ELECTRICAL BONDING PROCESSES

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This Subject gives the necessary conditions and procedures for electrical bonds and electrical grounds.

For the procedure to replace a ground stud, refer to Subject 20-20-10.

For the procedure to assemble a dual ground, refer to Subject 20-20-12.

1. GENERAL DATA

A. Definitions

Table 1
DEFINITIONS

Term	Definition
Axial Swage	A forced permanent installation of a tube joint fitting onto a tube, with a tube axis, parallel motion, hydraulically actuated tool.
Basic Structure	The major, electrically integral, metallic part of an airplane
Bond Jumper	An assembly that has one wire with a terminal lug at each end
Cable Assembly, Ground Path	An assembly that has more than one wire segment with a terminal lug at each end of the assembly and an integral terminal between each wire segment
CRN	Current Return Network, refer to Subject 20-20-14
CRN Component, Flexible	A bond jumper or a ground path cable assembly that has the same installation requirements as a wire harness that has only one wire or cable; refer to Subject 20-10-11
Carbon Fiber Reinforced Plastic (CFRP)	A strong, lightweight, composite material consisting of a plastic matrix (often an epoxy) embedded with carbon filament thread fibers or fabric.
Case Ground	A current return path through the equipment mounting surface
Cleaned Surface	A bonding surface from which all surface finishes and contaminants have been removed.
Clearance Fit Hole	A hole with dimension limits larger than the shank diameter of the fastener. The installed fastener will always have a clearance between the shank and the mating surface.
Corrosion Inhibiting Compound (CIC)	An organic compound applied to a structure to provide supplemental corrosion protection.
Coupling	The hardware used to connect low pressure ducting such as cooling, environmental control systems, fuel, and waste water.
Critical Ground	An important current return path; the voltage drop (resistance) from the wire terminal to the structure must be measured after the assembly of each wire terminal to a ground
Current-Return Ground	A current path or connection that is established between the ground side of the circuit of an electrical or electronic device and the basic structure; made with a designated ground lead or wire on the non-case grounded equipment with either a direct case to the structure ground or a jumper on the Case Grounded equipment
Designated Bond	An important bond; the maximum permitted resistance and the other major conditions are directly specified. The bond resistance value specified on the installation drawing must be obeyed. If the bond resistance value is not specified on the installation drawing, make sure that the bond resistance value of Table 34 for the combination of materials to be bonded is obeyed.
Dual Ground	A type of connection that has two physical paths of the current return to structure
Dual Terminated Ground	An alternative term for Dual Ground
Electrical Bond	A stable connection between two objects that has the result of electrical conductivity between those objects

Table 1 DEFINITIONS (Continued)

Term	Definition
Electrostatic Drain Ground Path	An electrical path through which electrical charge current generated by electrostatic charging is continuously conducted to ground in order to prevent the accumulation of the charge to levels where damaging sudden discharge would occur.
Explosion Hazard Area	A work area, or the area of an airplane or other manufactured product that is identified by the responsible organization as a hazard because of the combustible or explosive substances in the area
External Swage	The forced external permanent radial inward deformation of a tube joint fitting onto a tube, with a hydraulically actuated tool.
Fairing Tool	A tool used to form a sealant fillet. Any clean tool that will form a satisfactory fillet.
Faying Surface	A surface that is prepared to have the correct fit against a second surface so that an electrical bond is made between the two surfaces
Fire/Explosion Hazard Area	A work area where combustible liquid or vapor is present.
Fitting	A large global category of hardware associated with connecting tubing together. This includes flared, flareless reconnectible hardware (elbows, tees, crosses, sleeves, unions, and nuts) and permanent (welded, external swage, axial swage, cryogenic type, etc..).
Flammable Leakage Zone	An area of the airplane where combustible liquid or vapor may be expected to be present due to a single failure or leakage during operation.
Flexible Coupling	A conductive, self bonding aluminum clamshell coupling assembly which provides a flexible, current carrying connection for joining tubing and components in aircraft fuel, vent, and other systems. The assembly has internal bonding springs/devices which, when installed over fixed cavity ferrules together with a sleeve, provides a bonding path (electrical conductivity) across the coupling assembly (tube to tube and sleeve to both tubes).
Fuel Tank Area	The area located inside the fuel tank or inside the surge tank.
Ground	An electrically conductive path between a component or an electrical circuit and the basic structure, or a connection between the conductive frame or housing of an object and the earth-ground connection point in a facility
Inherent Bond	When the materials that are used and the assembly procedure gives the low resistance junction without special installation procedures; included are parts that are welded, brazed, sweated, or swaged; also included are major structural components that are attached by a large number of fasteners
Interference Fit Hole	A hole with dimension limits smaller than the shank diameter of the fastener. The installed fastener will have interference between the shank and the mating surface. An interference fit hole will always have a permanent fastener installed in it.
Isolator	A non-metallic material, installed to provide electrical isolation. The isloator is designed to withstand voltage surges, such as lightning, and dissipate the electrostatic charge.
Non-Designated Bond or Ground	A bond or ground that is not Inherent or specified as Designated. The parts must be satisfactorily electrically bonded. If a bond resistance value is specified on the installation drawing, it must be obeyed. If a bond resistance value is not specified on the installation drawing, make sure that the bond resistance value of Table 34 for the combination of materials to be bonded is obeyed.
Precipitation Static	An electrical charge accumulation on surfaces of an aircraft as a result if triboelectric or frictional charging caused by flying through snow, ice, sleet, hail, and dust.

