000-801

4. P-Clamps Removal

A. Procedure

SUBTASK 20-10-53-020-005

(1) Remove the fastener from the clamp and the structure.

SUBTASK 20-10-53-020-006

(2) Remove the pan dirt strap from the clamp.

SUBTASK 20-10-53-020-007

(3) Remove the clamp away from the tubes and structure.

————— **END OF TASK** —————

TASK 20-10-53-400-802

5. P-Clamp Installation

A. Procedure

SUBTASK 20-10-53-420-004

(1) Put the P-clamp on the tube.

SUBTASK 20-10-53-420-005

(2) Put the pan dirt strap in the hole of the clamp.

SUBTASK 20-10-53-420-006

(3) Put the fasteners on the clamp and structure.

SUBTASK 20-10-53-210-001

(4) Make sure everything is tight.

————— **END OF TASK** —————

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TASK 20-10-53-400-803

6. Protective Lacing - Installation

A. Consumable Materials

Reference	Description	Specification
A00027	Adhesive - Silicone Rubber, 1 Part, RTV	BAC5010, Type 60
G00057	Tape - PTFE Flim With Acrylic Adhesive, 3M 63 Tape	
G02503	Lacing - Black Nylon, Untreated Sleeving, 1/8 inch	

B. Procedure - Install the Protective Lacing

SUBTASK 20-10-53-400-001

- (1) Install the protective lacing, G02503 as shown in (Figure 401), steps 1 through 3, except nose landing gear.

SUBTASK 20-10-53-400-002

- (2) Install the protective lacing, G02503 on nose landing gear as shown in (Figure 401), steps 1 through 3.
 - (a) Prior to pulling lock lace through, (step 3), apply adhesive, A00027 to the lace.
 - (b) Pull laces into place, (step 3), this will bond the laces in place.
 - (c) Apply two layers of 3M 63 tape, G00057 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 (25-38 mm) beyond each end of the lacing.

END OF TASK

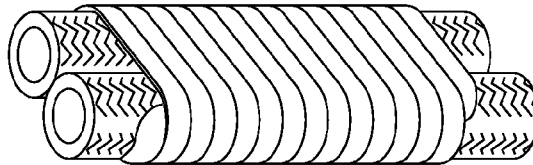
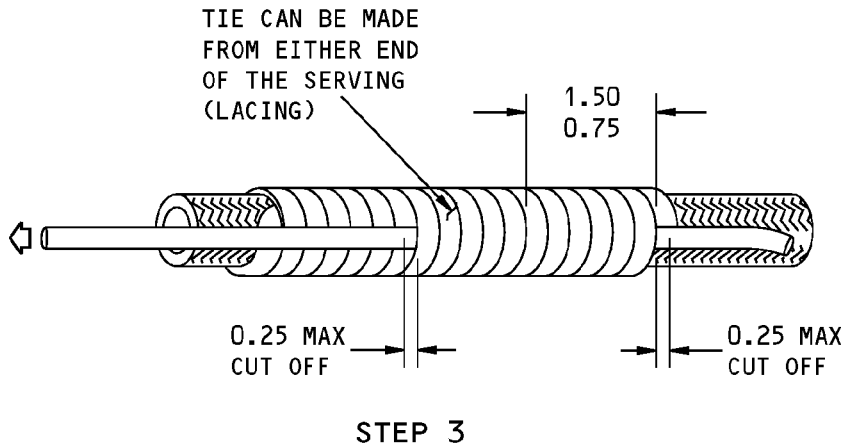
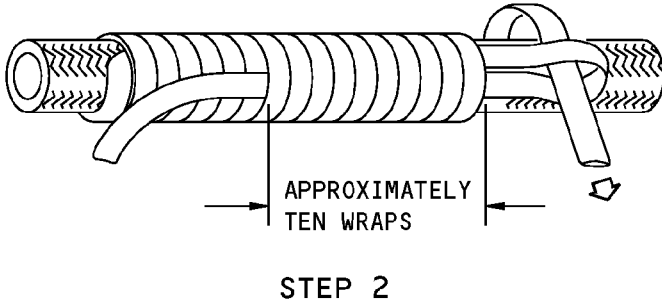
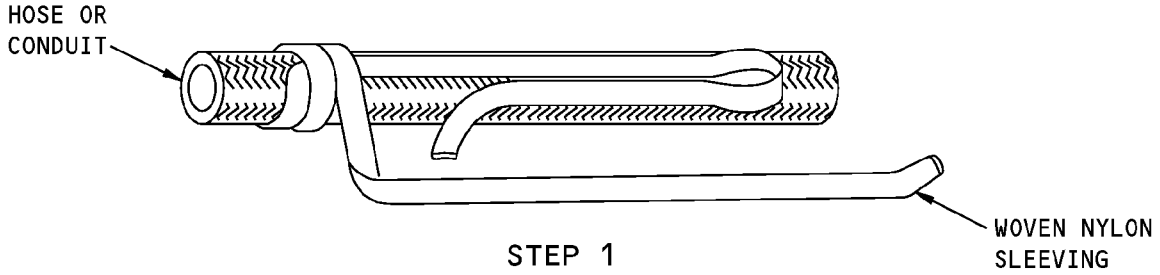
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FOR TWO OR MORE HOSES

NOTE: ALL DIMENSIONS ARE IN INCHES.

**Protective Lacing Installation
Figure 401/20-10-53-990-801**

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STENCIL MARKINGS - REMOVAL/INSTALLATION

1. General

- A. This procedure has these tasks:
 - (1) A removal of the stencil markings.
 - (2) An installation of the stencil markings.
- B. For decorative finishes used on airplane external surfaces, do this task: Decorative Exterior Paint System Application, TASK 51-21-99-300-801.
- C. Paint used for markings is determined by the surface you will paint and the type of finish necessary. Paint must be compatible with the initial surface finish.

TASK 20-10-61-000-801

2. Stencil Markings Removal

A. References

Reference	Title
51-21-11-150-801	Paint Stripping (P/B 701)
51-21-21-370-801	Prepare the Surface to be Painted (P/B 701)
51-21-99-300-801	Decorative Exterior Paint System Application (P/B 701)

B. Consumable Materials

Reference	Description	Specification
C00319	Primer - Urethane Compatible, Corrosion Resistant	BMS10-79, Type II

C. Removal

SUBTASK 20-10-61-420-001

- (1) Remove the old markings if necessary:
 - (a) Strip the markings. To strip them, do this task: Paint Stripping, TASK 51-21-11-150-801.
 - (b) Prepare the surface for the coating. To prepare the surface, do this task: Prepare the Surface to be Painted, TASK 51-21-21-370-801.
 - (c) Apply primer, C00319 that is equivalent to the initial material. To apply it, do this task: Decorative Exterior Paint System Application, TASK 51-21-99-300-801.

————— **END OF TASK** —————

TASK 20-10-61-400-801

3. Stencil Markings Installation

A. General

- (1) Make sure clean surfaces do not become dirty when you clean the adjacent surfaces.
- (2) Use a polyethylene wash bottle to apply solvents. Identify the contents.
- (3) Do not contaminate adjacent areas when you spray.
- (4) Make sure all coatings or finishes are uniform and free from unusual particles.
- (5) Apply primer, C00319 and coating, C00032 with spray equipment only.
- (6) Make sure all coating or finish materials are correctly mixed and labeled. Discard materials with expired pot life.
- (7) Make sure the painted markings are well made and have a solid, homogeneous color.

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B. References

Reference	Title
20-30-98-910-801	Cleaning of Specific Polymeric (Series 98) (P/B 201)
51-21-99-300-801	Decorative Exterior Paint System Application (P/B 701)

C. Tools/Equipment

Reference	Description
STD-1104	Bottle - Polyethylene, Capacity 1 Pint, with Polyethylene Screw Cap and Seal
STD-1133	Gun - Spray, Paint, with Interchangeable Nozzles

D. Consumable Materials

Reference	Description	Specification
B00083	Solvent - Aliphatic Naphtha (For Acrylic Plastics)	TT-N-95 Type II, ASTM D-3735 Type III
B01018	Solvent - Cleaning Of Specific Polymeric (AMM 20-30-98/201) - Series 98	
C00032	Coating - Exterior Protective Enamel, General Use	BMS10-60, Type I
C00033	Coating - Exterior Protective Enamel, Flexibility Use	BMS10-60, Type II
C00319	Primer - Urethane Compatible, Corrosion Resistant	BMS10-79, Type II
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5
G00251	Abrasive - Mat, Non-Woven, Non-Metallic	A-A-58054
G00270	Tape - Scotch Flatback Masking 250	ASTM D6123 (Supersedes A-A-883)

E. Prepare the Surface for Stencil Markings

SUBTASK 20-10-61-950-001

(1) Mask or put a protective cover on all adjacent surfaces that you will not clean, treat, or coat.

SUBTASK 20-10-61-110-001

(2) Clean the surface:

(a) Remove loose soil and unwanted grease or oil.

NOTE: Be careful not to get dirt on a larger area than necessary.

WARNING: MAKE SURE YOU DO NOT SPRAY SOLVENTS OR KEEP THEM IN OPEN CONTAINERS. DO NOT USE FLAMMABLE SOLVENTS IN THE AIRPLANE. SOLVENTS AND CLEANERS CONTAIN TOXIC INGREDIENTS. WEAR PROTECTIVE GLOVES, AND DO NOT GET SOLVENT OR CLEANER ON SKIN OR EYES. MAKE SURE YOU HAVE SUFFICIENT VENTILATION OR USE RESPIRATOR MASKS. INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT CAN OCCUR.

CAUTION: MAKE SURE YOU DO NOT USE SOLVENTS OTHER THAN THOSE SPECIFIED. THEY CAN CAUSE DAMAGE TO THE FINISH.

(b) Use the applicable solvent:

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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.

- 1) For Tedlar, Teflon, and solvent resistant finishes, use Series 98 solvent, B01018 .(Cleaning of Specific Polymerics (Series 98), TASK 20-30-98-910-801)
 - 2) For acrylic surfaces, use solvent, B00083.
 - 3) For all other surfaces and for hydraulic fluid contamination, use solvent, B00083.
- (c) Use a polyethylene bottle (1 pint), STD-1104 to apply solvent to the work surface or to a clean wiper.

NOTE: Do not put the wiper into the solvent container.

- (d) Rub the surface with a cotton wiper, G00034 or a soft brush.
- (e) Rinse the surface with clean solvent.
 - 1) Use clean wipers.
- (f) Remove unwanted solvent.
- (g) Let the surface drain, then rub dry.

SUBTASK 20-10-61-110-002

(3) Clean the surface again:

- (a) Put solvent on a clean wiper.

NOTE: Do not put the wiper into the solvent container.

- (b) Rub the surface with a solvent-soaked cotton wiper, G00034. Immediately rub dry with a clean, dry cotton wiper, G00034.

NOTE: Do not let the solvent air dry.

- (c) Replace the dirty cotton wiper, G00034 frequently with clean ones.
- (d) Do the last three steps until the wiper shows no dirt.

NOTE: If a clean surface becomes dirty, clean it again.

SUBTASK 20-10-61-120-001

(4) For plastic laminates and painted surfaces, do these steps:

- (a) If necessary, clean the surface.

CAUTION: MAKE SURE YOU DO NOT SAND THE PAINTED SURFACE AROUND THE DECAL EDGE IF CLEAR HYDRAULIC FLUID RESISTANT COATING WAS USED AS AN EDGE SEALER FOR THE DECAL. DAMAGE TO THE SEAL CAN OCCUR.

- (b) Lightly sand the surface with abrasive mat, G00251 or finer abrasive paper.
- (c) Do again the two steps to clean the surface.

F. Install Stencil Markings

SUBTASK 20-10-61-420-002

(1) Install the stencil.

- (a) Make sure all stencil cuts are sharp and clear of burrs.
- (b) Attach the stencil tightly with Scotch Flatback Masking Tape 250, G00270 so the paint does not go under the edges.

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SUBTASK 20-10-61-370-001

- (2) Prepare the stencil paint.

NOTE: Make sure you use a marking enamel or lacquer that agrees with the surface finish.

- (a) To prepare primer, C00319, coating, C00032 (preferred) or coating, C00033 (alternate) , do this task: Decorative Exterior Paint System Application, TASK 51-21-99-300-801.

SUBTASK 20-10-61-380-001

WARNING: MAKE SURE YOU DO NOT BREATHE THE FUMES OF FINISHES AND SOLVENTS. DO WORK IN A WELL-VENTILATED AREA. USE APPROVED RESPIRATORY PROTECTION AS NECESSARY. DO NOT GET FINISHES AND SOLVENTS IN EYES OR ON SKIN AND CLOTHING. KEEP MATERIALS AWAY FROM SOURCE OF IGNITION. FINISHES AND SOLVENTS ARE TOXIC AND FLAMMABLE. THEY CAN CAUSE INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT.

- (3) Apply coating, C00032(prefered) or coating, C00033(alternate) or lacquer with the paint spray gun with interchangeable nozzles, STD-1133.

- (a) In areas where a BMS3-11 resistant finish is necessary, apply coating, C00033.
(b) When letter sizes are greater than 2 in. (51 mm) in height, use coating, C00033 for the letters.

NOTE: The best conditions to apply paint are when the temperature is 50 to 95°F (10-35°C) and the relative humidity is less than 85%

- (c) Make sure there is a sufficiently wet layer to give uniform flow but not to cause runs and sags.

SUBTASK 20-10-61-800-001

- (4) Remove the rough edges from the markings with solvent, B00083 or with a burnishing tool after the marking cures.

NOTE: An alternative procedure to remove the rough edges is to remove the masking tape while the paint is still wet. This permits paint to flow out.

————— **END OF TASK** —————

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COAXIAL CABLE - MAINTENANCE PRACTICES

1. General

- A. Use a time domain reflectometer (TDR) to examine coaxial cables. The TDR can locate opens, shorts, crimps and other defects in coaxial cables of lengths up to 1,200 feet long. The TDR can also be used on a twisted pair or parallel wires which are the same length.
- B. The TDR transmits pulses of energy down the cable. The TDR then monitors the impedance changes in the pulse energy that is reflected back. You can see these reflections on the liquid crystal display (LCD). You then find failures in the cable from the properties of the waveform shown on the LCD.
- C. Use the 3M Advanced System Tester 900AST Series (recommended) TDR or the Tektronix Model 1502 (optional) TDR to examine the coaxial cable.

TASK 20-10-72-210-801

2. Coaxial Cable Inspection

- A. General
 - (1) Refer to 3M's 900AST (preferred) or the tektronix 1502C Instruction Manual for information on how to test the coaxial cable.

————— **END OF TASK** —————

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CONTROL CABLES - REMOVAL/INSTALLATION

1. General

A. This procedure has these tasks:

- (1) A removal of the control cables, except for the stabilizer control cables.

NOTE: To remove the stabilizer control cables, do the following task: (Stabilizer Control Cable Removal, TASK 27-41-82-000-801).

- (2) An installation of the control cables, except for the stabilizer control cables.

NOTE: To install the stabilizer control cables, do the following task: (Stabilizer Control Cable Installation, TASK 27-41-82-000-802).

B. The installation procedure contains prefabricated and nonprefabricated cables for easier installation when portable swaging machines are available.

TASK 20-10-91-000-801

2. Control Cables Removal

A. References

Reference	Title
20-10-04-000-801	Control Cable Air Seal Removal (P/B 401)
20-10-09-000-801	Control Cable Pulleys Removal (P/B 401)
20-10-10-000-801	Turnbuckle Locking Clips Removal (P/B 401)

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-1569	Clamp - Control Cable (Part #: A20005-9, Supplier: 81205, A/P Effectivity: 737-100, -200, -200C, -300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)

C. Consumable Materials

Reference	Description	Specification
G00270	Tape - Scotch Flatback Masking 250	ASTM D6123 (Supersedes A-A-883)

D. Procedure

SUBTASK 20-10-91-930-001

- (1) Use Scotch Flatback Masking Tape 250, G00270 to make a mark on the cable and fittings.

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

SUBTASK 20-10-91-020-001

- (2) Do this task: Turnbuckle Locking Clips Removal, TASK 20-10-10-000-801.

SUBTASK 20-10-91-020-002

- (3) Do this task: Control Cable Air Seal Removal, TASK 20-10-04-000-801.

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SUBTASK 20-10-91-420-001

- (4) Install control cable clamp, SPL-1569 on the cable you do not remove to keep light tension on the cable.

NOTE: Light tension on the cable will prevent wind off on the cable drums. Light tension will also make sure the cables do not move out of the pulley guides.

SUBTASK 20-10-91-480-001

- (5) If you can isolate the cable between rigging pin locations, it is acceptable to install rigging pins through the applicable drum or quadrant.

SUBTASK 20-10-91-420-002

- (6) Prior to removing the cable, do this task: Control Cable Pulleys Removal, TASK 20-10-09-000-801.
 - (a) Remove the cable.

————— END OF TASK —————

TASK 20-10-91-400-801

3. Control Cables Installation

A. General

- (1) If this procedure does not agree with a specified maintenance procedure, use the specified maintenance procedure.
- (2) Detailed data is in Chapter 27 for flight control cables and Chapter 32 for Landing Gear Control Cables.

B. References

Reference	Title
20-10-04-400-801	Control Cable Air Seal Installation (P/B 401)
20-10-09-400-801	Control Cable Pulleys Installation (P/B 401)
20-10-10-400-801	Turnbuckle Lock Installation (P/B 401)
27-21-00-700-815-001	Rudder Centering Test (P/B 501)
27-21-00-700-815-002	Rudder Centering Test (P/B 501)
27-21-00-700-816-001	Rudder Pedal Forces Test (P/B 501)
27-21-00-700-816-002	Rudder Pedal Forces Test (P/B 501)
27-21-00-700-817-001	Rudder Travel Test (P/B 501)
27-21-00-700-817-002	Rudder Travel Test (P/B 501)
27-21-00-820-808-001	Rudder Control Cables RA and RB Adjustment (P/B 501)
27-21-00-820-808-002	Rudder Control Cables RA and RB Adjustment (P/B 501)
27-31-00-700-804	Elevator Travel Limit - Test (P/B 501)
27-31-00-700-808	Control Column Travel and Centering - Test (P/B 501)
27-31-00-700-809	Control Column Power Force - Test (P/B 501)
27-31-00-710-801	Elevator and Elevator Trim Control System - Operational Test (P/B 501)
27-31-00-820-801	Elevator Control Cables EA and EB and Pitch Force Transducers - Adjustment (P/B 501)
27-41-00-700-801	Stabilizer Manual Trim and Trim Indicator Test (P/B 501)
27-41-00-700-802	Horizontal Stabilizer Trim Control System Friction Test (P/B 501)
27-41-00-700-803	Stabilizer Electric Trim System Test (P/B 501)
27-41-00-700-804	Stabilizer Trim Wheel Free Movement Test (P/B 501)
27-41-00-700-806	Stabilizer Clutch Friction System Test (P/B 501)

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Reference	Title
27-41-00-820-801	Stabilizer Control Cable and Chain Adjustment (P/B 501)
27-62-00-710-801	Speed Brake Control System Operational Test (P/B 501)
27-62-00-800-803	Speed Brake Lever Friction Test (P/B 501)
27-62-00-820-802	Speed Brake Control Cable Adjustment (P/B 501)
27-62-34-400-802	Speed Brake Armed Switch and Speed Brake Handle Position Switch Adjustment (P/B 401)

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-1583	Kit - Swager, Portable Cable (Part #: AT520HK, Supplier: 00784, A/P Effectivity: 737-ALL) (Part #: AT520JK, Supplier: 00784, A/P Effectivity: 737-ALL)

D. Consumable Materials

Reference	Description	Specification
C00308	Compound - Corrosion Preventive, Petrolatum Hot Application	MIL-C-11796
D00015	Grease - Aircraft Bearing (Use BMS 3-24 until existing stocks are depleted, BMS 3-33 supersedes BMS 3-24)	BMS3-24 (Superseded by BMS 3-33)
D00633	Grease - Aircraft General Purpose	BMS3-33
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5

E. Prefabricated Cable Installation

SUBTASK 20-10-91-420-003

(1) Install the cable.

- (a) Attach the new cable to the old cable.

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

- (b) Pull the old cable out, which pulls the new cable through at the same time.
- (c) Keep light tension on the new cable.

SUBTASK 20-10-91-410-001

(2) Do this task: Control Cable Pulleys Installation, TASK 20-10-09-400-801.

and, do this task: Control Cable Air Seal Installation, TASK 20-10-04-400-801

F. Nonprefabricated Cable Installation

SUBTASK 20-10-91-820-001

(1) Identify the cable you remove.

- (a) Refer to the applicable system chapter to prepare a new cable.

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(b) Refer to Figure 401 to calculate cable length.

NOTE: The total length of the cable after assembly and the test will be longer than the lengths of the terminals and the cable before they are assembled. The terminals will be longer after they are swaged, and the cable will be longer after the proof test. Make sure you include an allowance for each of these changes before you cut the cable to the required length.

SUBTASK 20-10-91-420-004

(2) Install only those fittings that will permit cable installation.

- (a) If the wire rope has a nylon jacket, remove the nylon from the end of the wire rope before you put the rope in the terminal.
1) Remove a length of nylon to give 0.50 in. (12.70 mm) maximum clearance between the terminal and the jacket after the rope is installed in the terminal.
(b) Put the cut end of the wire rope into the full depth of the bore of the terminal.
1) If the bore of the terminal does not go completely through, make sure the wire rope is at the full depth as follows:
a) Measure the depth of the bore.
b) Mark this as a length from the end of the wire rope before you install and swage the fittings.
(c) Terminals can be staked on the wire rope to keep them in the correct position before they are swaged
1) The depth of this stake must be a maximum of 0.003 in. (0.076 mm).
2) The stake must be within the minimum swage length given by Table 401 or Table 402.

SUBTASK 20-10-91-830-001

(3) Use the portable cable swager kit, SPL-1583 to install the fittings as follows:

- (a) The swaging must smoothly cold-work the fitting until its dimension agree with the data given by the table below.
(b) During the swaging process, do not let die touch the these areas of the fitting:
1) The hex.
2) The fork.
3) The eye of the terminal.
(c) Do not swage the same terminal a second time.
(d) The completed swage dimensions are as follows:

Table 401/20-10-91-993-801 Terminal Dimensions After Swaging

Table with 6 columns: Cable Diameter, 1/16 in. (1.588 mm), 3/32 in. (2.381 mm), 1/8 in. (3.175 mm), 5/32 in. (3.969 mm), 3/16 in. (4.762 mm). Rows include X (Minimum), AS Diameter (Maximum), and AS Diameter (Minimum) with values in inches and millimeters.

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Cable Diameter	1/16 in. (1.588 mm)	3/32 in. (2.381 mm)	1/8 in. (3.175 mm)	5/32 in. (3.969 mm)	3/16 in. (4.762 mm)
AS Diameter (Minimum) ^{*[2]}	0.128 in. (3.251 mm)	0.180 in. (4.572 mm)	0.209 in. (5.309 mm)	0.236 in. (5.994 mm)	0.299 in. (7.595 mm)

*[1] BASIC MINIMUM DIAMETER AFTER SWAGING

*[2] IN THE AREA OF THE ORIGINAL DESIGN TAPER, THE END OF THE SWAGED AREA CAN HAVE THIS MINIMUM DIAMETER

Table 402/20-10-91-993-802 Terminal Dimensions After Swaging

Cable Diameter	7/32 in. (5.556 mm)	1/4 in. (6.350 mm)	9/32 in. (7.144 mm)	5/16 in. (7.938 mm)	3/8 in. (9.525 mm)
X (Minimum)	1.550 in. (39.370 mm)	1.700 in. (43.180 mm)	1.890 in. (48.006 mm)	2.060 in. (52.324 mm)	3.120 in. (79.248 mm)
AS Diameter (Maximum)	0.375 in. (9.525 mm)	0.438 in. (11.125 mm)	0.500 in. (12.700 mm)	0.563 in. (14.300 mm)	0.625 in. (15.875 mm)
AS Diameter (Minimum) ^{*[1]}	0.368 in. (9.347 mm)	0.431 in. (10.947 mm)	0.492 in. (12.497 mm)	0.555 in. (14.097 mm)	0.617 in. (15.672 mm)
AS Diameter (Minimum) ^{*[2]}	0.361 in. (9.169 mm)	0.424 in. (10.770 mm)	0.484 in. (12.294 mm)	0.547 in. (13.894 mm)	0.609 in. (15.469 mm)

*[1] BASIC MINIMUM DIAMETER AFTER SWAGING

*[2] IN THE AREA OF THE ORIGINAL DESIGN TAPER, THE END OF THE SWAGED AREA CAN HAVE THIS MINIMUM DIAMETER

- (e) The swaged terminal must have no pits, die marks, cracks that could be seen with a 10-power lens.
 - 1) Small nicks or dents are satisfactory if the swaged surface is 63 microinches or smoother.
- (f) The threaded, eye, or fork end of the terminal must be straight with the centerline of the swaged end as shown in Figure 401.
- (g) The cable assembly must not have the following:
 - 1) Kinks.
 - 2) Damaged nylon jacket.
 - 3) Popped cores.
 - 4) Broken wire strands.
 - 5) Wire ends above the terminal ends.

SUBTASK 20-10-91-820-002

- (4) Apply a proof load (Figure 401) to the cable and to the installed fittings.

NOTE: This will check the swaging and this will also stretch the cable.

NOTE: If you use prestretched cable you do not have to use a proof load. You can use other applicable procedures to do a check on the swaging.

NOTE: The proof load for stabilizer trim cables shall be 900 ± 25 lb (408 ± 12 kg).

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Table 403/20-10-91-993-803 Proof Loads For Cable Assemblies

WIRE ROPE TYPE		CABLE DIAMETER * ^[1]				
		1/16 in. (1.588 mm)	3/32 in. (2.381 mm)	1/8 in. (3 mm)	5/32 in. (3.969 mm)	3/16 in. (5 mm)
---		PROOF LOAD				
BMS 7-265 OR MIL-W-8342 Carbon Steel – Zinc Coated (Composition "A")	7X7	288 + 25 / - 0 lb (131 + 12 / - 0 kg)	552 + 25 / - 0 lb (250 + 12 / - 0 kg)	---	---	---
	7X19	---	600 + 25 / - 0 lb (272 + 11 / - 0 kg)	1200 + 60 / - 0 lb (544 + 28 / - 0 kg)	1680 + 85 / - 0 lb (762 + 39 / - 0 kg)	2520 + 125 / - 0 lb (1143 + 57 / - 0 kg)
BMS 7-265 OR MIL-W-83420 Corrosion Resistant Steel (CRES) (Composition "B")	7X7	288 + 25 / - 0 lb (131 + 12 / - 0 kg)	552 + 25 / - 0 lb (250 + 12 / - 0 kg)	---	---	---
	7X19	---	552 + 25 / - 0 lb (250 + 12 / - 0 kg)	1056 + 50 / - 0 lb (479 + 23 / - 0 kg)	1440 + 70 / - 0 lb (653 + 32 / - 0 kg)	2220 + 110 / - 0 lb (1007 + 50 / - 0 kg)

*[1] THE DIAMETER OF THE WIRE ROPE TELLS YOU THE PROOF LOAD TO USE ON NYLON JACKETED CABLE. DO NOT INCLUDE THE JACKETED CABLE. DO NOT INCLUDE THE JACKET IN THE DIAMETER.

Table 404/20-10-91-993-804 Proof Loads For Cable Assemblies

WIRE ROPE TYPE		CABLE DIAMETER * ^[1]				
		7/32 in. (5.556 mm)	1/4 in. (6.350 mm)	9/32 in. (7.144 mm)	5/16 in. (7.938 mm)	3/8 in. (9.525 mm)
---		PROOF LOAD				
BMS 7-265 OR MIL-W-8342 Carbon Steel – Zinc Coated (Composition "A")	7X19	3360 + 170 / - 0 lb (1524 + 77 / - 0 kg)	4200 + 210 / - 0 lb (1905 + 95 / - 0 kg)	4800 + 240 / - 0 lb (2177 + 109 / - 0 kg)	5880 + 295 / - 0 lb (2667 + 134 / - 0 kg)	8640 + 435 / - 0 lb (3919 + 197 / - 0 kg)
	7X19	3000 + 150 / - 0 lb (1361 + 68 / - 0 kg)	3840 + 190 / - 0 lb (1742 + 86 / - 0 kg)	4680 + 230 / - 0 lb (2123 + 105 / - 0 kg)	5400 + 270 / - 0 lb (2449 + 123 / - 0 kg)	7200 + 360 / - 0 lb (3266 + 163 / - 0 kg)

*[1] THE DIAMETER OF THE WIRE ROPE TELLS YOU THE PROOF LOAD TO USE ON NYLON JACKETED CABLE. DO NOT INCLUDE THE JACKETED CABLE. DO NOT INCLUDE THE JACKET IN THE DIAMETER.

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SUBTASK 20-10-91-160-001

- (5) Rub the full length of the cable with cotton wiper, G00034.

SUBTASK 20-10-91-640-001

CAUTION: DO NOT APPLY SOLVENTS, GREASE, OR OIL TO STAINLESS STEEL CONTROL CABLES. THESE MATERIALS CAN COLLECT CONTAMINATION THAT CAN CAUSE DAMAGE TO THE INTERNAL SURFACES OF THE CRES CABLE STRANDS. THIS CAN DECREASE THE SERVICE LIFE OF THE CABLE.

- (6) Lubricate the cable.

NOTE: Only lubricate carbon steel cables. It is not necessary to lubricate CRES cables. CRES cables can be wiped with a clean cloth.

- (a) Apply a light, thin layer of grease, D00633 (recommended) or grease, D00015 to the carbon steel cable.
- (b) Wipe the cable with a clean rag to leave a thin film of grease between the strands on the cable.

SUBTASK 20-10-91-930-002

- (7) Make marks on the positions of the fittings not installed on the cable before installation.

SUBTASK 20-10-91-820-003

- (8) Put tape on the old cable so it will not unravel.

SUBTASK 20-10-91-820-004

- (9) Cut off the cable end fitting of the old cable and make a splice to attach the old cable to the new cable.

NOTE: If you do not attach the new cable to the old cable, you will have a problem in routing the new cable. Make the splice of minimum diameter and sufficiently strong not to break when you pull the cable through. Make the splice on only the center strands of the cable. Put tape on the loose outer strands.

NOTE: If a person can assist with control cable installation, have them remove retainer pins and fairleads as new cable passes through pulley. Connect retainer pins and fairleads when new cable is in place. Continue with next pulley until done.

SUBTASK 20-10-91-820-005

- (10) Pull the old cable out with light tension on the new cable.

SUBTASK 20-10-91-420-005

- (11) Install the remaining fittings and apply a proof load to fittings (Figure 401).

NOTE: You must apply the full proof load in less than three seconds and hold it for a minimum of five seconds.

SUBTASK 20-10-91-160-002

- (12) If necessary, remove unwanted corrosion preventive compound, C00308 from the surface of the control cable with a clean cotton wiper, G00034.

NOTE: Clean all of the cable, including through the fairleads and air seals, and over the pulleys, quadrants, and drums.

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SUBTASK 20-10-91-640-002

CAUTION: DO NOT APPLY SOLVENTS, GREASE, OR OIL TO STAINLESS STEEL CONTROL CABLES. THESE MATERIALS CAN COLLECT CONTAMINATION THAT CAN CAUSE DAMAGE TO THE INTERNAL SURFACES OF THE CRES CABLE STRANDS. THIS CAN DECREASE THE SERVICE LIFE OF THE CABLE.

(13) Lubricate the cable.

NOTE: Only lubricate carbon steel cables. It is not necessary to lubricate CRES cables. CRES cables can be wiped with a clean cloth.

- (a) Apply a light thin layer of grease, D00633 (recommended) or grease, D00015 to the carbon steel cable.
- (b) Wipe the cable with a clean rag to leave a thin film of grease between the strands on the cable.

SUBTASK 20-10-91-420-006

(14) 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.

SUBTASK 20-10-91-020-003

(15) Remove the cable clamps and rigging pins from the control cable and drums.

SUBTASK 20-10-91-420-007

(16) 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 at least 6 in. (152 mm) from the turnbuckle terminal or other fittings. To make sure you have the correct cable tension, permit a minimum of one hour at constant ambient temperature (± 5 °F [± 3 °C]) for airplane temperature to become stable.

SUBTASK 20-10-91-710-001

(17) If a new cable is installed, operate the system for a number of test cycles, with cables tightened to two times the working tension.

NOTE: See the applicable chapter for tension specifications.

SUBTASK 20-10-91-820-006

(18) Make the last rigging adjustments.

NOTE: Refer to the applicable chapter for rigging load and test cycle tables.

SUBTASK 20-10-91-210-001

(19) Do this task: Control Cable Air Seal Installation, TASK 20-10-04-400-801.

NOTE: Correctly adjusted seals stop deflection of the cable and make sure the cable is free to move.

SUBTASK 20-10-91-220-001

(20) 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.

- (a) Between different cable systems - 0.50 in. (12.70 mm).

NOTE: A clearance of 2.00 in. (50.80 mm) is recommended.

- (b) Between structure, wiring, tubing and fixed equipment:
 - 1) At a fairlead - 0.50 in. (12.70 mm).

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2) At a rubstrip - 0.10 in. (2.54 mm).

NOTE: A clearance of 1.50 in. (38.10 mm) is recommended below the cable, and 1.00 in. (25.40 mm) is recommended in the other directions.

(c) Between doors, landing gear, and components that move - 2.00 in. (50.80 mm).

NOTE: A clearance of 4.00 in. (101.60 mm) is recommended.

SUBTASK 20-10-91-420-008

(21) Do this task: Turnbuckle Lock Installation, TASK 20-10-10-400-801.
on all the turnbuckles adjusted.

SUBTASK 20-10-91-710-002

(22) Operate controls through full travel to make sure that cables move freely with minimum force.

SUBTASK 20-10-91-700-001

(23) If you replaced the rudder control cables, do these tasks:

- Rudder Control Cables RA and RB Adjustment, TASK 27-21-00-820-808-001 or Rudder Control Cables RA and RB Adjustment, TASK 27-21-00-820-808-002
- Rudder Travel Test, TASK 27-21-00-700-817-001 or Rudder Travel Test, TASK 27-21-00-700-817-002
- Rudder Centering Test, TASK 27-21-00-700-815-001 or Rudder Centering Test, TASK 27-21-00-700-815-002
- Rudder Pedal Forces Test, TASK 27-21-00-700-816-001 or Rudder Pedal Forces Test, TASK 27-21-00-700-816-002

(24) If you replaced the elevator control cables, do these tasks:

- Elevator Control Cables EA and EB and Pitch Force Transducers - Adjustment, TASK 27-31-00-820-801
- Elevator and Elevator Trim Control System - Operational Test, TASK 27-31-00-710-801
- Elevator Travel Limit - Test, TASK 27-31-00-700-804
- Control Column Travel and Centering - Test, TASK 27-31-00-700-808
- Control Column Power Force - Test, TASK 27-31-00-700-809

(25) If you replaced the horizontal stabilizer control cables, do these tasks:

- Stabilizer Control Cable and Chain Adjustment, TASK 27-41-00-820-801
- Stabilizer Manual Trim and Trim Indicator Test, TASK 27-41-00-700-801
- Horizontal Stabilizer Trim Control System Friction Test, TASK 27-41-00-700-802
- Stabilizer Electric Trim System Test, TASK 27-41-00-700-803
- Stabilizer Trim Wheel Free Movement Test, TASK 27-41-00-700-804
- Stabilizer Clutch Friction System Test, TASK 27-41-00-700-806

(26) If you replaced the ground speed brake control cables, do these tasks:

- Speed Brake Control Cable Adjustment, TASK 27-62-00-820-802
- Speed Brake Armed Switch and Speed Brake Handle Position Switch Adjustment, TASK 27-62-34-400-802
- Speed Brake Lever Friction Test, TASK 27-62-00-800-803
- Speed Brake Control System Operational Test, TASK 27-62-00-710-801

————— **END OF TASK** —————

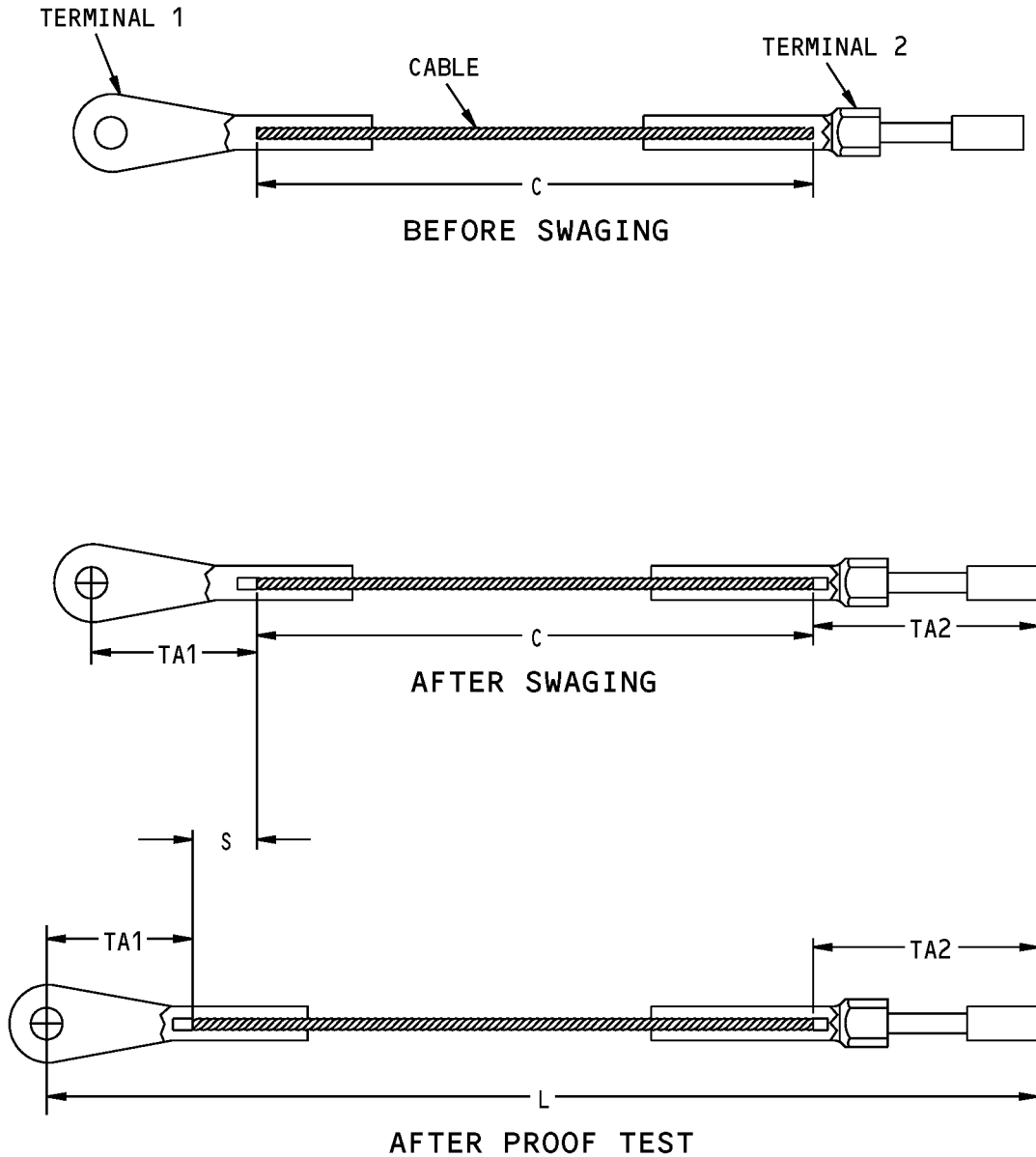
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$C = L - (TA1 + TA2 + S)$ WHERE:
 C = CUT LENGTH OF CABLE
 L = FINAL ASSEMBLY LENGTH
 S = AMOUNT OF INCREASED CABLE LENGTH AFTER PROOF TEST
 $TA1$ = TERMINAL 1 ALLOWANCE AFTER SWAGING
 $TA2$ = TERMINAL 2 ALLOWANCE AFTER SWAGING