Table 1 DEFINITIONS (Continued)

Term	Definition
Rigid Coupling	A conductive self-bonding coupling assembly that provides a rigid, current carrying connection for joining tubing and components in aircraft fuel, vent, and other systems. The coupling split retainer ring has and internal bonding spring which, when installed inside the threaded body, provides electrical continuity to the mating fixed cavity compatible ferrule.
Self-Bonding Coupling	A type of coupling that mechanically joins two sections of tubing while providing an electrically conductive bond path between them. The action of assembling the coupling electrically bonds all the parts together automatically.
Steel	Stainless steel, corrosion resistant steel (CRES), or low alloy steel.
Surface Finish	Finishes which have been applied on top of a bonding surface and which must be removed before electrical bonding.

NOTE: Subject 20-20-10 gives the installation procedures for the terminals of bonding jumpers.

NOTE: Subject 20-20-14 gives the installation procedures for the terminals of the BACC13AU and BACC13AW Current Return Network cables.

B. Applicable Conditions for the Separation of Grounds

These are the types of grounds:

- A direct current or DC ground
- An alternating current or AC ground
- A static ground.

For the conditions that are applicable for:

- Ground wires in one termination, refer to Table 2
- Ground connections, refer to Table 3.

Table 2
APPLICABLE CONDITIONS FOR GROUNDS IN A WIRE TERMINATION

Wire Termination	Applicable Condition
A Contact	More than one type of ground is not permitted
A Terminal Lug	More than one type of ground is not permitted

Table 3
APPLICABLE CONDITIONS FOR GROUNDS IN A GROUND CONNECTION

Ground Connection	Wire Termination	Applicable Condition
Ground Module	A Contact	More than one type of ground is permitted
Ground Stud	A Terminal Lug	More than one type of ground is not permitted

C. Damage Limits and Service Conditions for a Bond and Ground Jumper Assembly

This paragraph gives the damage limits and service conditions for electrical bond and ground jumper assemblies.

For the applicable:

- Assemblies, refer to Table 4
- Damage limits and service conditions, refer to Table 5.

Table 4
BOND AND GROUND JUMPER ASSEMBLIES

Jumper Assembly	Supplier
BACJ40A()	Boeing
BACJ40AB()	Boeing
BACJ40AP()	Boeing
BACJ40AR()	Boeing
BACJ40AT()	Boeing
BACJ40AV()	Boeing
BACJ40B()	Boeing
BACJ40C()	Boeing
BACJ40D()	Boeing
BACJ40E()	Boeing
BACJ40F()	Boeing
BACJ40K()	Boeing
BACJ40T()	Boeing
BACJ40W()	Boeing
M83413/8-A()	QPL
M83413/8-B()	QPL
M83413/8-D()	QPL
M83413/8-E()	QPL
M83413/8-F()	QPL
M83413/8-G()	QPL
M83413/8-H()	QPL
MS25083-2()	QPL
MS25083-3()	QPL
MS25083-4()	QPL
MS25083-5()	QPL
MS25083-6()	QPL