**Control Cables Installation
Figure 401 (Sheet 1 of 2)/20-10-91-990-801**

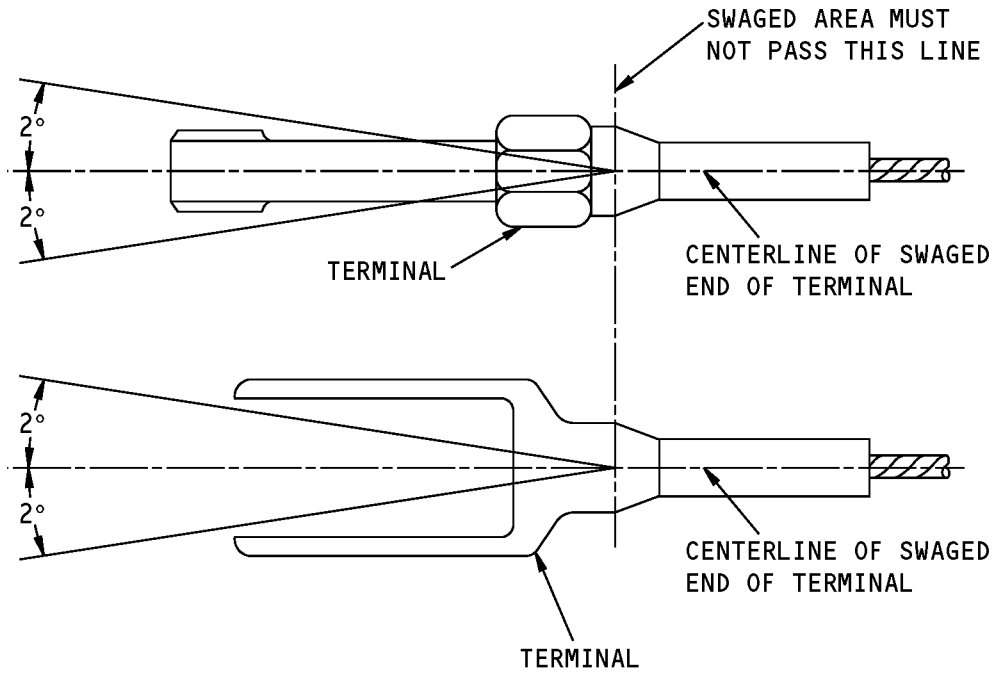
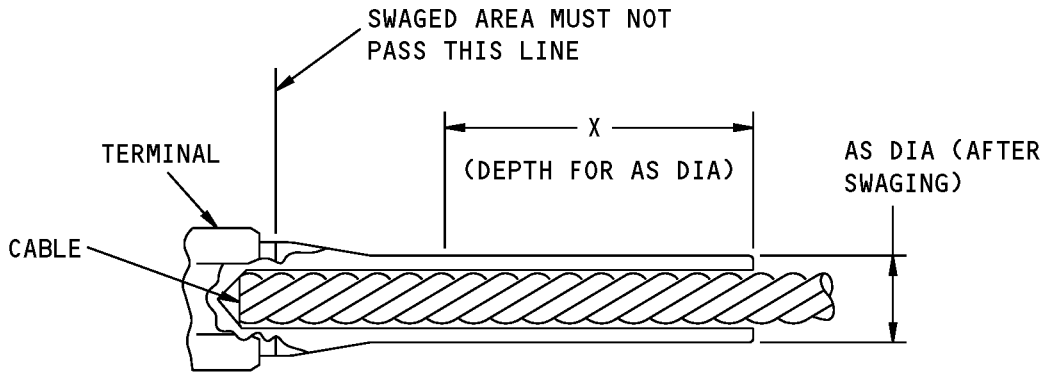
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**Control Cables Installation
Figure 401 (Sheet 2 of 2)/20-10-91-990-801**

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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 20-15-01-410-801

2. Off-Airplane Software Installation

A. General

- (1) Off-airplane data loading equipment may have the capability to support various interfaces: ie 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. Equipment information for the data loader, COM-1407 follows.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1407	Loader - Data (Part #: 615 FDS, Supplier: 0D4J3, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER) (Part #: QSL7X7, Supplier: 0D4J3, A/P Effectivity: 737-ALL)

C. Additional Alternative Equipment

SUBTASK 20-15-01-860-001

- (1) Data Loader - Shop, Pentar Avionics Headquarters, 19820 North Creek Parkway Suite 102, Bothell, WA 98011

D. Procedures

SUBTASK 20-15-01-410-001

- (1) Off-airplane data loading is accomplished on software loadable LRUs that are removed from the airplane or are taken out of stores.

SUBTASK 20-15-01-410-002

- (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.

SUBTASK 20-15-01-410-003

- (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.

SUBTASK 20-15-01-410-004

- (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.

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SUBTASK 20-15-01-410-005

- (5) Refer to the airline's off-airplane data loading policy for additional off-airplane loading equipment and procedures information.

————— **END OF TASK** —————

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ON-AIRPLANE SOFTWARE INSTALLATION - MAINTENANCE PRACTICES

TASK 20-15-11-400-801

1. On-Airplane Software Installation

(Figure 201)

A. General

(1) Software Installation Times

- (a) The time required to install software in a component is variable and is dependent on several factors which 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.
- (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 display electronic unit (DEU) for the Common Display System is an example of a component that can do a short load.

(3) Table 201 - Data Transfer Times

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- (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.
 - 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.
 - 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 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 the 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) is an example of a system that can cross-load.

Table 201/20-15-11-993-801 Table 201

AMM CHAPTER	COMPONENT	SOFTWARE	DATA TRANSFER TIME (IN MINUTES)
22-11	Flight Control Computer (FCC)	OPS	5 to 16
23-15	Satellite Data Unit (Rockwell Collins)	OPS ORT (DB)	15 to 48 1 to 5
23-15	Satellite Data Unit (Honeywell)	USER ORT (DB) SECURED ORT (DB)	1 to 5 1 to 5
23-27 23-27	ACARS Management Unit (AlliedSignal)	CORE and Application (OPS) Airplane Database (DB)	5 to 16 1 to 15
23-27 23-27	ACARS Management Unit (Rockwell Collins)	CORE (OPS) AOC (DB)	2 to 16 3 to 15
23-27 23-27	ACARS Management Unit (Teledyne)	Application (OPS)	5 to 16

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(Continued)

AMM CHAPTER	COMPONENT	SOFTWARE	DATA TRANSFER TIME (IN MINUTES)
23-27	ACARS Multi-Purpose Display Unit (MIDU) (AlliedSignal)	OPS ^{*[1]}	5 to 6
23-32	Digital Interface Unit (Passenger Flight Information Display System)	Airshow DB ^{*[2]}	3 to 15
31-31	Digital Flight Data Acquisition Unit	DFDAU Mandatory (OPS) ^{*[3]} ACMS Monitoring (OPS) ^{*[3]}	5 to 32 3 to 20
31-31	Optical Quick Access Recorder (Teledyne)	OPS ^{*[5]}	30
31-62	Display Electronic Unit (Common Display System)	OPS OPC DB	35 to 128 1 to 3 2 to 15
34-46	Enhanced Ground Proximity Warning Computer (EGPWC)	DB ^{*[1]}	5 to 45
34-61	Flight Management Computer (FMCS)	OPS OPC MEDB NAV DB ACARS Datalink DB ^{*[4]} Perf Defaults DB ^{*[4]}	10 to 32 1 to 3 3 to 15 3 to 30 3 to 15 3 to 15
34-61	LCD Control Display Unit	OPS	5 to 16
49-61	APU Electronic Control Unit	OPS	5 to 16

*[1] Software installed from PCMCIA card

*[2] Software installed from disk or CD-ROM

*[3] Software installed from disk or PCMCIA card

*[4] Optional software

*[5] Software 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.

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- (f) A data loader control panel is installed on the P61 panel. The control panel has interface wiring to components that can receive software installation from a data loader in the flight compartment. The control panel has a switch position for each applicable component. There are INOP labels on switch positions that are not available for software installation.
 - (g) There is an airborne data loader (ADL) or a connector panel for a portable data loader (PDL) on the P61 panel.
 - (h) Figure 201 shows examples of data loader control panels, airborne data loaders, and the connector panel for a portable data loader.
- (5) Alternative Software Installation
- (a) Usually software is installed with a data loader in the flight compartment. But some components have an interface connector, disk drive, CD-ROM drive, 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) AlliedSignal (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 on the P61 panel. 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) SEL CONFIG prompt on CDU
- (a) The SEL CONFIG prompt shows on the INIT/REF INDEX page on the FMCS control display unit (CDU).
 - (b) The SEL CONFIG page will show software part numbers for some systems. For example, the flight data acquisition unit (FDAU) will show software part numbers when selected.
 - (c) To show software part numbers, first set the data loader control panel to the applicable system. Then push the line select key adjacent to SEL CONFIG.
 - 1) If the configuration supports this page, then software part numbers will show for the selected system.
 - 2) If the configuration does not support the SEL CONFIG function or if the selected system is not operational, then the selected page will be blank.
 - 3) The selected system controls the format of the SEL CONFIG page.

B. References

Reference	Title
24-22-00-860-811	Supply Electrical Power (P/B 201)
24-22-00-860-812	Remove Electrical Power (P/B 201)

C. AlliedSignal (Sundstrand) Airborne Data Loader Procedure

SUBTASK 20-15-11-860-002

- (1) The AlliedSignal ADL has these status lights:

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- (a) PROG (In Progress) - shows as software installation occurs.
- (b) CHNG (Change) - shows when it is time to install the subsequent disk.
- (c) COMP (Complete) - shows when the software installation is completed.
- (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 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.

SUBTASK 20-15-11-860-003

(2) Do these steps to prepare for the software installation:

- (a) Do this task: Supply Electrical Power, TASK 24-22-00-860-811.
 - 1) Make sure that the power is not removed while you install software.

NOTE: A power interruption will cause a failure of the software installation.

- (b) Make sure that the system select switch on the data loader control panel (P61) is set to NORM or NORMAL.
- (c) Open this circuit breaker:

CAPT Electrical System Panel, P18-2

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
A	9	C00923	DATA LOADER

- (d) To open the ADL front cover, pull at the top edge.
- (e) Push the eject button on the ADL.
 - 1) If a plastic protective disk is ejected from the disk drive, then remove it.
- (f) Close this circuit breaker:

CAPT Electrical System Panel, P18-2

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
A	9	C00923	DATA LOADER

- (g) Wait until all the status lights are off.

NOTE: The status lights will flash on and off while the ADL does a self test.
- (h) Make sure that the circuit breakers are closed for the applicable component or system that will receive the new software.

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SUBTASK 20-15-11-420-001

(3) 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.

SUBTASK 20-15-11-860-004

(4) Set the system select switch on the data loader control panel to NORM or NORMAL.

SUBTASK 20-15-11-410-001

(5) Close the front cover on the ADL.

SUBTASK 20-15-11-740-001

(6) 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.

SUBTASK 20-15-11-860-005

(7) Do this task: Remove Electrical Power, TASK 24-22-00-860-812.

D. Teledyne Airborne Data Loader Procedure

SUBTASK 20-15-11-860-006

(1) Do these steps to prepare for the software installation:

- (a) Do this task: Supply Electrical Power, TASK 24-22-00-860-811.

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1) Make sure that the power is not removed while you install software.

NOTE: A power interruption will cause a failure of the software installation.

(b) Make sure that the system select switch on the data loader control panel (P61) is set to NORM or NORMAL.

(c) Open this circuit breaker:

CAPT Electrical System Panel, P18-2

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
A	9	C00923	DATA LOADER

(d) To open the ADL front cover, turn the cover knob clockwise and pull.

(e) Push the eject button on the ADL.

1) If a plastic protective disk is ejected from the disk drive, then remove it.

(f) Close this circuit breaker:

CAPT Electrical System Panel, P18-2

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
A	9	C00923	DATA LOADER

(g) 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.

(h) Make sure that the circuit breakers are closed for the applicable component or system that will receive the new software.

SUBTASK 20-15-11-420-002

(2) 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.

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- (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 and 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.

SUBTASK 20-15-11-860-007

- (3) Set the system select switch on the data loader control panel to NORM or NORMAL.

SUBTASK 20-15-11-410-002

- (4) Close the front cover on the ADL.

SUBTASK 20-15-11-740-002

- (5) 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.

SUBTASK 20-15-11-860-008

- (6) Do this task: Remove Electrical Power, TASK 24-22-00-860-812.

E. SFIM Airborne Data Loader Procedure

SUBTASK 20-15-11-860-009

- (1) Do these steps to prepare for the software installation:
 - (a) Do this task: Supply Electrical Power, TASK 24-22-00-860-811.
 - 1) Make sure that the power is not removed while you install software.

NOTE: A power interruption will cause a failure of the software installation.
 - (b) Make sure that the system select switch on the data loader control panel (P61) is set to NORM or NORMAL.
 - (c) Open this circuit breaker:

CAPT Electrical System Panel, P18-2

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
A	9	C00923	DATA LOADER
 - (d) To open the ADL front cover, pull at the top edge.
 - (e) Push the eject button on the ADL.
 - 1) If a plastic protective disk is ejected from the disk drive, then remove it.
 - (f) Close this circuit breaker:

CAPT Electrical System Panel, P18-2

<u>Row</u>	<u>Col</u>	<u>Number</u>	<u>Name</u>
A	9	C00923	DATA LOADER

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- (g) Wait until the display shows UNIT READY.

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.

- (h) Make sure that the circuit breakers are closed for the applicable component or system that will receive the new software.

SUBTASK 20-15-11-420-003

- (2) 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.

SUBTASK 20-15-11-860-010

- (3) Set the system select switch on the data loader control panel to NORM or NORMAL.

SUBTASK 20-15-11-410-003

- (4) Close the front cover on the ADL.

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SUBTASK 20-15-11-740-003

- (5) 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.

SUBTASK 20-15-11-860-011

- (6) Do this task: Remove Electrical Power, TASK 24-22-00-860-812.

————— **END OF TASK** —————

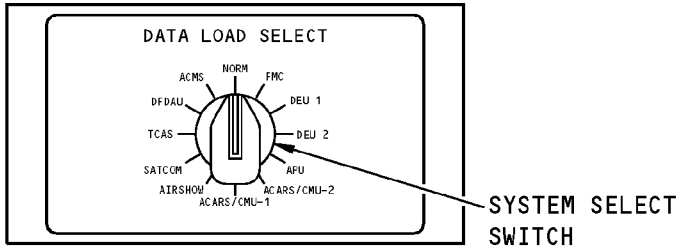
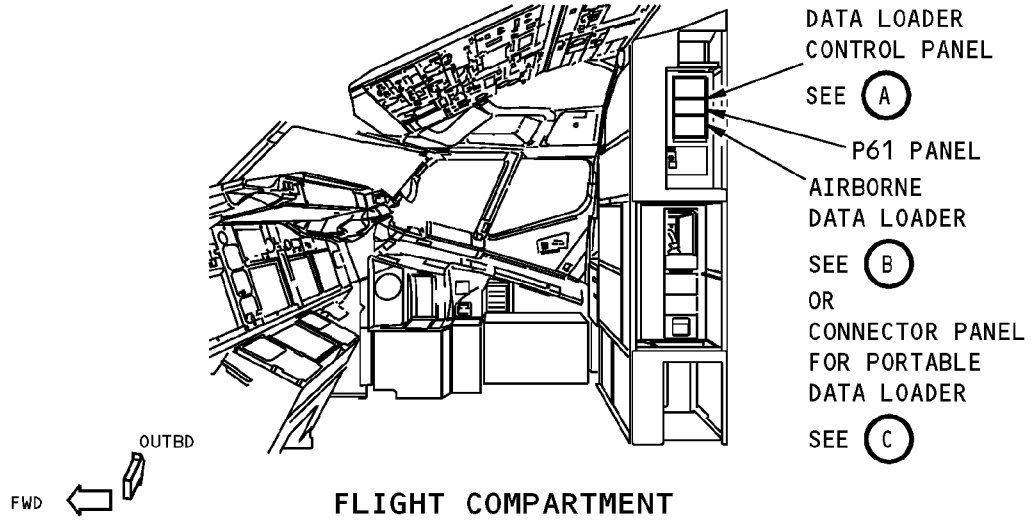
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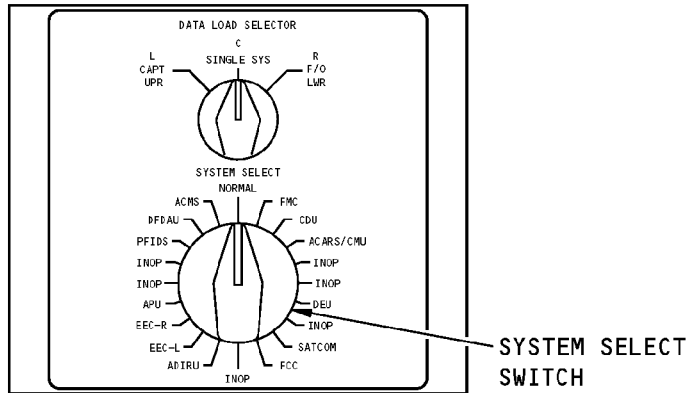
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**DATA LOADER CONTROL PANEL
(EXAMPLE)**

(A)



**DATA LOADER CONTROL PANEL
(EXAMPLE)**

(A)

**On-Airplane Software Installation
Figure 201 (Sheet 1 of 2)/20-15-11-990-801**

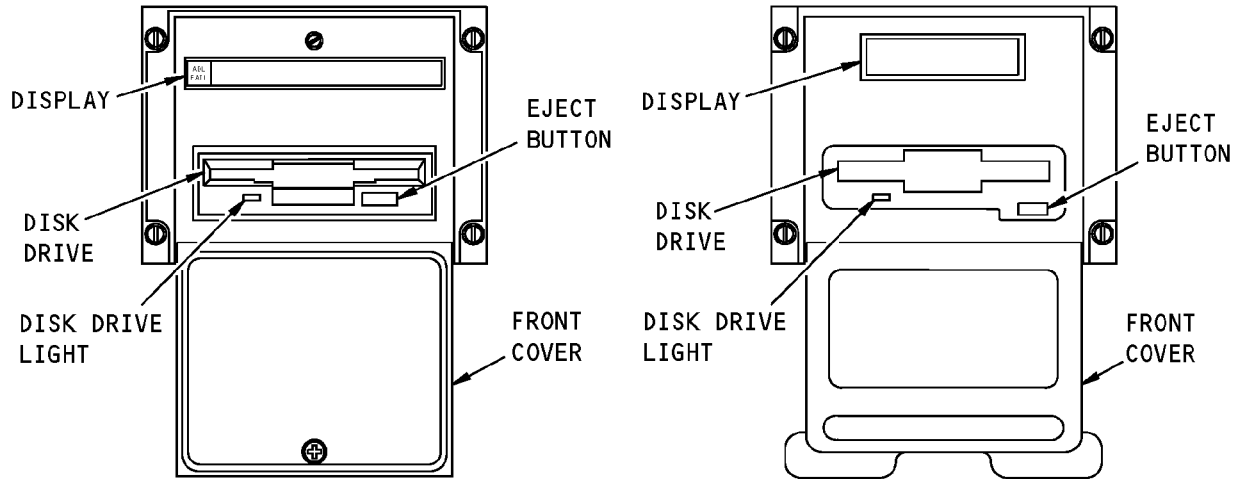
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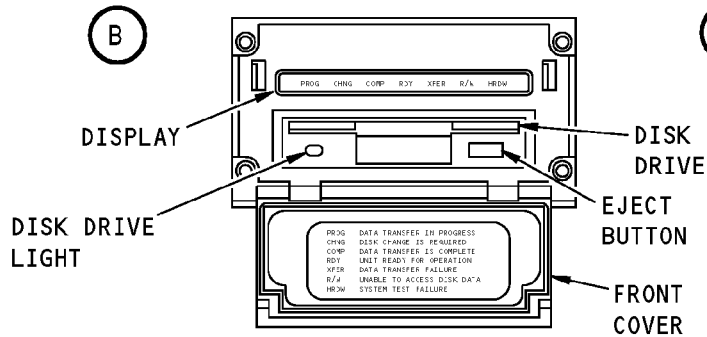
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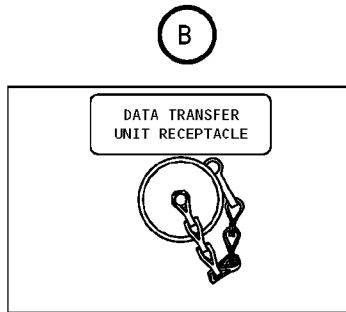


**AIRBORNE DATA LOADER
(TELEDYNE)**

**AIRBORNE DATA LOADER
(SFIM)**



**AIRBORNE DATA LOADER
[ALLIED SIGNAL (SUNDSTRAND)]**



**CONNECTOR PANEL
FOR PORTABLE DATA LOADER**

C

**On-Airplane Software Installation
Figure 201 (Sheet 2 of 2)/20-15-11-990-801**

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SELF-LUBRICATING BEARINGS AND BUSHINGS - INSPECTION/CHECK

1. General

A. This procedure contains three tasks:

- (1) The first task has two inspection/check procedures of bearings and bushings. One procedure is for bearings and bushings that are installed on the airplane. The other procedure is when the bearings and bushing are on the bench.
- (2) The second is an inspection/check of special bushing and bearing configurations. Special bushings and bearings are those with holes, keyways, flanges, threads, or other special properties.
- (3) The third is an inspection/check of bushings and bearings (bench check). Do this task after you have done the bench test instructions from the first task. This task gives steps to do a check of the breakaway torques of spherical bearings.

B. You can examine the self-lubricated (teflon-cloth lining) bearings and bushings on the airplane or removed (bench check). The recommended procedure is the bench check. During the bench check you fully examine the parts for signs of damage from corrosion or cracks. Also, you can do a torque check of the bearing inner race.

TASK 20-20-21-210-801

2. Bearing and Bushings - Inspection/Check

A. Procedure - Check of Self-Lubricated Bearings and Bushings (Installed on the Airplane)

SUBTASK 20-20-21-210-001

CAUTION: DO NOT LUBRICATE TEFLON BEARINGS. TEFLON BEARINGS ARE SELF-LUBRICATED. GREASE OR OTHER LUBRICANTS CAN CAUSE LINING DETERIORATION.

(1) Examine the bearings or bushings to make sure they are not too worn or too loose as follows:

NOTE: If you find more than 0.010 inch internal diametrical play, you must carefully examine the bearing or bushing. Reject a bearing that has signs of galling of the bearing surfaces. If there is play but not galling, then examine the parts for a failure condition given at each maintenance inspection. These bearings and bushing do not always have noise when they are loose.

- (a) Try to move and turn the assembly to make sure the bearing or bushing is not too worn.
- (b) Make sure the bearing is not loosely held by its housing or turns in its housing.
- (c) Make sure there is not damage, cracks or too much corrosion on the bearing or housing

SUBTASK 20-20-21-210-002

(2) If you can turn the bearing, or if removal of bolts permits you to turn the bearing, do the steps that follow:

NOTE: If you can see the lining after bolt removal, refer to the bench check instructions and examine the lining material.

- (a) Turn the bearing without a load on the bearing.
 - 1) Make sure it is not too worn, is rough, or has too much drag.
- (b) Turn the bearing while you apply a load.
 - 1) Make sure it is not too worn, is rough, or has too much drag.

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SUBTASK 20-20-21-210-003

- (3) Examine the bearings and bushings to make sure there is not lining material that comes out of the housing too far.

NOTE: Some bushings and bearings have some lining material that comes out a small distance when they are made. These bearing and bushings can be serviceable.

B. Procedure - Check of Self-Lubricated Bearing and Bushing (Bench Check)

SUBTASK 20-20-21-210-004

CAUTION: DO NOT LUBRICATE TEFLON BEARINGS. TEFLON BEARINGS ARE SELF-LUBRICATED. GREASE OR OTHER LUBRICANTS CAN CAUSE LINING DETERIORATION.

- (1) Examine the bearing and bushing for physical damage, cracks, or corrosion.

SUBTASK 20-20-21-210-005

- (2) Examine the bearing or bushing to see if it turns in the housing or for fretting on the surfaces without the lining.

NOTE: If the bearing or bushing turns in the housing, you must measure the dimension to make sure it is not too worn.

SUBTASK 20-20-21-210-006

- (3) Manually turn the bearing and feel for signs that it is too rough, too loose, has too much drag or unusual drag.

SUBTASK 20-20-21-210-007

- (4) Do a check of the bearing lining:

NOTE: On most spherical bearings, you can turn the ball and look at the lining through the bearing bore.

- (a) Examine the lining for worn areas.

- 1) Usually, reject bearings and bushings that have internal dimeterical play of 0.010 inch. But, use service experience and the applicable permitted wear limits to know if the part is serviceable.

- (b) Examine the lining load pattern.

- 1) Examine the surface where the lining and ball/pin touch. Make sure all of the surface has an equal load.

NOTE: Incorrect swaging during manufacture or installation can cause the edges of the lining to wear too much. These bearings and bushings are not serviceable.

- (c) Examine the lining for unwanted material.

- 1) Examine the lining to make sure that no unwanted material becomes attached.

- (d) Examine the lining for chemical deterioration.

- 1) Examine the lining and lining bond for signs of chemical damage.

SUBTASK 20-20-21-210-008

- (5) Do the Bearings and Bushings (Bench Check) - Inspection/Check, TASK 20-20-21-220-801 task.

————— **END OF TASK** —————

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TASK 20-20-21-210-802

3. Special Bearing and Bushing Configuration - Inspection/Check

A. Procedure - Special Bearing and Bushing Configurations - Check

SUBTASK 20-20-21-210-009

- (1) Examine aluminum bearing races for serviceable surface treatment or plating, and for corrosion and cracks.

SUBTASK 20-20-21-210-010

- (2) Examine special configurations bearings with threads, holes, keyways, flanges, or equivalent properties for cracks in these areas.

NOTE: These special configurations can cause stress risers in these areas.

SUBTASK 20-20-21-210-011

- (3) Do the Bearing/Bushing - Inspection/Check (Bench Check) task.

————— **END OF TASK** —————

TASK 20-20-21-220-801

4. Bearings and Bushings (Bench Check) - Inspection/Check

A. General

- (1) Before you do this task, do the Procedure Bearing and Bushings - Inspection/Check, TASK 20-20-21-210-801 (Bench Check) in the first task.

B. Procedure - Wear Check

SUBTASK 20-20-21-220-001

- (1) To determine the amount of bearing wear, manually apply a reversing load to bearing in a simple holding fixture and measure play with a dial indicator. Radial wear should be measured by applying a reversing radial load of 10 to 15 pounds and total diametrical play measured. A reversing load of the same magnitude should then be applied in a axial (thrust) direction and axial play measured.

NOTE: When measuring play in the radial direction, several points should be checked by rotating the outer race relative to the inner race to establish the point where maximum play exists before attempting to make an accurate wear reading.

C. Procedure - Bearing Breakaway Torque on Spherical Bearing Check

SUBTASK 20-20-21-220-002

- (1) To do the breakaway preload torque checks, measure the torque necessary to turn one race with the other race held.

NOTE: The bearing must not have lubricants or other contaminants. The breakaway torque must not be more than twice the permitted rotational preload torque as listed in the applicable drawing for the specific bearing.

NOTE: Measure the breakaway torque before you do the rotational torque checks. Do the test at room temperature.

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D. Procedure - Bearing Rotational Torque on Spherical Bearing Check

SUBTASK 20-20-21-220-003

- (1) To do the rotational preload torques checks, measure the torque necessary to turn one race with the other race held.

NOTE: The bearing must not have lubricants or other contaminants. The permitted rotational preload torques values are listed in the applicable drawing for the specific bearing.

NOTE: Measure the breakaway torque before you do the rotational torque checks. For rotational torque tests, you must turn the bearing through two or three full turns immediately before you measure the torque. Do the tests at room temperature.

————— **END OF TASK** —————

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CONTROL CABLES - INSPECTION/CHECK

1. General

- A. This procedure contains scheduled maintenance task data.
- B. This procedure has these tasks:
 - (1) An inspection of the control cables wire rope
 - (2) An inspection of the control cable fittings
 - (3) An inspection of the pulleys
- C. These three tasks may be performed concurrently to one location of the control cable system on the airplane if desired for convenience.
- D. Use these procedures to verify the integrity of the control cable system.
- E. The procedures must be performed along the entire cable run in each system.
- F. 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.
- G. This procedure gives the inspections for control cables. If the inspections for specified control cables are different from these inspections, use the inspections for the specified control cables.
- H. Control cables are made of strands of thin wires. Each strand is one unit of hard steel. Thus, if one strand is broken, the control cable is not fully weak.
- I. Control cable type and construction are identified by two numbers. The first number is the number of strands. The second number is the number of wires in a strand. For example, a 7x7 flexible cable has seven strands, each of which has seven wires. The more strands a cable has, the more flexible it is. Thus, use 7x7 and 7x19 cables when cables go through pulleys or when you must bend the wires.
- J. Wires break most frequently where cables go through fairleads or around pulleys. Examine these areas carefully.

TASK 20-20-31-200-801

2. Inspection of the Control Cable Wire Rope

(Figure 601)

- A. General
 - (1) This procedure is a scheduled maintenance task.
- B. References

Reference	Title
12-26-00-600-801	Control Cable Lubrication (P/B 301)

- C. Prepare for the Inspection

SUBTASK 20-20-31-100-001

CAUTION: DO NOT APPLY SOLVENTS, GREASE, OR OIL TO STAINLESS STEEL CONTROL CABLES. THESE MATERIALS CAN COLLECT CONTAMINATION THAT CAN CAUSE DAMAGE TO THE INTERNAL SURFACES OF THE CRES CABLE STRANDS. THIS CAN DECREASE THE SERVICE LIFE OF THE CABLE.

- (1) Clean the cables (as necessary) for the inspection, do this task: Control Cable Lubrication, TASK 12-26-00-600-801.

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SUBTASK 20-20-31-200-003

- (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 cable routing.

NOTE: The minimum cable clearance from other parts is 0.20 inches, except 0.10 inches within 10 inches of a pulley or quadrant.

- (a) Look for evidence of contact with other parts. Correct the condition if evidence of contact is found.
- D. Perform a detailed visual inspection of the cable runs for incorrect routing, kinks in the wire rope, or other damage.

SUBTASK 20-20-31-200-004

- (1) Replace the cable assembly if:
 - (a) A wear patten exists where the individual wires in a strand appear to blend together (outer wires worn by more than 40 percent) (Figure 601).
 - (b) If a kink is found.
 - (c) If corrosion is found.

- E. Perform a detailed visual inspection of the cable.

NOTE: To do a check for broken wires, rub a cloth along the cable. The cloth will catch on any broken wires

SUBTASK 20-20-31-160-001

- (1) Replace the 7X7 cable assembly if:
 - (a) There are two or more broken wires in 12 continuous inches of cable.
 - (b) There are three or more broken wires anywhere in the total cable assembly.

SUBTASK 20-20-31-200-006

- (2) Replace the 7X19 cable assembly if:
 - (a) There are four or more broken wires in 12 continuous inches of cable.
 - (b) There are six or more broken wires anywhere in the total cable assembly.

SUBTASK 20-20-31-210-011

- (3) 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, do this task, do this task: Control Cable Lubrication, TASK 12-26-00-600-801.

NOTE: Do not apply the grease or oil to the stainless steel (CRES) control cables.

————— **END OF TASK** —————

TASK 20-20-31-200-802

3. Inspection of the Control Cable Fittings

A. General

- (1) This procedure is a scheduled maintenance task.

B. Procedure

SUBTASK 20-20-31-200-007

- (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.).

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- (a) Install any missing parts.

SUBTASK 20-20-31-200-008

- (2) Perform a detailed inspection of the swaged portions of swaged end fittings for surface cracks or corrosion.

- (a) Replace the cable assembly if cracks or corrosion are found.

SUBTASK 20-20-31-200-009

- (3) Perform a detailed visual inspection of the unswaged portion of the end fitting.

- (a) Replace the cable assembly if a crack is found, if corrosion is present, or if the end fitting is bent more than 2 degrees.

SUBTASK 20-20-31-200-010

- (4) Perform a detailed visual inspection of the turnbuckle.

- (a) Replace the turnbuckle if a crack is visible or if corrosion is present.

————— END OF TASK —————

TASK 20-20-31-200-805

4. Inspection of Pulleys

A. General

- (1) This procedure is a scheduled maintenance task.

B. Procedure

SUBTASK 20-20-31-200-011

- (1) Perform a detailed visual inspection to make sure that pulleys are free to rotate.

- (a) Replace pulleys that are not free to rotate.

SUBTASK 20-20-31-200-012

- (2) Perform a detailed inspection of the pulleys for conditions shown in (Figure 602).

- (a) Replace any pulleys that match the conditions in (Figure 602).

————— END OF TASK —————

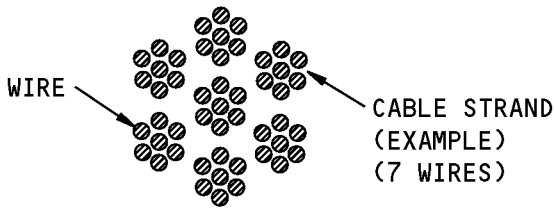
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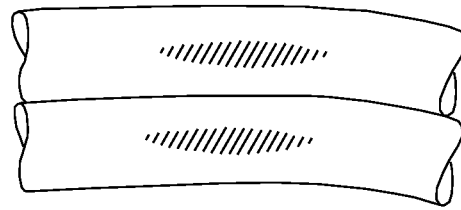
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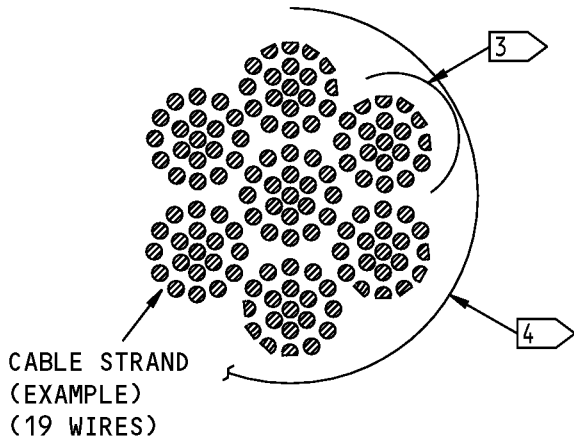
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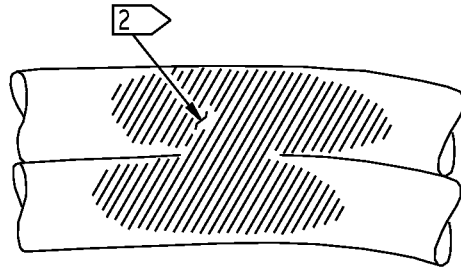
7x7 CABLE



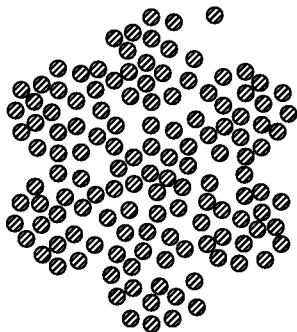
EACH OUTER WIRE WORN
LESS THAN 40%
(WORN AREAS NOT BLENDED)



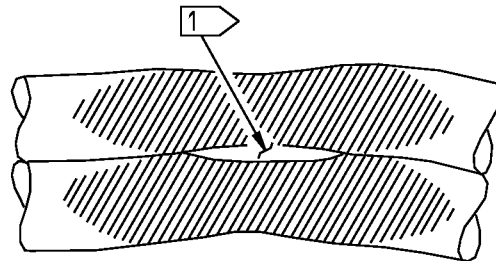
7x19 CABLE



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

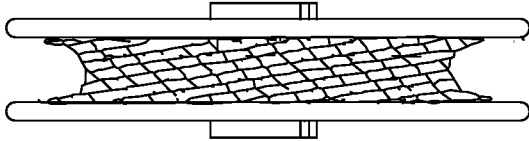
4 CABLE WEAR MAY OCCUR ON ONE SIDE ONLY OR ON FULL CIRCUMFERENCE. CABLE WEAR CAN EXTEND ALONG THE CABLE FOR A DISTANCE EQUAL TO USUAL CABLE TRAVEL.