Table 5
APPLICABLE SERVICE CONDITIONS FOR JUMPER ASSEMBLIES

Assembly Configuration	Type of Damage	Permitted Number of Broken Strands	Service Condition
Installed in a Fuel Tank	All	0	If the assembly has one or more broken strands, it must be replaced immediately.
Insulated Jumper	All	0	If the assembly has one or more broken strands, it must be replaced immediately
			If the assembly has damage to the insulation, repair of the insulation can be necessary; refer to Subject 20-10-13.
Uninsulated Jumper shorter than or equal to 12 inches	Abrasion	6	The source of abrasion must be removed immediately.
			The assembly must be replaced at the next scheduled maintenance.
	Not Abrasion	6	If the assembly has more than 6 broken strands, but a total of broken strands that is less than 10 per cent of the totasl number of strands, it must be replaced at the next scheduled maintenance.
			If the assembly has less than 7 broken strands, it must be inspected at each scheduled maintenance.
Uninsulated Supported Jumper longer than 12 inches	Abrasion	6	The source of abrasion must be removed immediately.
			The assembly must be replaced at the next scheduled maintenance.
	Not Abrasion	6	If the assembly has 1 to 30 broken strands, it must be replaced at the next scheduled maintenance.
Uninsulated Unsupported Jumper longer than 12 inches	All	0	If the assembly has one or more broken strands, it must be replaced.

D. General Conditions for the Preparation of a Faying Surface

All faying surfaces in the current path must be cleaned. Refer to Table 6.

These conditions are applicable:

- Lye, alkaline paint remover, hydroxides, or other caustic solutions must not be used to clean a bonding surface
- Abrasive cleaning materials or wire brushes must not be used to clean plated surfaces, clad surfaces, or unpainted metals such as corrosion resistant or stainless steel and 6061 aluminum
- If the bond will be made immediately after cleaning, the faying surfaces must be cleaned again with a clean cloth that is free of lint to make sure that remaining, abrasive particles are removed
- If a cleaned faying surface has contamination, clean the surface again
- The bond assembly and resistance measurement must be done within 24 hours of the surface preparation. If the bond assembly and resistance measurement are not done within 24 hours, the faying surfaces must be cleaned again.

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CAUTION: DO NOT PERMIT CONTAMINATION FROM THE ABRASIVE MATERIALS THAT ARE USED TO PREPARE A SURFACE FOR AN ELECTRICAL BOND TO GO INTO A MECHANISM OR ELECTRICAL EQUIPMENT.

Table 6
FAYING SURFACE PREPARATION PROCEDURES

Faying Surface	Finish	Preparation Procedure
Aluminum Alloy	Bare with or without grease, oil, corrosion inhibiting compound, or other contaminants	Paragraph 2.E.
	Bare with oxide film contaminaition	Paragraph 2.
	Paint, primer or enamel	Paragraph 2.
	Chemical conversion coating	Paragraph 2.
	Anodize	Paragraph 2.
BMS10-21 Type III Anti-Static Coating	Bare	Paragraph 2.E.
	Paint, primer or enamel	Paragraph 2.
Flame Spray	Bare	Paragraph 2.E.
	Paint, primer or enamel	Paragraph 2.
Magnesium	Bare	Paragraph 2.E.
Nickel Alloy 625	Bare	Paragraph 2.E.
Stainless Steel	Bare	Paragraph 2.E.
	Paint, primer or enamel	Paragraph 2.
Stainless Steel with Cadmium Plating	Bare	Paragraph 2.E.
Titanium	Bare	Paragraph 2.E.
	Paint, primer or enamel	Paragraph 2.

E. Replacement of a Surface Finish After a Bond Is Made

After the bond is made, these conditions are applicable for the cleaned surfaces that are not part of the faying surface:

- All finishes must be applied again
- The applicable surface finish must be applied within one week after the original finish is been removed
- A minimum of one layer of primer and one layer of the equivalent finish must be applied where the original paint finish is removed
- Machine finished flanges of fuel or hydraulic pumps, valves, and equivalent equipment that must have a seal for liquids at the mounting surface must not be painted
- A chemical conversion coating can be applied if the original finish is anodized
- A layer of alodine or chemical conversion coating must be applied to all bare aluminum surfaces that have no protection.

After the bond is made, these conditions are applicable for the cleaned magnesium surfaces that are not part of the faying surface:

- A layer of primer must be applied 24 hours after the original finish has been removed

- If the specified finish is Dow 17 Anodize or equivalent, a minimum of one coat of zinc chromate primer must be applied.

F. Airworthiness Limitations

These wiring configurations, installations, and procedures are given in Critical Design Configuration Control Limitations (CDCCL) related to:

- Fuel System Wiring that has Airworthiness Limitations
- Wiring that is installed adjacent to the fuel tank.