Cable Wear Patterns
Figure 601/20-20-31-990-801

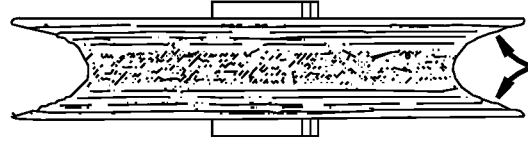
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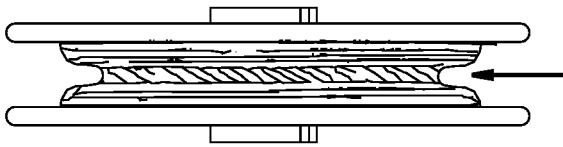
20-20-31



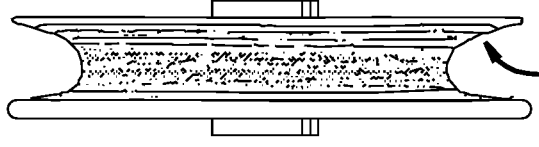
CABLE TENSION TOO HIGH



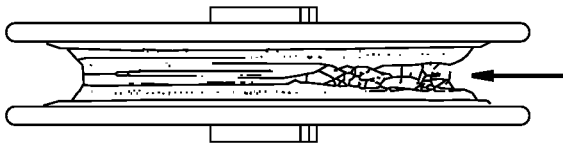
PULLEY NOT ALIGNED CORRECTLY



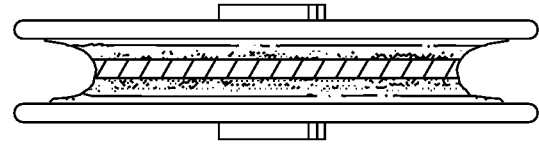
PULLEY GROOVE WITH EXCESSIVE WEAR



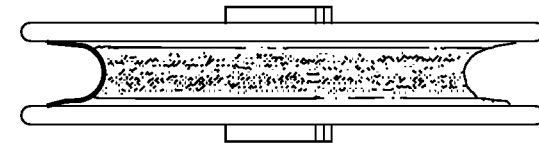
CABLE NOT ALIGNED CORRECTLY



PULLEY WILL NOT TURN



OR



NORMAL CONDITION

Pulley Wear Patterns
Figure 602/20-20-31-990-802

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SPECIFICATIONS AND MATERIALS - MAINTENANCE PRACTICES

1. General

A. This procedure contains one task:

- (1) Specifications and Materials

TASK 20-30-00-800-801

2. Specifications and Materials

A. General

- (1) Specifications and materials sections contain lists of consumable materials that can be necessary during regular maintenance of the airplane.
- (2) Whenever possible, consumable materials will be referenced in the Maintenance Manual by a material specification.
- (3) In the event a material is shown with no material specification, the material will be a specific vendor product or it will be commercially available.
- (4) For specific vendor information on a product, you should refer to the U-File or the IPC Specification Cross-reference Index. Or, you should refer to the qualified products list of the applicable material specification.
- (5) Material other than those listed can be tested using the procedures in Boeing document D6-17487, Certification Testing of Aircraft Maintenance Materials, to verify that any substitute material will not be injurious to airplane surfaces when used as specified by the manufacturer.

B. References

Reference	Title
20-30-11-910-801	Adhesives, Cements, and Sealants (P/B 201)
20-30-21-910-801	Lubricants (P/B 201)
20-30-31-910-801	Cleaners and Polishes (P/B 201)
20-30-41-910-801	Finishing Materials (P/B 201)
20-30-51-910-801	Miscellaneous Materials (P/B 201)
20-30-61-910-801	Welding Materials (P/B 201)
20-30-71-910-801	Strippers (P/B 201)
70-30-11-910-801-F00	Adhesives, Cements, and Sealants (P/B 201)
70-30-21-910-801-F00	Lubricants (P/B 201)
70-30-31-910-801-F00	Cleaners and Polishes (P/B 201)
70-30-41-910-801-F00	Finishing Materials (P/B 201)
70-30-51-910-801-F00	Miscellaneous Materials (P/B 201)

C. Procedure

SUBTASK 20-30-00-800-002

- (1) Use these tasks for information on airframe consumable materials:
 - (a) Adhesives, Cements, and Sealers (Adhesives, Cements, and Sealants, TASK 20-30-11-910-801)
 - (b) Cleaners and Polishes (Cleaners and Polishes, TASK 20-30-31-910-801)
 - (c) Finishing Materials (Finishing Materials, TASK 20-30-41-910-801)
 - (d) Lubricants (Lubricants, TASK 20-30-21-910-801)
 - (e) Strippers (Strippers, TASK 20-30-71-910-801)
 - (f) Welding Materials (Welding Materials, TASK 20-30-61-910-801)

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(g) Miscellaneous Materials (Miscellaneous Materials, TASK 20-30-51-910-801)

SUBTASK 20-30-00-800-001

(2) Use these tasks for information on General Electric/CFMI engine consumable materials:

- (a) Adhesives, Cements, and Sealers (Adhesives, Cements, and Sealants, TASK 70-30-11-910-801-F00)
- (b) Cleaners and Polishes (Cleaners and Polishes, TASK 70-30-31-910-801-F00)
- (c) Finishing Materials (Finishing Materials, TASK 70-30-41-910-801-F00)
- (d) Lubricants (Lubricants, TASK 70-30-21-910-801-F00)
- (e) Miscellaneous Materials (Miscellaneous Materials, TASK 70-30-51-910-801-F00)

END OF TASK

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ADHESIVES, CEMENTS, AND SEALANTS - MAINTENANCE PRACTICES

1. General

A. This procedure lists adhesives, cements, and sealants for airplane maintenance. There are no procedural steps in this procedure.

TASK 20-30-11-910-801

2. Adhesives, Cements, and Sealants

A. General

(1) The list of adhesives, cements, and sealers has been moved to the introduction section of the AMM.

TABLE I

Permitted Substitutes for Initial Specified Sealant							
Initial Specified Sealants	Permitted Alternate 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 III	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 II	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

*[1] This alternative is not permitted for mating surface seal, pre-pack sealing, and wet fastener installation procedures.

*[2] This sealant has a primer that must also be used.

TABLE II

BMS 5-79 Sealant Alternatives	
Initial Material	Alternate 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

TABLE III

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

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BMS 5-26, Types, Classes, Grade	Superseded by BMS 5-45, Classes, Grade
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 IV

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 (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 applications.
Class C	For brush and faying surface sealing applications where a long squeeze-out life is required.
Class E	For spray application as a coating.
Class F	For spray application as a primer.
Class G	For spray, brush, or roller applications where long squeeze-out life and lower viscosity are required.

————— **END OF TASK** —————

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LUBRICANTS - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of lubricants for airplane maintenance. There are no procedural steps in this procedure.

TASK 20-30-21-910-801

2. Lubricants

- A. General

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

————— **END OF TASK** —————

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CLEANERS AND POLISHES - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of cleaners and polishes for airplane maintenance. There are no procedural steps in this procedure.

TASK 20-30-31-910-801

2. Cleaners and Polishes

- A. General

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

————— **END OF TASK** —————

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FINISHING MATERIALS - MAINTENANCE PRACTICES

1. General

- A. This procedure lists finishing materials for airplane maintenance. There are no procedural steps in this procedure.

TASK 20-30-41-910-801

2. Finishing Materials

- A. General

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

————— **END OF TASK** —————

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MISCELLANEOUS MATERIALS - MAINTENANCE PRACTICES

1. General

- A. This procedure lists miscellaneous consumable materials for airplane maintenance. There are no procedural steps in this procedure.

TASK 20-30-51-910-801

2. Miscellaneous Materials

- A. General

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

————— **END OF TASK** —————

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WELDING MATERIALS - MAINTENANCE PRACTICES

1. General

- A. This procedure lists the consumable materials which are necessary for welding and soldering. There are no procedural steps in this procedure.

TASK 20-30-61-910-801

2. Welding Materials

- A. General

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

————— **END OF TASK** —————

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AIRCRAFT MAINTENANCE MANUAL

STRIPPERS - MAINTENANCE PRACTICES

1. General

- A. This procedure lists the consumable materials which are necessary for stripping organic and inorganic coatings. There are no procedural steps in this procedure.

TASK 20-30-71-910-801

2. Strippers

- A. General

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

————— **END OF TASK** —————

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AIRCRAFT MAINTENANCE MANUAL

AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 80) - MAINTENANCE PRACTICES

1. General

A. This procedure contains a list of solvents for general cleaning of metals as listed in BAC5750. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-80-910-801

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

SUBTASK 20-30-80-800-001

(1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-80-993-801 General Cleaning of Metal (Series 80)

Material Name	Material Bulk Code	Other Specifications
1,1,1-Trichloroethane	B00090	
Acetone	B00062	JIS-K-1503
Aerfluor 343		
BMS11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Citra Safe	B00634	
Citra Safe, Deodorized		
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	

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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 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*		
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		

————— END OF TASK —————

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AIRCRAFT MAINTENANCE MANUAL

AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 81) - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of solvents for general cleaning of all organic coatings as listed in BAC5750. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-81-910-801

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

SUBTASK 20-30-81-800-001

- (1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-81-993-801 General Cleaning of All Organic Coatings (Series 81)

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	
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		

————— END OF TASK —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 82) - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of solvents for general cleaning of solvent resistant organic coatings as listed in BAC5750. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-82-910-801

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 this applicable vendors.

B. Procedure

SUBTASK 20-30-82-800-001

- (1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-82-993-801 General Cleaning of Solvent Resistant Organic Coatings (Series 82)

Material Name	Material Bulk Code	Other Specifications
1,1,1-Trichloroethane	B00090	
Acetone	B00062	JIS-K-1503
Aerfluor 343		
BMS11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Citra Safe	B00634	
Citra Safe, Deodorized		
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	

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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 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*		
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		

————— END OF TASK —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 83) - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of solvents for general cleaning of composites as given in BAC5750. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-83-910-801

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

SUBTASK 20-30-83-800-001

- (1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-83-993-801 General Cleaning of Composites (Series 83)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
Aerfluor 343		
BMS11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Citra Safe	B00634	
Citra Safe, Deodorized		
d-Limonene		
Ethyl alcohol, denatured	B00068	
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	

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Material Name	Material Bulk Code	Other Specifications
Turco 4460 BK		
Turco 6709		

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 84) - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of solvents for final cleaning of metal before painting as given in BAC5750. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-84-910-801

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

SUBTASK 20-30-84-800-001

- (1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-84-993-801 Final Cleaning of Metal Prior to Painting (Series 84)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
BMS11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Citra Safe	B00634	
Citra Safe, Deodorized		
d-Limonene		
DeSo Clean 45	B00647	
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	

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Material Name	Material Bulk Code	Other Specifications
Turco 4460 BK		
Turco 6709		

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 85) - MAINTENANCE PRACTICES

1. General

A. This procedure contains a list of solvents for final cleaning of all organic coatings before 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 20-30-85-910-801

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

SUBTASK 20-30-85-800-001

(1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-85-993-801 Final Cleaning of All Organic Coatings Prior to Painting (Series 85)

Material Name	Material Bulk Code	Other Specifications
BMS11-7	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	
Methyl propyl ketone (MPK)	B00666	
MIBK:MEK 3:2		
MIL-C-81302, Type I	B00143	
Toluene	B00094	
Turco 4460 BK		
Turco 6709		

————— END OF TASK —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 86) - MAINTENANCE PRACTICES

1. General

A. This procedure contains a list of solvents for final cleaning of solvent resistant organic coatings before painting as given in BAC5750. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-86-910-801

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

SUBTASK 20-30-86-800-001

(1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-86-993-801 Final Cleaning of Solvent Resistant Organic Coatings Prior to Painting (Series 86)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
BMS11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Citra Safe	B00634	
Citra Safe, Deodorized		
d-Limonene		
DeSo Clean 45	B00647	
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	

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Material Name	Material Bulk Code	Other Specifications
Turco 4460 BK		
Turco 6709		

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 87) - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of solvents for final cleaning of composites before painting as given in BAC5750. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-87-910-801

2. Final Cleaning of Composites Prior to Painting (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

SUBTASK 20-30-87-800-001

- (1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-87-993-801 Final Cleaning of Composites Prior to Painting (Series 87)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
BMS11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Citra Safe	B00634	
Citra Safe, Deodorized		
d-limonene		
FCC-55		
Glidsafe Prepsolv		
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		

————— END OF TASK —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 88) - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of solvents for final cleaning of metal before non-structural bonding as given in BAC5750. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-88-910-801

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

SUBTASK 20-30-88-800-001

- (1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-88-993-801 Final Cleaning of Metal Prior to Non-structural Bonding (Series 88)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
BMS11-7	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		
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		

————— END OF TASK —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 89) - MAINTENANCE PRACTICES

1. General

A. This procedure contains a list of solvents for final cleaning of all organic coatings before non-structural bonding as given in BAC5750. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-89-910-801

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

SUBTASK 20-30-89-800-001

(1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-89-993-801 Final Cleaning of All Organic Coatings Prior to Non-structural Bonding (Series 89)

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	

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 90) - MAINTENANCE PRACTICES

1. General

A. This procedure contains a list of solvents for final cleaning of solvent resistant organic coatings before non-structural bonding as given in BAC5750. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-90-910-801

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

SUBTASK 20-30-90-800-001

(1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-90-993-801 Final Cleaning of Solvent Resistant Organic Coatings Prior to Non-structural Bonding (Series 90)

Table with 3 columns: Material Name, Material Bulk Code, Other Specifications. Rows include BMS11-7, CDG-110, CDG-211, Ethyl alcohol, denatured, FCC-55, Isopropyl alcohol (IPA), MEK:1,1,1-Trichloroethane 1:1, MEK:sec-Butyl alcohol 42:58 percent, Methyl ethyl ketone (MEK), Methyl propyl ketone (MPK), MIBK:MEK 3:2, MIL-C-81302, Type I, Turco 6709.

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 91) - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of solvents for final cleaning of composites before non-structural bonding as given in BAC5750. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-91-910-801

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

SUBTASK 20-30-91-800-001

- (1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-91-993-801 Final Cleaning of Composites Prior to Non-structural Bonding (Series 91)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
BMS11-7	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		
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	
Methyl propyl ketone (MPK)	B00666	
MIBK:MEK 3:2		
Turco 6709		

————— END OF TASK —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 92) - MAINTENANCE PRACTICES

1. General

A. This procedure contains a list of solvents for final cleaning before general sealings given in BAC5000. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-92-910-801

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 his 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

SUBTASK 20-30-92-800-001

(1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-92-993-801 Final Cleaning Prior to General Sealing (Series 92)

Material Name	Material Bulk Code	Other Specifications
1,1,1-Trichloroethane	B00090	
Aliphatic Naphtha (for acrylic surfaces only)	B00083	TT-N-95(TyII)
BMS11-7	B00184	
Citra Safe	B00634	
Dowclene DC		
FCC-55		
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone	B00148	ASTM D740 JIS-K-1524
Methyl propyl ketone (MPK)	B00666	

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 93) - MAINTENANCE PRACTICES

1. General

A. This procedure contains a list of solvents for final cleaning before fuel tank sealing as given in BAC5504. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-93-910-801

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

SUBTASK 20-30-93-800-001

(1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-93-993-801 Final Cleaning Prior to Fuel Tank Sealing (Series 93)

Material Name	Material Bulk Code	Other Specifications
1,1,1-Trichloroethane	B00090	O-T-620
BMS11-7	B00184	
Dowclene EC		
FCC-55		
MEK:sec-Butyl alcohol 42:58 percent		
Methyl ethyl ketone (MEK)	B00148	ASTM D740 JIS-K-1524
Methyl propyl ketone (MPK)	B00666	

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 94) - MAINTENANCE PRACTICES

1. General

A. This procedure contains a list of solvents for final cleaning before application of rain erosion coating before painting as given in BAC5880. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-94-910-801

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

SUBTASK 20-30-94-800-001

(1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-94-993-801 Final Cleaning Prior to Application of Rain Erosion Resistant Coating (Series 94)

Material Name	Material Bulk Code	Other Specifications
Methyl ethyl ketone (MEK)	B00148	TT-M-261

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 95) - MAINTENANCE PRACTICES

1. General

- A. This procedure contains a list of solvents for final cleaning before aerodynamic smoothing and fairing as given in BAC5030. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-95-910-801

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

SUBTASK 20-30-95-800-001

- (1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-95-993-801 Final Cleaning Prior to Aerodynamic Smoothing and Fairing (Series 95)

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, Tyll
BMS11-7	B00184	MIL-C-38736B
Citra Safe	B00634	
FCC-55		
Methyl ethyl ketone (MEK)	B00148	ASTM D740
Methyl propyl ketone (MPK)	B00666	

————— END OF TASK —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 96) - MAINTENANCE PRACTICES

1. General

A. This procedure contains a list of solvents for final cleaning of oxygen componenets exposed to oxygen as given in BAC5402. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-96-910-801

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

SUBTASK 20-30-96-800-001

(1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-96-993-801 Final Cleaning of Oxygen Components Exposed to Oxygen (Series 96)

Material Name	Material Bulk Code	Other Specifications
Freon TF	B00143	
Trichloroethylene	B00081	ASTM D 4080
Tetrachloroethylene	B00093	0-T-236
Isopropyl Alcohol	B00130	TT-I-735
HFE 7100	B50002	
HFE 71DE	B50003	
Vertrel XF	B50004	
Vertral MCA	B50005	

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 97) - MAINTENANCE PRACTICES

1. General

A. This procedure contains a list of solvents for final cleaning before structural bonding as given in BAC5514. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents.

TASK 20-30-97-910-801

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

SUBTASK 20-30-97-800-001

(1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-97-993-801 Final Cleaning Prior to Structural Bonding (Series 97)

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

————— **END OF TASK** —————

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AIRPLANE STRUCTURE CLEANING SOLVENTS (Series 98 & 98-1) - MAINTENANCE PRACTICES

1. General

A. This procedure contains a list of solvents for general cleaning of various polymerics as given in BAC5750. This procedure gives only the list of solvents. It does not tell you which solvent to use or how to use the solvents. This procedure contains two tasks:

- (1) Cleaning of specific polymerics (Series 98).
- (2) Cleaning of phenolics or nylon (Series 98-1).

TASK 20-30-98-910-801

2. Cleaning of Specific Polymerics (Series 98)

A. General

(1) This selection of solvents uses BAC5750 as a guide. This procedure contains a list of solvents for general cleaning of specific polymerics as given in BAC5750. 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) Polytetrafluorethylene (Teflon)
- 3) Polyvinyl fluoride (Tedlar).

(c) OR, the final cleaning of the following prior to non-structural bonding:

- 1) Polyester (Vibrin, Mylar, Dacron)
- 2) Polytetrafluorethylene (Teflon)
- 3) Polyvinyl fluoride (Tedlar).

B. Procedure

SUBTASK 20-30-98-800-001

(1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-98-993-801 Cleaning of Specific Polymerics (Series 98)

Material Name	Material Bulk Code	Other Specifications
Acetone	B00062	JIS-K-1503
BMS11-7	B00184	MIL-C-38736B
CDG-110		
CDG-211		
Ethyl alcohol, denatured	B00068	

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Material Name	Material Bulk Code	Other Specifications
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		

END OF TASK

TASK 20-30-98-910-802

3. Cleaning of Phenolics or Nylon (Series 98-1)

A. General

- (1) This selection of solvents uses BAC5750 as a guide. This procedure contains a list of solvents for general cleaning of phenolics or nylon as given in BAC5750. 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

SUBTASK 20-30-98-800-002

- (1) When your procedure refers to this subject (Table 202), use a solvent from this list.

Table 202/20-30-98-993-802 Cleaning of Phenolics or Nylon (Series 98-1)

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		

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(Continued)

Material Name	Material Bulk Code	Other Specifications
Methyl ethyl ketone (MEK) (Nylon only)	B00148	
Methyl isobutyl ketone (MIBK) (Nylon only)	B00151	JIS-K-8903
Methyl propyl ketone (MPK) (Nylon only)	B00666	
Toluene (Nylon only)	B00094	
TT-N-95, Type II	B00083	
Turco 6709		

————— **END OF TASK** —————

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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 20-30-99-910-801

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

SUBTASK 20-30-99-800-001

(1) When your procedure refers to this subject (Table 201), use a solvent from this list.

Table 201/20-30-99-993-801 Final Cleaning of Composites Prior to Structural Bonding (Series 99)

Material Name	Material Bulk Code	Other Specifications
1,1,1-Trichloroethane (Non-Metalic core only)	B00090	
Acetone	B00062	O-A-51
BMS11-7 (Non-Metalic 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
Methyl Propyl Ketone (MPK) (High purity)	B00666	
Naphtha (Non-Metalic core only)	B00083	TT-N-95

————— **END OF TASK** —————

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AIRPLANE GROUNDING - MAINTENANCE PRACTICES

1. General

A. This procedure contains these tasks:

- (1) Static Grounding
- (2) Electrical Bonding
- (3) Measurement of Airplane Electrical Resistance to Ground

B. If operators choose not to do these recommended tasks, they should develop alternate procedures which adequately protect personnel and equipment. Local fire codes and customs may require alternative or additional procedures to those shown here.

TASK 20-40-11-910-801

2. Static Grounding

(Figure 201)

A. General

- (1) Static grounding is not necessary if the airplane is parked for turnaround flight and no maintenance is to be done.
- (2) During pressure refueling of the airplane:
 - (a) An electrical bond is necessary between the airplane and the refueling vehicle.
 - (b) Static grounding is not necessary as long as the conductivity of the airplane and the parking site are adequate (Refer to the task, Measure Airplane Electrical Resistance to Ground).
 - 1) The operator must ensure that the conductivity of the airplane and the parking site are adequate and may need to establish local procedures in area 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.
- (3) Static grounding is necessary when performing maintenance tasks using these devices:
 - (a) power tools
 - (b) electrical power sources
 - (c) lights
 - (d) powered instruments
 - (e) flammable conditions (such as painting and solvent application)
- (4) When static grounding is recommended in a detailed procedure, the airplane must be statically grounded to a common, approved, identified ground.
- (5) 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, use a single approved and identified ground as the common ground for all grounding cables.

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 KILL PERSONNEL OR CAUSE INJURY.

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(WARNING PRECEDES)

WARNING: DO NOT WEAR HEADSET OR HANDLE ANY UMBILICAL CONNECTIONS TO AIRPLANE DURING ATMOSPHERIC ELECTRICAL DISTURBANCES. LIGHTNING STRIKE CAN CAUSE SEVERE INJURY.

- (6) Stop ground servicing operations, external to the airplane, during electrical storms.
- (7) The airplane is normally electrostatically grounded through conductive tires (Refer to the task, Measure Electrical Resistance to Ground). However, static grounding is necessary for:
 - (a) Airplanes having inadequate conductivity to ground through the tires.
 - (b) Airplanes on parking sites that have inadequate conductivity.

B. Location Zones

Zone	Area
731	Left Main Landing Gear - Outboard Door
741	Right Main Landing Gear - Outboard Door

C. Grounding Procedure:

SUBTASK 20-40-11-480-001

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.

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 ground and to the airplane in the following sequence:
 - (a) Connect the grounding cable to an approved, identified static ground point.

NOTE: 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 (Figure 201).
 - 1) Connect the grounding cable to the jack pad during landing gear retraction tests. The jack pad must be completely installed and the grounding stud on it must be unpainted and free from oil.

SUBTASK 20-40-11-020-001

- (2) Before the airplane is moved, remove the ground cables in reverse sequence of attachment.

————— **END OF TASK** —————

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TASK 20-40-11-760-801

3. Electrical Bonding

A. Procedure:

SUBTASK 20-40-11-420-001

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 ATTACHED TO DOORS OR FAIRINGS MADE FROM COMPOSITE MATERIALS DO NOT PROVIDE A BOND.

- (1) Connect a bonding cable to a known bonding or grounding point on the airplane.

SUBTASK 20-40-11-480-002

- (2) Connect the other end of the bonding cable to a known bonding or grounding point on the support equipment in use.

SUBTASK 20-40-11-020-002

- (3) Before the airplane is moved, remove the ground cables in the opposite sequence that you attached them.

————— **END OF TASK** —————

TASK 20-40-11-760-802

4. Measurement of Airplane Electrical Resistance to Ground

A. References

Reference	Title
24-22-00-860-812	Remove Electrical Power (P/B 201)
24-41-11-200-803	External Power Receptacle Neutral Pin to Ground Continuity Check (P/B 601)
SWPM 20-02-10	Airplane Flammable Leakage Zones

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

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Reference	Description
COM-591	Multimeter - Digital, Handheld (volt dc/vac, ampere & resistance measurements or equivalent Multimeter) (Part #: 187, Supplier: 89536, A/P Effectivity: 737-ALL) (Part #: 189, Supplier: 89536, A/P Effectivity: 737-ALL) (Part #: 87V, Supplier: 89536, A/P Effectivity: 737-ALL) (Part #: FLUKE 117, Supplier: 89536, A/P Effectivity: 737-ALL) (Part #: MODEL 27, Supplier: 89536, A/P Effectivity: 737-ALL)
COM-1615	Megohmmeter (50 to 500 VDC/ 10 to 1090 VDC, .5 - 5,000 MEGOHM; 5MA Short Circuit Max) (Part #: 1863-9700, Supplier: 0PK96) (Part #: 1863-9700, Supplier: 62015, A/P Effectivity: 737-ALL) (Part #: 1864-9700, Supplier: 62015, A/P Effectivity: 737-ALL)
COM-6141	Multimeter - Insulation (Part #: 1587, Supplier: 89536, A/P Effectivity: 737-ALL) (Part #: 260-8XPI, Supplier: 55026, A/P Effectivity: 737-ALL) (Part #: MODEL 8 MK7, Supplier: 00426, A/P Effectivity: 737-ALL)

C. Prepare to Check

SUBTASK 20-40-11-840-001

- (1) Make sure the airplane is not parked over painted surfaces.

SUBTASK 20-40-11-860-001

- (2) Do this task: External Power Receptacle Neutral Pin to Ground Continuity Check, TASK 24-41-11-200-803.

SUBTASK 20-40-11-000-001

- (3) Do this task: Remove Electrical Power, TASK 24-22-00-860-812.

SUBTASK 20-40-11-940-001

WARNING: DO NOT USE A MEGOHMMETER NEAR A FUEL TANK VENT. IT CAN CAUSE AN EXPLOSION OR FIRE. FIRE AND EXPLOSIONS CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT.

- (4) Use these precautions for possible fuel vapors when you use a megohmmeter to measure the discharger resistance.
 - (a) Use a megohmmeter, COM-1615 or equivalent meter with a 500 VDC test voltage and a maximum 5 milliampere short circuit current.
 - (b) Do not use a megohmmeter at these locations:
 - 1) Area adjacent to or below a wing fuel tank vent, five foot (1.524 meters) diameter column, from vent to ground.
 - 2) Area defined as a Flammable Leakage Zone in SWPM 20-02-10.
 - 3) Zero to 18 in. (457 mm) above the ground in the area around the airplane.
 - (c) Make sure that:
 - 1) Area is well ventilated.
 - 2) Metal workstands are grounded.
 - 3) Megohmmeter is plugged into a grounded receptacle.
 - 4) Megohmmeter is insulated from metal work stand.

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SUBTASK 20-40-11-480-003

- (5) Connect a Insulation Multimeter, COM-6141 to a known bonding/grounding point in the wheel well.

NOTE: If Insulation Multimeter, COM-6141 is not available, handheld digital multimeter, COM-591 is an alternate.

SUBTASK 20-40-11-480-004

- (6) Connect the other end of the Insulation Multimeter, COM-6141 to an identified ground point on the ramp.

SUBTASK 20-40-11-420-002

- (7) Set the Insulation Multimeter, COM-6141 the 50 Vdc range.

SUBTASK 20-40-11-970-001

- (8) Measure the resistance to ground and record the resistance in the maintenance log.

NOTE: The resistance should be less than 1.0 megohms. If the resistance is more than 1.0 megohms this may be the result of a bad grounding location. There may be a very high surface resistance on the airplane.

- (a) If the resistance is more than 1.0 megohms, tell the flight crews of subsequent flights in this airplane the conductivity to ground is not sufficient through the tires to electrostatically ground this airplane on a parking surface.

NOTE: Positive ground procedures may apply.

SUBTASK 20-40-11-210-001

- (9) Make sure the airplane is not parked over painted surfaces.

- (a) Make sure the tires have sufficient conductivity.

SUBTASK 20-40-11-970-003

- (10) Repeat the measurement at other parking site locations where successful measurements have been made.

NOTE: This will make sure the airplane has sufficient conductivity.

————— **END OF TASK** —————

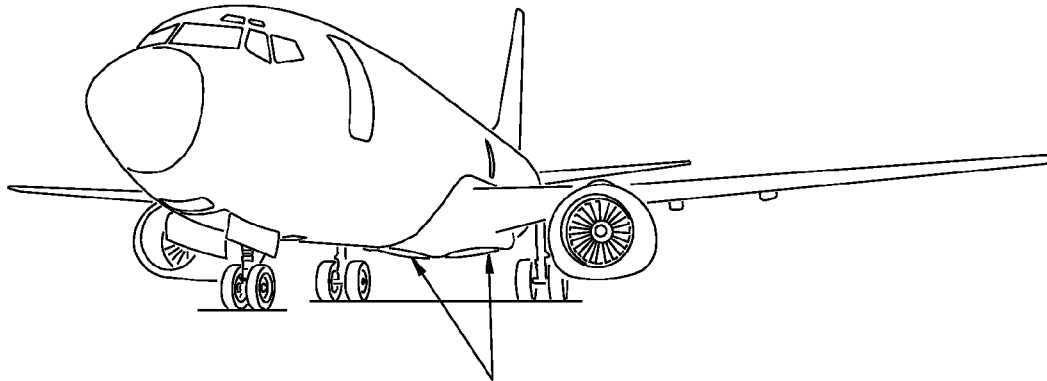
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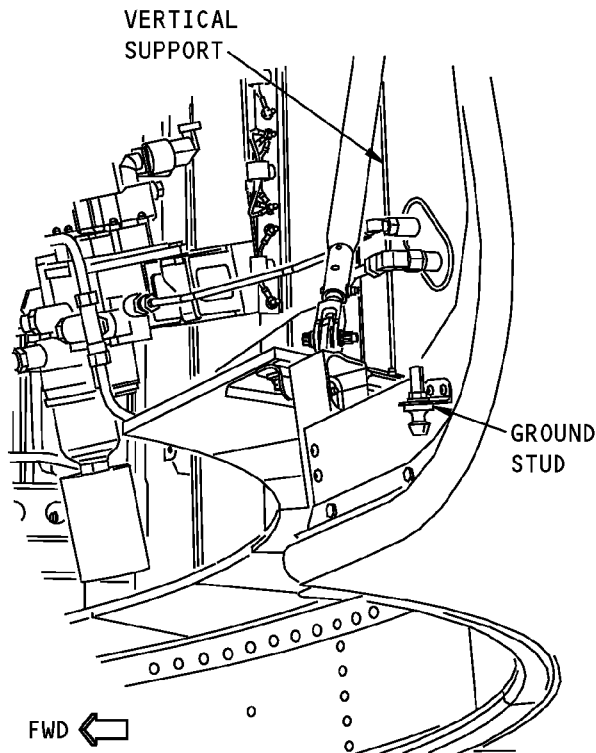
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MAIN WHEEL WELL
GROUND STUD
LOCATION
SEE (A)



VERTICAL SUPPORT

GROUND STUD

FWD ←

MAIN WHEEL WELL GROUND STUD
LOCATION
(A)

**Static Ground Point Location
Figure 201/20-40-11-990-801**

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ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES - MAINTENANCE PRACTICES

1. General

- A. This procedure has these tasks:
- (1) Wrist Strap continuity test.
 - (2) The ESDS handling for printed circuit board removal.
 - (3) The ESDS handling for printed circuit board installation.
 - (4) The ESDS handling for removal of metal encased units.
 - (5) The ESDS handling for installation of metal encased units.
 - (6) The installation of conductive dust caps and connector covers.
 - (7) The removal of conductive dust caps and connector covers.
- B. Many electronic line replaceable units (LRUs) contain micro-circuits and other sensitive devices which can be damaged internally by electrostatic discharges. These LRUs are identified 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 how to protect ESDS LRUs from static discharges.
- C. 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.
- D. The function of this procedure is to show the maintenance persons how to handle the ESDS LRUs. This procedure contains the precautions that are necessary to safely touch the units that are identified by the ESDS placard. Three types of decals are 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 placards (Figure 201). The ESDS printed circuit boards that are LRU's are identified with a "STATIC SENSITIVE" placard (Figure 201).
- E. The placards on the outer area of the cardfiles show the cards that contain electrostatic sensitive devices.

TASK 20-40-12-820-801

2. Wrist Strap Continuity Test

- A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

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Reference	Description
COM-1565	Strap - Adjustable Wrist, Conductive, Static Control (Part #: 14810, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 2214, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 9070, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2211, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2212, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2213, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)
STD-1231	Multimeter - Standard

B. Procedure

SUBTASK 20-40-12-700-001

- (1) Plug the jack end of the static control wrist strap, COM-1565 into the ground or common receptacle of multimeter, STD-1231.

SUBTASK 20-40-12-820-001

- (2) Adjust multimeter, STD-1231 to the applicable resistance range.

SUBTASK 20-40-12-820-002

- (3) Touch the red lead of multimeter, STD-1231 to the resistor portion of static control wrist strap, COM-1565. The acceptable range is from 250 kilohms to 1.5 megohms.

SUBTASK 20-40-12-980-001

- (4) Put static control wrist strap, COM-1565 on the wrist of the person who will be handling the ESDS unit.

SUBTASK 20-40-12-820-003

- (5) Hold the red lead of multimeter, STD-1231 between the person's forefinger and thumb. The acceptable range is less than 10 megohms.

SUBTASK 20-40-12-090-001

- (6) Discard static control wrist strap, COM-1565 if it does not operate in the acceptable range.

————— END OF TASK —————

TASK 20-40-12-000-801

3. ESDS Handling for Printed Circuit Board Removal

(Figure 201)

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

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Reference	Description
COM-1565	Strap - Adjustable Wrist, Conductive, Static Control (Part #: 14810, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 2214, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 9070, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2211, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2212, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2213, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)
COM-1566	Bags - Conductive, Static Shielding (Part #: 13020, Supplier: 63070, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 13670, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 2100RX4X6, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 2120R, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 2120X6X7, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)
COM-1567	Container - Conductive, Antistatic (Part #: 2217-12, Supplier: 9A807, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: PCC-700-ADE, Supplier: 62049, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)

B. Handling Procedure

SUBTASK 20-40-12-860-001

- (1) Make sure you remove electrical power from the printed circuit board.

SUBTASK 20-40-12-750-001

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 this task: Wrist Strap Continuity Test, TASK 20-40-12-820-801 to do a resistance test of the static control wrist strap, COM-1565:

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.

- (a) Connect the static control wrist strap, COM-1565 to an applicable electrostatic ground jack.

SUBTASK 20-40-12-020-001

- (3) Remove the printed circuit board with the applicable removal task.

SUBTASK 20-40-12-860-002

- (4) Put the printed circuit board in a static shielding bag, COM-1566, or antistatic conductive container, COM-1567, with an ESDS placard.

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SUBTASK 20-40-12-860-003

CAUTION: DO NOT USE STAPLES OR ADHESIVE TAPES TO CLOSE THE BAG OR CONTAINER. FAILURE TO CLOSE CORRECTLY CAN CAUSE DAMAGE TO THE PRINTED CIRCUIT BOARD.

(5) Use 100% cotton twine to close the antistatic conductive container, COM-1567.

NOTE: The static shielding bag, COM-1566, or antistatic conductive container, COM-1567 must be put in a rigid container to make sure it stays in a satisfactory condition.

SUBTASK 20-40-12-860-004

(6) Do not remove the static control wrist strap, COM-1565, until you close the applicable access door.

————— **END OF TASK** —————

TASK 20-40-12-400-801

4. ESDS Handling for Printed Circuit Board Installation

(Figure 201)

A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1565	Strap - Adjustable Wrist, Conductive, Static Control (Part #: 14810, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 2214, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 9070, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2211, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2212, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2213, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)
COM-1566	Bags - Conductive, Static Shielding (Part #: 13020, Supplier: 63070, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 13670, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 2100RX4X6, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 2120R, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 2120X6X7, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)
COM-1567	Container - Conductive, Antistatic (Part #: 2217-12, Supplier: 9A807, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: PCC-700-ADE, Supplier: 62049, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)

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B. Handling Procedure

SUBTASK 20-40-12-860-005

- (1) Make sure electrical power is removed from the printed circuit board.

SUBTASK 20-40-12-750-002

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 this task: Wrist Strap Continuity Test, TASK 20-40-12-820-801 to do a resistance test of the static control wrist strap, COM-1565:

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.

- (a) Connect the static control wrist strap, COM-1565, to an applicable electrostatic ground jack.

SUBTASK 20-40-12-860-006

- (3) Remove the ESDS printed circuit board from the static shielding bag, COM-1566, or antistatic conductive container, COM-1567.

SUBTASK 20-40-12-860-007

- (4) Install the printed circuit board with the applicable installation procedure.

SUBTASK 20-40-12-860-008

- (5) Do not remove the static control wrist strap, COM-1565, until you close the applicable access door.

END OF TASK

TASK 20-40-12-000-802

5. ESDS Handling for Metal Encased Unit Removal

(Figure 201)

A. General

- (1) This task provides instructions to touch an ESDS metal encased unit during removal.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Table with 2 columns: Reference, Description. Reference: COM-1565. Description: Strap - Adjustable Wrist, Conductive, Static Control (Part #: 14810, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 2214, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 9070, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2211, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2212, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2213, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)

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C. ESDS Metal Encased Units Removal

SUBTASK 20-40-12-860-009

(1) Make sure you remove electrical power from the metal encased unit.

SUBTASK 20-40-12-750-003

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 this task: Wrist Strap Continuity Test, TASK 20-40-12-820-801 to do a resistance test of the static control wrist strap, COM-1565:

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.

(a) Connect the static control wrist strap, COM-1565, to an applicable electrostatic ground jack.

SUBTASK 20-40-12-860-010

(3) Remove the ESDS unit with the applicable removal task.

SUBTASK 20-40-12-420-001

(4) Do this task: Conductive Dust Cap and Connector Cover Installation, TASK 20-40-12-400-804.

SUBTASK 20-40-12-860-013

(5) Remove the static control wrist strap, COM-1565.

END OF TASK

TASK 20-40-12-400-802

6. ESDS Handling for Metal Encased Unit Installation

(Figure 201)

A. General

(1) This task provides instructions to touch an ESDS metal encased unit during installation.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Table with 2 columns: Reference and Description. Reference: COM-1565. Description: Strap - Adjustable Wrist, Conductive, Static Control (Part #: 14810, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 2214, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: 9070, Supplier: 62576, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2211, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2212, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Opt Part #: 2213, Supplier: 57707, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)

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C. ESDS Metal Encased Unit Installation

SUBTASK 20-40-12-860-014

- (1) Make sure electrical power is removed from the metal encased unit.

SUBTASK 20-40-12-750-004

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 this task: Wrist Strap Continuity Test, TASK 20-40-12-820-801 to do a resistance test of the static control wrist strap, COM-1565:

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.

- (a) Connect the static control wrist strap, COM-1565, to an applicable electrostatic ground jack.

SUBTASK 20-40-12-420-003

- (3) Do this task: Conductive Dust Cap and Conductor Cover Removal, TASK 20-40-12-000-804.

SUBTASK 20-40-12-860-016

- (4) Install the ESDS unit with the applicable installation task.

SUBTASK 20-40-12-860-017

- (5) Remove the static control wrist strap, COM-1565.

————— **END OF TASK** —————

TASK 20-40-12-000-804

7. Conductive Dust Cap and Conductor Cover Removal

(Figure 201)

A. Conductive Dust Cap and Conductor Cover Removal

SUBTASK 20-40-12-020-005

CAUTION: DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE UNIT. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE UNIT.

- (1) Remove all of the conductive dust caps and the connector covers from the unit to be installed.

SUBTASK 20-40-12-020-006

- (2) Install the ESDS unit with the applicable installation task.

————— **END OF TASK** —————

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COMMERCIAL

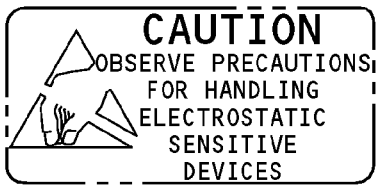
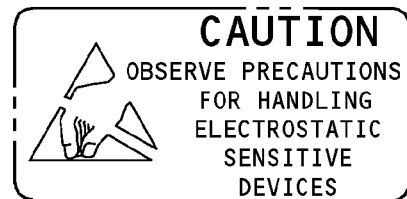
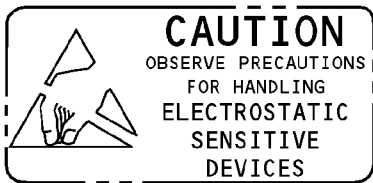


GOVERNMENT



INTERNATIONAL
(BOEING)

TYPES OF ESDS SYMBOLS



BOEING ESDS DECALS (EXAMPLE)

**Static Discharge Sensitive Devices Identifiers
Figure 201/20-40-12-990-801**



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TASK 20-40-12-400-804

8. Conductive Dust Cap and Connector Cover Installation

(Figure 201) (Table 201 Table 202)

A. General

- (1) Conductive dust caps and connector covers must be installed on the connectors of ESDS units when the units are removed.
- (2) Use ITT Cannon dust caps and connectors as applicable (stamped "CONDUCTIVE") (Table 201).

Table 201/20-40-12-993-804

Table 1 ITT CANON		
PART NUMBER	MARKING ON CAP	CONNECTOR
025-1155-001	BKAD1-A&B-R	BKAD1-A-R BKAD1-B-R
025-1156-001 025-1157-001	BKAD1-C-R 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

- (3) Use Souriau dust caps and connectors as applicable (Table 202).

Table 202/20-40-12-993-805

TABLE 2 SOURIAU		
PART NUMBER	TYPE CONNECTOR	SHELL SIZE
8660-1404	Power	1
8660-1405	Signal	1
8660-1406	Power	2 & 3
8660-1407	Signal	2 & 3

B. Conductive Dust Cap and Connector Cover Installation

SUBTASK 20-40-12-420-005

CAUTION: DO NOT TOUCH THE CONDUCTOR PINS OR OTHER CONDUCTORS ON THE UNIT. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE UNIT.

- (1) Remove the ESDS unit as shown in the applicable removal procedure.

NOTE: Make sure a static sensitive placard is installed adjacent to the electrical connector(s).

SUBTASK 20-40-12-420-006

- (2) Install conductive dust covers on the connectors with a static sensitive placard and standard dust covers on the connectors that do not have the placard.

NOTE: The conductive dust caps and the connector covers are black in color. The conductive dust caps and the connector covers from the installed unit can be used on the removed unit. Conductive bags can be used as an alternate to conductive dust caps and covers.

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SUBTASK 20-40-12-860-019

- (3) Move the unit, as shown in the applicable procedure, with the conductive dust caps and connector covers installed.

————— **END OF TASK** —————

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STANDARD TORQUE VALUES - MAINTENANCE PRACTICES

1. General

A. This procedure has one task:

- (1) Standard Torque Values

TASK 20-50-11-910-801

2. Standard Torque Values

A. General

- (1) Refer to the figures that follow for the torque data.
 - (a) Torque Wrench Adapter Figure 201
 - (b) Nuts and Bolts Figure 202
 - (c) Self-Locking Nuts Figure 203
 - (d) Reduced-Head Bolts Figure 204
 - (e) Rigid Tube Coupling Connectors Figure 205
 - (f) Pipe346Thread Fittings Figure 206
 - (g) Low Pressure and Return Line Fittings Figure 207
 - (h) Flareless Tube Fittings Figure 208
 - (i) Clamps, V-Band, and Channel-Band Figure 209

B. Consumable Materials

Reference	Description	Specification
C00308	Compound - Corrosion Preventive, Petrolatum Hot Application	MIL-C-11796
D00010	Compound - Thread Antiseize, High Temperature	MIL-PRF-907F
D00013	Grease - Aircraft And Instrument Grease	MIL-PRF-23827 (NATO G-354) (Supersedes MIL-G-23827)

C. Procedure

SUBTASK 20-50-11-420-001

- (1) Tighten the bolt, nut, fitting, clamps, or connector (Figure 201, Figure 202, Figure 203, Figure 204, Figure 205, Figure 206, Figure 207, Figure 208, Figure 209).
 - (a) Lubricate the threads with one of these materials if required:
 - 1) corrosion preventive compound, C00308.
 - 2) grease, D00013.
 - 3) compound, D00010.
 - (b) Tighten the bolts, nuts, fitting, clamps, or connectors to the correct torque.
 - (c) Make sure that one male tread (minimum), plus the chamfer of the male tread, extends above the top of the nut.

NOTE: If the male thread does not have a chamfer, the male thread must extend one and one-half treads (minimum) above the top of the nut.

END OF TASK

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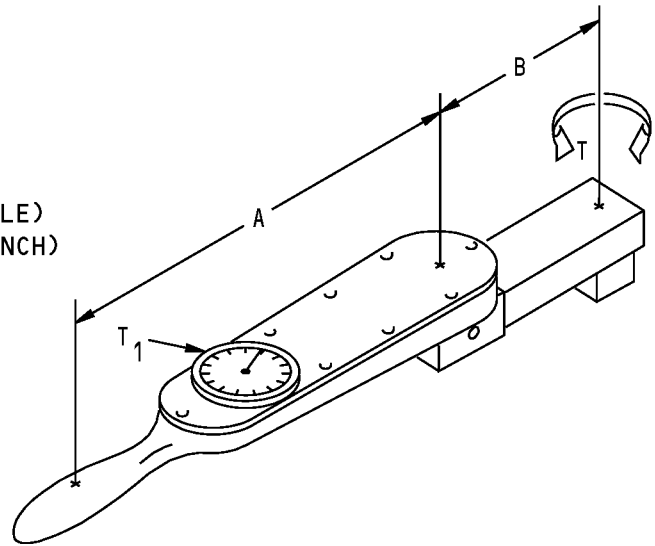
$$T_1 = \frac{TA}{A+B}$$

A = LENGTH OF THE TORQUE WRENCH
 B = EFFECTIVE LENGTH OF THE ADAPTER
 T = APPROVED TORQUE (SHOWN IN TORQUE TABLE)
 T₁ = ADJUSTED TORQUE (SHOWN ON TORQUE WRENCH)

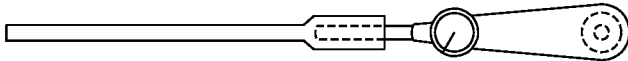
EXAMPLE: A = 12 INCHES
 B = 3 INCHES
 T = 160 POUND-INCHES

$$T_1 = \frac{160 \times 12}{12+3}$$

T₁ = 128 POUND-INCHES

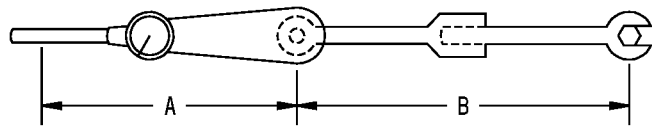


METHOD 1



HANDLE EXTENSION ONLY.
 NO CORRECTION NECESSARY.

METHOD 2



ADAPTER WITH THE EXTENSION BETWEEN THE ADAPTER AND THE WRENCH. BOTH ARE IN LINE WITH THE WRENCH. INDICATED TORQUE T₁:

$$T_1 = \frac{TA}{A+B}$$

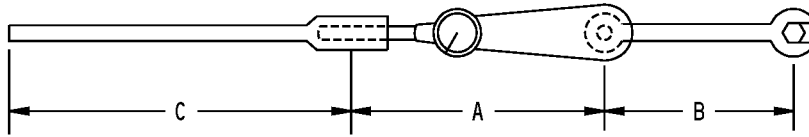
METHOD 3

Finding Torque Values for a Torque Wrench with an Adapter
 Figure 201 (Sheet 1 of 2)/20-50-11-990-801

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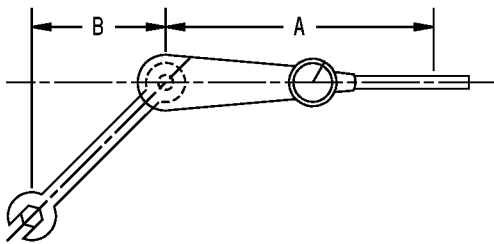
BOTH HANDLE EXTENSION AND ADAPTER,
INDICATED TORQUE T_1 :

$$T_1 = \frac{T_x(A+C)}{A+B+C}$$

METHOD 4

IF POSSIBLE, METHODS 5 AND 6 SHOULD NOT BE USED. WHEN IT IS NECESSARY TO USE THESE METHODS, THE FOLLOWING CONDITIONS MUST BE APPLICABLE:

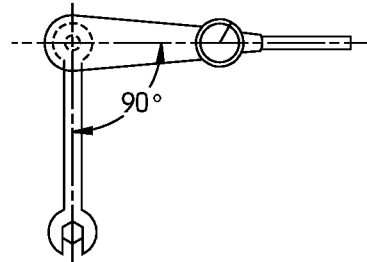
1. THE ADAPTER PLUS ANY EXTENSIONS USED BETWEEN THE WRENCH AND THE ADAPTER MUST NOT BE MORE THAN THE LENGTH OF THE WRENCH.
2. WHEN A FORCE IS APPLIED AT $90 \pm 3^\circ$ TO THE HANDLE OF THE WRENCH, IT IS RECOMMENDED THAT A STIRRUP-TYPE HANDLE WITH A POINTER (INDICATING ANGLE OF LOADING) BE USED TO MAKE SURE LOADING IS AT THE CORRECT ANGLE.



ADAPTER AT ANGLE OTHER THAN 90° . INDICATED TORQUE T_1 :

$$T_1 = \frac{TA}{A+B}$$

METHOD 5



ADAPTER AT RIGHT ANGLE TO THE WRENCH. NO CORRECTION NECESSARY.

METHOD 6

**Finding Torque Values for a Torque Wrench with an Adapter
Figure 201 (Sheet 2 of 2)/20-50-11-990-801**



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AIRCRAFT MAINTENANCE MANUAL

NUT TIGHTENING TORQUE 		
N U T	PART NUMBER AND STYLE	COARSE THREADED NUTS, INSERTS AND TAPPED HOLES
	STYLE	ALL COARSE BOLTS AND SCREWS
B O L T	PART NUMBER	ALL
	TORQUE (POUND-INCHES)	
THREAD SIZE	DRY BOLT	MAXIMUM 
---	---	---
---	---	---
---	---	---
---	---	---
10-24 1/4-20 5/16-18 3/8-16	13.5-14.5 29-31 49-52 97-103	21 45 100 170
7/16-14 1/2-13 9/16-12 5/8-11	146 262-278 349-371 466-494	280 520 650 900
3/4-10 7/8-9 1-8 1-1/8-7	800-850 1500-1590 2520-2670 3540-3760	1500 2700 4500 7200
1-1/4-7 --- ---	4360-4630 --- ---	10,000 --- ---

F16179 S0006562224_V3

**Torque Values for Most Bolts and Nuts
Figure 202 (Sheet 2 of 3)/20-50-11-990-802**

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HAP ALL



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THREAD SIZE	DIAMETER DASH NO.	NAS1423 AND NAS509 JAM NUTS 			ALL OTHER NONSELF-LOCKING JAM NUTS 		
		TORQUE, INCH-POUNDS			TORQUE, INCH-POUNDS		
		MINIMUM	TARGET	MAXIMUM	MINIMUM	TARGET	MAXIMUM
0.1900-32	-3	13	13	15	18	19	20
0.2500-28	-4	18	18	20	24	25	26
0.3125-24	-5	34	35	36	49	50	52
0.3750-24	-6	40	45	46	63	65	67
0.4375-20	-7	63	65	67	97	100	103
0.5000-20	-8	78	80	82	112	115	118
0.5625-18	-9	87	90	93	130	135	140
0.6250-18	-10	97	100	103	146	150	155
0.7500-16	-12	155	160	165	233	240	247
0.8750-14	-14	213	220	227	320	330	340
1.0000-12	-16	272	280	288	407	420	433
1.1250-12	-18	359	370	380	534	550	567
1.2500-12	-20	437	450	464	655	675	695

JAM NUTS

-  LOCKWIRED JAM NUTS
-  NON-LOCKWIRED JAM NUTS

F44299 S0006562225_V2

**Torque Values for Most Bolts and Nuts
Figure 202 (Sheet 3 of 3)/20-50-11-990-802**

EFFECTIVITY
HAP ALL

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
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AIRCRAFT MAINTENANCE MANUAL

TORQUE - SELF-LOCKING NUTS 						
SIZE	FINE THREADS (REF BPS-N-70)			SIZE	COARSE THREADS (REF MIL-N-25027)	
	TORQUE (POUND-INCHES)				TORQUE (POUND-INCHES)	
	USED NUT		NEW NUT		MINIMUM LOCKING	MAXIMUM LOCKING
	MINIMUM BREAKAWAY	MAXIMUM LOCKING	MINIMUM 1ST CYCLE BREAKAWAY			
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



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.

F15937 S0006562232_V3

Locking Torque Values for Self-Locking Nuts
Figure 203/20-50-11-990-803

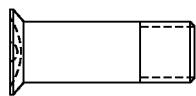
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HAP ALL

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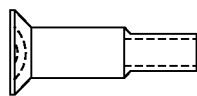
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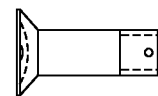
AIRCRAFT MAINTENANCE MANUAL



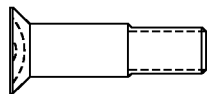
BACB30DP (CRES)
BACB30EL (STEEL)
NAS1581 (CRES)



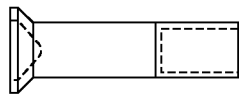
BACB30NU
(TITANIUM)



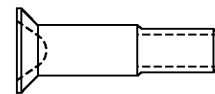
BACB30LL
(CRES)



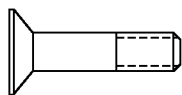
BACB30FB (STEEL)
BACB30RF (STEEL)
BACB30UW (STEEL)



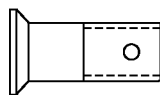
BACB30UR (TITANIUM)



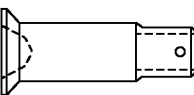
BACB30VF (TITANIUM)
BACB30XD (TITANIUM)



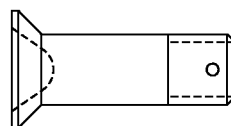
NAS1581



NAS1992 THRU NAS2000



NAS8702 THRU
NAS8716



BACB30ZE (CRES)

BOLT PART NUMBERS AND STYLES

THREAD SIZE AND BASIC MAJOR DIAMETER		TORQUE RANGE (POUND-INCHES)
0.2500	1/4-28	38 - 40
0.3125	5/16-24	92 - 98
0.3750	3/8-24	97 - 103
0.4375	7/16-20	155 - 165
0.5000	1/2-20	223 - 237
0.5625	9/16-18	300 - 320
0.6250	5/8-18	407 - 433
0.7500	3/4-16	660 - 700
0.8750	7/8-14	1070 - 1130
1.0000	1-12 OR 1-14	1600 - 1700

F15953 S0006562234_V3

Torque Values for Reduced-Head Bolts
Figure 204/20-50-11-990-804

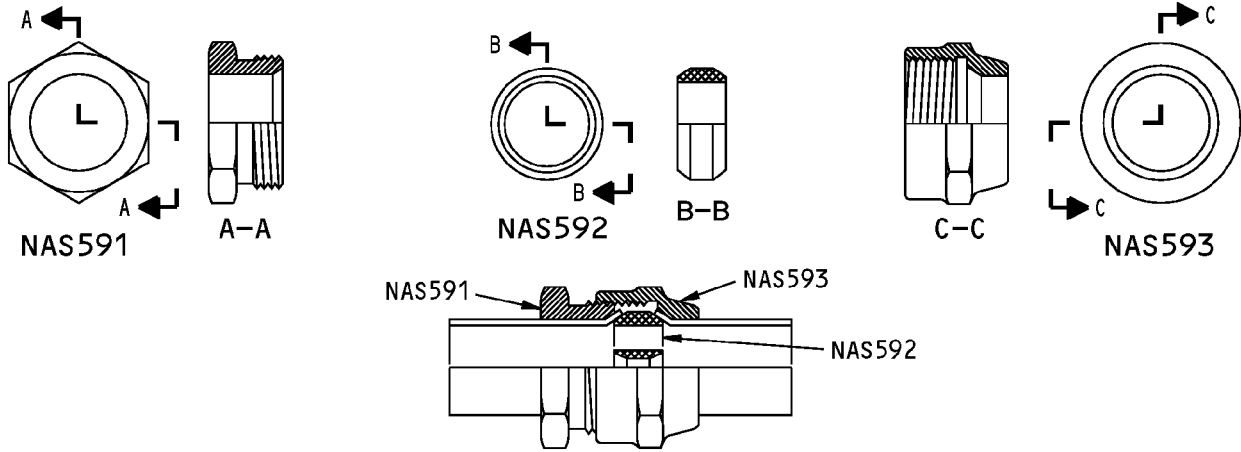
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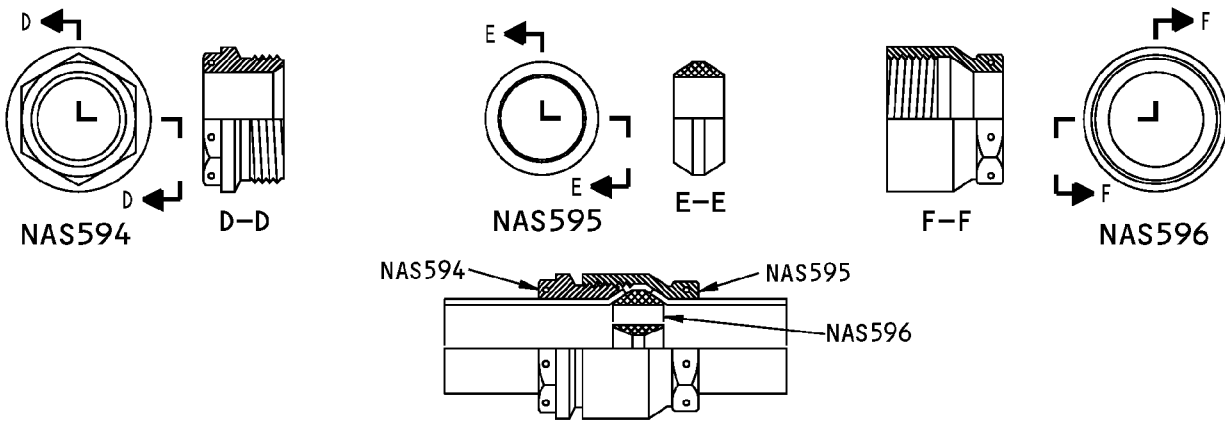
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CONNECTION ASSEMBLY FOR ALUMINUM ALLOY FITTINGS
NAS591-NAS593



CONNECTION ASSEMBLY FOR STAINLESS STEEL FITTINGS
NAS594-NAS596

TUBE OD (INCHES)	TORQUE VALUE (POUND-INCHES)			
	ALUMINUM ALLOY FITTINGS NAS591-NAS593		STAINLESS STEEL FITTINGS NAS594-NAS596	
	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 205/20-50-11-990-805

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PIPE THREAD SIZE (INCHES)	TORQUE VALUE (POUND-INCHES)			
	ALL PIPE EXCEPT STAINLESS STEEL TO STAINLESS STEEL		STAINLESS STEEL TO STAINLESS STEEL PIPE FITTINGS	
	WORKING	MAX	MIN	MAX
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

Standard Torque Values for Pipe Thread Fittings
Figure 206/20-50-11-990-806

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TUBE OD (INCHES)	FITTING NUT SIZE	TORQUE VALUE (POUND-INCHES)	
		1	2
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

NOTE: THE TORQUE VALUES ARE APPLICABLE TO ALL WALL THICKNESSES FOR A GIVEN DIAMETER TUBE. AND THE TORQUE VALUES HAVE A $\pm 5\%$ TOLERANCE.

- 1 THESE TORQUE VALUES ARE APPLICABLE TO:
- FLARED ALUMINUM TUBE ENDS
 - FLARELESS ALUMINUM TUBE ENDS WITH BACS13BD SWAGED SLEEVES
 - FLARELESS TYPE HOSE END FITTINGS WITH ALUMINUM INSERTS
 - STANDARD MS FLARELESS TUBE ENDS ON 6061-T6 ALUMINUM TUBING AND ON ANNEALED CRES TUBING. ANNEALED CRES TUBING IS IDENTIFIED BY A WIDE YELLOW BAND ADJACENT TO THE TUBING-USE IDENTIFICATION CODE MARKINGS.
- 2 THESE TORQUE VALUES ARE APPLICABLE TO FLARED HOSE END FITTINGS WITH ALUMINUM INSERTS.

Standard Torque Values for Low Pressure and Return Line Fittings
Figure 207/20-50-11-990-807

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AIRCRAFT MAINTENANCE MANUAL

TUBING		INSTALLATION TORQUE ON FLARELESS TUBING FITTINGS (POUND-INCHES, ±5%) 1 2	
OD SIZE (INCHES)	TUBE DASH NO.	STEEL AND TITANIUM TUBES 3	ALUMINUM AND ANNEALED CRES TUBES 4
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: 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.

- 1 YOU MUST USE CARE WHEN YOU SELECT THE CORRECT TORQUE FOR REDUCER FITTINGS. YOU MUST FIND THE CORRECT FITTINGS INSTALLATION TORQUE FOR THE SIZE AND THE MATERIAL OF THE BOSS OR BULKHEAD.
- USE ALUMINUM FITTING TORQUE VALUES FOR ALUMINUM, STEEL FOR TITANIUM FITTINGS INSTALLED IN ALUMINUM BOSSES.
 - USE ALUMINUM FITTING TORQUE VALUES FOR ALUMINUM JAMNUTS INSTALLED ON ALUMINUM, TITANIUM OR STEEL BULKHEAD FITTINGS.
 - USE STEEL FITTING TORQUE VALUES FOR STEEL OR TITANIUM FITTINGS INSTALLED IN STEEL OR TITANIUM BOSSES.
 - USE STEEL FITTING TORQUE VALUES FOR STEEL OR TITANIUM JAMNUTS INSTALLED ON STEEL OR TITANIUM BULKHEAD FITTINGS.
 - THE BOSS OR BULKHEAD FITTING SIZE DETERMINES THE TORQUE VALUE FOR REDUCER FITTINGS.

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

Installation Torque for Flareless Tubing Fittings
Figure 208 (Sheet 1 of 2)/20-50-11-990-808

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3 THESE TORQUE VALUES ARE APPLICABLE TO THESE TUBE ENDS:

- 21-6-9 STEEL WITH BACS13BDX SWAGED SLEEVE
- CRES STEEL WITH BACS13BDX SWAGED SLEEVE
- MIL-T-6845 CRES WITH BACS13AP PRESET SLEEVE 5
- HOSE END FITTINGS WITH STEEL INSERTS (NIPPLES)
- ALL TITANIUM TUBE ENDS

4 THESE TORQUE VALUES ARE APPLICABLE TO THESE TUBE ENDS:

- ALUMINUM WITH BACS13BD AND BACS13BX SWAGED SLEEVES
- 6061-T6 ALUMINUM WITH PRESET BACS13AP SLEEVES 6
- ANNEALED CRES WITH PRESET BACS13AP SLEEVES 6
- HOSE END FITTINGS WITH ALUMINUM INSERTS (NIPPLES)

5 THESE TORQUE VALUES ARE APPLICABLE TO STANDARD MS FLARELESS TUBE ENDS (BACS13AP SLEEVES) ON MIL-T-6845 (304-1/8 HARD) TUBING WITH THE MINIMUM WALL THICKNESS 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 (POUND-INCHES)	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	-8	-10	-12
WALL THICKNESS	0.020	0.020	0.020
TORQUE (POUND-INCHES)	160	250	325

Installation Torque for Flareless Tubing Fittings
Figure 208 (Sheet 2 of 2)/20-50-11-990-808

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
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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	100	11.30
	550-600		
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	105	11.86
	425-800		
BACC10EZ()B	150-400	75	8.47
	125-275	105	11.86
	300		
BACC10GY()	125-300		
	150-175	40	4.52
	200-275	45	5.08
	300-450	50	5.65
	475-600	55	6.21
BACC10HX()	650-900	65	7.34
	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** 
TABLE A

-  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 of 2)/20-50-11-990-809

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AIRCRAFT MAINTENANCE MANUAL

TYPE	DUCT OD (INCHES)	TORQUE (POUND-INCHES)
BACC10CT	1.00-6.00	100-105

CHANNEL BAND CLAMPS
TABLE B

TYPE	DUCT OD (INCHES)	TORQUE (POUND-INCHES)
BACC10AD	2.00-8.00	20-25

DUCT-SUPPORT CLAMPS
TABLE C

TYPE	HOSE OD (INCHES)	TORQUE (POUND-INCHES)
BACC10BN	1.75-20.00	20

HOSE CLAMPS
TABLE D

TYPE	DUCT OD INCHES/MATERIAL	TORQUE (POUND-INCHES)
BACR12H	1.50/5052-0	600-1000
	1.50/STAINLESS	900-1200
	1.75/5052-0	900-1200
	2.00/5052-0	1300-2500
	2.50/5052-0	2000-3000

ROYLYN COUPLING
TABLE E

INSIDE OF COUPLING IS NOT LUBRICATED.

Standard Torque Values for Clamps
Figure 209 (Sheet 2 of 2)/20-50-11-990-809

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AIRCRAFT MAINTENANCE MANUAL

CIRCUIT BREAKER RESET - MAINTENANCE PRACTICES

1. General

A. This procedure has these tasks:

- (1) Circuit Breaker Reset

B. This procedure is for on-the-ground maintenance.

- (1) 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.
- (2) If there are currently specific instructions for the reset of a tripped circuit breaker in maintenance and troubleshooting procedures, follow those instructions.
- (3) A defective circuit breaker can cause the circuit breaker to open. Make sure that the circuit breaker is serviceable.
- (4) Use your judgement and airline policy to reset a tripped circuit breaker.
- (5) Monitor the airplane to see if a tripped circuit breaker occurs again on subsequent flights.
- (6) 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.
- (7) 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.

TASK 20-60-01-860-801

2. Circuit Breaker Reset

A. References

Reference	Title
SWPM 20-02-10	Airplane Flammable Leakage Zones

B. Location Zones

Zone	Area
100	Lower Half of Fuselage
200	Upper Half of Fuselage

C. Procedure

SUBTASK 20-60-01-860-001

- (1) Attach a DO-NOT-CLOSE tag to the tripped circuit breaker.

SUBTASK 20-60-01-860-002

- (2) Install a circuit breaker lock on the tripped circuit breaker.

SUBTASK 20-60-01-860-003

- (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.

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SUBTASK 20-60-01-860-004

- (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.

SUBTASK 20-60-01-860-005

- (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.

SUBTASK 20-60-01-860-006

- (6) Make sure that there are no loose terminal connections.

NOTE: Loose terminal connections can be a source of electrical arcing.

SUBTASK 20-60-01-860-007

- (7) If you find damage to the electrical wiring, refer to the Standard Wiring Practices Manual (SWPM) and repair the electrical wiring.

SUBTASK 20-60-01-860-008

- (8) If you find damage to a system component, refer to the applicable Aircraft Maintenance Manual (AMM) procedure and replace the component.

SUBTASK 20-60-01-860-009

- (9) Remove contamination and metal shavings if necessary.

SUBTASK 20-60-01-860-010

- (10) Remove the DO-NOT-CLOSE tag(s).

SUBTASK 20-60-01-860-011

- (11) Remove the circuit breaker lock(s).

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SUBTASK 20-60-01-860-012

WARNING: BEFORE YOU CLOSE A FUEL PUMP CIRCUIT BREAKER THAT OPENED DURING PUMP OPERATION, DO THE APPLICABLE FIM PROCEDURE. A DAMAGED PUMP, OR A PROBLEM WITH THE PUMP WIRING CAN CAUSE THE CIRCUIT BREAKER TO OPEN. THIS CONDITION CAN CAUSE A FIRE, OR AN EXPLOSION.

WARNING: KEEP PERSONS AND EQUIPMENT CLEAR OF THE SYSTEM RELATED TO THE TRIPPED CIRCUIT BREAKER. MAKE SURE THAT THERE IS NO DAMAGE TO THE ELECTRICAL WIRING AND SYSTEM COMPONENTS. MAKE SURE THAT ALL TERMINAL CONNECTIONS ARE TIGHT. DAMAGED ELECTRICAL WIRING, DAMAGED SYSTEM COMPONENTS AND LOOSE TERMINAL CONNECTIONS CAN CAUSE ELECTRICAL ARCING AND A FIRE WHEN THE CIRCUIT BREAKER IS CLOSED.

MAKE SURE THROUGH SWPM 20-02-10 THAT THE OPEN CIRCUIT BREAKER DOES NOT HAVE AN EFFECT ON FLAMMABLE LEAKAGE ZONES. IF THE CIRCUIT BREAKER IS CLOSED WITHOUT FLAMMABLE LEAKAGE ZONE VERIFICATION, SPARKS CAN CAUSE A FIRE OR EXPLOSION.

(12) Close the circuit breaker(s).

SUBTASK 20-60-01-860-013

(13) After you close the circuit breaker(s), make sure that there is no electrical arcing or other damage to the system.

SUBTASK 20-60-01-860-014

(14) To make sure that the airplane system operates correctly, refer to the applicable procedure in the Aircraft Maintenance Manual (AMM).

————— **END OF TASK** —————

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CLEANING TO REMOVE COMBUSTIBLE MATERIAL AROUND WIRING (EZAP) - MAINTENANCE PRACTICES

1. General

A. This procedure contains scheduled maintenance task data.

TASK 20-60-02-100-801

2. Cleaning to Remove Combustible Material Around Wiring

A. General

- (1) This procedure is a scheduled maintenance task.
(2) This procedure cleans the wire bundles and the area around them where dust accumulates to significantly reduce the amount of combustible material.
(3) This procedure is an enhanced zonal analysis procedure (EZAP) task.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Table with 2 columns: Reference, Description. Rows include COM-2618 (Cleaner - Vacuum) and STD-123 (Brush - Soft Bristle).

C. Procedure

SUBTASK 20-60-02-010-001

(1) Remove panels as necessary to gain access to the wire bundles and the area around them.

SUBTASK 20-60-02-100-001

(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, COM-2618 to remove accumulations of dust.
(c) Use a soft bristle brush, STD-123 to loosen accumulations of dust that remain and vacuum the area again.

SUBTASK 20-60-02-410-001

(3) Install all panels removed for access.

END OF TASK

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DETAILED WIRING INSPECTION (EZAP) - MAINTENANCE PRACTICES

1. General

A. This procedure contains scheduled maintenance task data.

TASK 20-60-03-100-801

2. Detailed Wiring Inspection

A. General

- (1) This procedure is a scheduled maintenance task.
- (2) This procedure performs a detailed inspection of the wiring.
- (3) This procedure is an enhanced zonal analysis procedure (EZAP) task.

B. References

Reference	Title
20-60-02-100-801	Cleaning to Remove Combustible Material Around Wiring (P/B 201)

C. Procedure

SUBTASK 20-60-03-010-001

- (1) Remove panels as necessary to gain access to the wiring.

SUBTASK 20-60-03-100-001

- (2) Do these steps to perform a detailed inspection of the wire bundles:

NOTE: You do not need to pull on the wire bundles, shake the wire bundles, or disconnect the connectors to perform this inspection.

- (a) Check the wire bundles and the area around them for combustible material.
 - 1) If combustible material is found, do this task: Cleaning to Remove Combustible Material Around Wiring, TASK 20-60-02-100-801.
- (b) Check the wire and the wire harnesses for: contact, chafing, sagging, security, visible damage, lacing tape/ties installation, sheath/conduit deformity or installation, end of sheath rubbing on end attachment, missing or damaged grommets, dust and lint accumulation, surface contamination, deterioration of previous repairs.
- (c) Check connectors for: external corrosion, backshell tail, rubber pad/packing on backshell, backshell wire securing device, fool proofing chain, missing or broken safety wire, discoloration or evidence of overheat on terminal lugs or blocks, torque stripe misalignment.
- (d) Check switches for rear protection cap damage.
- (e) Check ground points for: corrosion, bonding braid/bonding jumper, broken or disconnected braid, multiple strands corroded or broken.
- (f) Check wiring clamps or brackets for: presence, corrosion, condition, bends or twists, attachment, protection/cushion.
- (g) Check supports (rails or tubes/conduit) for: breaks, deformity, missing fasteners, missing edge protection on rims of feed through holes, race track cushion damage.
- (h) Repair or replace any wire bundles found with defects.

SUBTASK 20-60-03-410-001

- (3) Install all panels removed for access .

END OF TASK

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GENERAL VISUAL INSPECTION OF WIRE BUNDLES (EZAP) - MAINTENANCE PRACTICES

1. General

A. This procedure contains scheduled maintenance task data.

TASK 20-60-04-100-801

2. General Visual Inspection of Wire Bundles

A. General

- (1) This procedure is a scheduled maintenance task.
- (2) This procedure performs a general visual inspection of wire bundles.
- (3) This procedure is an enhanced zonal analysis procedure (EZAP) task.

B. References

Reference	Title
20-60-02-100-801	Cleaning to Remove Combustible Material Around Wiring (P/B 201)

C. Procedure

SUBTASK 20-60-04-010-001

- (1) Remove panels as necessary to gain access to the wire bundles.

SUBTASK 20-60-04-100-001

- (2) Do these steps to perform a general visual inspection of the 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, TASK 20-60-02-100-801.
- (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 (SWPM (applicable procedure(s))).

SUBTASK 20-60-04-410-001

- (3) Install all panels removed for access.

————— **END OF TASK** —————

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CIRCUIT BREAKER CYCLE - MAINTENANCE PRACTICES

1. General

A. This procedure has this task:

- (1) Circuit Breaker Cycle

B. This procedure is for on-the-ground maintenance.

- (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.

TASK 20-60-05-800-801

2. Circuit Breaker Cycle

A. References

Reference	Title
24-22-00-860-812	Remove Electrical Power (P/B 201)

B. Procedure

SUBTASK 20-60-05-020-001

- (1) Do this task: Remove Electrical Power, TASK 24-22-00-860-812

NOTE: Electrical power must be off so that subsequent incorrect fault indications or nuisance messages are prevented.

SUBTASK 20-60-05-860-001

- (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.
 - (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.

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SUBTASK 20-60-05-860-002

(3) If necessary, do this procedure again to cycle another circuit breaker.

————— **END OF TASK** —————

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ELECTRONIC LINE REPLACEABLE UNIT CLEANING

1. General

- A. This procedure cleans the electronic line replaceable units and the area around it where dust can accumulate and obstruct filters and cooling systems.

TASK 20-60-06-100-801

2. Electronic Line Replaceable Unit Cleaning

- A. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-2618	Cleaner - Vacuum (Part #: 02146A, Supplier: 0A5X2, A/P Effectivity: 737-ALL) (Part #: BP80, Supplier: \$0373, A/P Effectivity: 737-ALL) (Part #: C-39485-41, Supplier: 16893, A/P Effectivity: 737-ALL) (Part #: C-39485-42, Supplier: 16893, A/P Effectivity: 737-ALL) (Part #: C-39685-01, Supplier: 16893, A/P Effectivity: 737-ALL) (Part #: C-47400-00, Supplier: 16893, A/P Effectivity: 737-ALL) (Opt Part #: 02132B, Supplier: 0A5X2, A/P Effectivity: 737-ALL)
STD-123	Brush - Soft Bristle

- B. Consumable Materials

Reference	Description	Specification
B01000	Solvent - General Cleaning Of Metal (AMM 20-30-801/201) - Series 80	

- C. Procedure

SUBTASK 20-60-06-010-001

- (1) Remove panels as necessary to gain access to the LRUs and the area around them.

SUBTASK 20-60-06-140-001

- (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, COM-2618 to remove any loose dirt or debris.
 - (c) Use a soft bristle brush, STD-123 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, B01000 if contaminated.

SUBTASK 20-60-06-410-001

- (3) Install all panels removed for access.

————— **END OF TASK** —————

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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).
- 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 wire bundles and their related components, regardless of gauge or insulation material, during airplane maintenance to prevent or significantly decrease the potential for damage from contamination or debris.
 - (1) Protection of the wire bundles and their related components starts with identification of the potential for contamination or mechanical damage.
 - (2) The protection ends with making sure that the wire bundles and their related components are free of all sources of contamination.
 - (3) 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.
 - (4) Wire bundles can be easily damaged during the removal of aircraft equipment or if used as a handhold or support for personal equipment.
 - (5) 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 wire bundles and their related components, they are not resistant to all chemicals and must be kept free of all chemicals and debris.
 - (1) Hydraulic fluid is a common cause of wire bundle and wire component degradation. Hydraulic fluid is very damaging to connector grommets, wire bundle clamps, and to wire insulation when exposed over a long time. This can cause indirect damage such as arching and chafing, and break down 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 20-60-07-913-801

2. Protection of the Wire Bundles During Maintenance

A. References

Reference	Title
20-60-02 P/B 201	CLEANING TO REMOVE COMBUSTIBLE MATERIAL AROUND WIRING (EZAP) - MAINTENANCE PRACTICES
20-60-03 P/B 201	DETAILED WIRING INSPECTION (EZAP) - MAINTENANCE PRACTICES

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B. Procedure

SUBTASK 20-60-07-913-001

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, INJURY 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.

SUBTASK 20-60-07-913-002

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.

C. Put the Airplane Back to Its Original Condition

SUBTASK 20-60-07-010-001

- (1) Remove the covers.

- (a) Make sure that the contaminants are contained and do not spill.

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SUBTASK 20-60-07-211-001

- (2) Examine the area to make sure that no contaminants spilled, do this procedure: DETAILED WIRING INSPECTION (EZAP) - MAINTENANCE PRACTICES, PAGEBLOCK 20-60-03/201.
- (a) If there is contamination on the wire bundles, do this procedure: CLEANING TO REMOVE COMBUSTIBLE MATERIAL AROUND WIRING (EZAP) - MAINTENANCE PRACTICES, PAGEBLOCK 20-60-02/201.
- (b) If there is damage to the wire bundles, refer to the Standard Wiring Practices Manual for applicable repairs.

————— **END OF TASK** —————

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