CDCCLs identify design configuration features that can decrease fuel tank ignition sources for the operational life of the airplane.

NOTE: The wiring configurations, installations, and procedures given allow the Critical Design Configuration Control Limitation (CDCCL) to decrease possible fuel tank ignition sources. If the CDCCL is not followed, the risk of a fuel tank ignition source can increase.

To find more data about CDCCLs, refer to Table 7 for the document that is applicable for the airplane model.

Table 7
BOEING DOCUMENTS FOR AIRWORTHINESS LIMITATIONS

Airplane Model	Boeing Document
707	D6-7552-AWL Airworthiness Limitations
727	D6-8766-AWL Airworthiness Limitations
737-100, -200, -200C, -300, -400, -500	D6-38278-CMR Airworthiness Limitations and Certification Maintenance Requirements
747-100, -200, -300, -SP	D6-13747-CMR Airworthiness Limitations and Certification Maintenance Requirements
737-600, -700, -700C, -800, -900, -900ER	D626A001-CMR Maintenance Planning Data Document, Section 9
747-400	D621U400-9 Maintenance Planning Data Document, Section 9
757	D622N001-9 Maintenance Planning Data Document, Section 9
767	D622T001-9-04 Special Compliance Items/Airworthiness Limitations
777	D622W001-9 Maintenance Planning Data Document, Section 9
747-8	D011U721-02-04 Special Compliance Items/Airworthiness Limitations
787	D011Z009-03-04 Special Compliance Items/Airworthiness Limitations

2. CLEANING OF FAYING SURFACES

A. Cleaning Procedure 1 - Abrasives Applied Manually

Table 8
ABRASIVE MATERIALS

Description	Specification	Supplier
Scotch-Brite Pad	Type A Very Fine	3M
Garnet Sandpaper	ANSI B74.18	An available source
Wet/Dry Sandpaper	ANSI B74.18 Grit size 280 or finer	An available source

(1) Make a selection of an abrasive material. Refer to Table 8.

(2) Manually apply the abrasive to the specified faying surface or spot area with a circular or an elliptical movement.

Make sure that the area is cleaned until:

- The surface is smooth and even
- Bright metal can be seen.

B. Cleaning Procedure 2 - Stainless Steel Rotary Brush

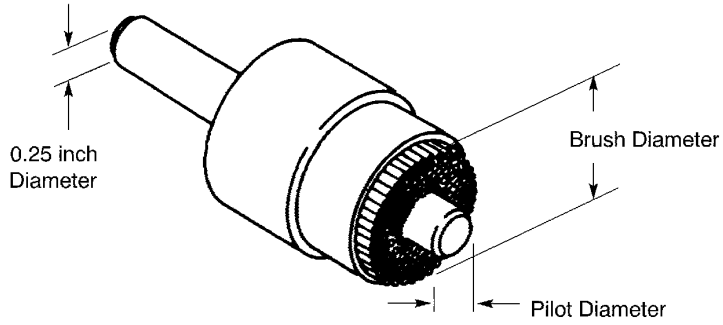
This paragraph gives the procedure to satisfactorily remove:

- Paint from metal
- Alodine, iridite, or light anodize from aluminum.

NOTE: Anodic films can have different thickness and can be difficult to remove with the wire brush. A better alternative for these surfaces is Cleaning Procedure 3. Refer to Paragraph 2.C.

Table 9
STAINLESS STEEL ROTARY BRUSHES

Pilot Diameter (inch)	Brush Diameter (inch)	Brush Wire Size (inch)		Boeing Standard
		Maximum	Minimum	
3/32	1/2	0.005	0.004	ST913K-50-09
1/8	1/2	0.005	0.004	ST913K-50-12
5/32	1/2	0.005	0.004	ST913K-50-16
3/16	1/2	0.005	0.004	ST913K-50-19
	3/4	0.006	0.005	ST913K-75-19
	1.0	0.008	0.006	ST913K-100-19
1/4	11/32	0.005	0.004	ST913K-34-24
	3/4	0.006	0.005	ST913K-75-25
	1.0	0.008	0.006	ST913K-100-25
5/16	3/4	0.006	0.005	ST913K-75-31
	1.0	0.008	0.006	ST913K-100-31



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DIMENSIONS OF THE ST913K-() ROTARY BRUSH
Figure 1

Table 10
ROTARY BRUSH COLOR CODES

Bond Surface	Color Code	
	Color	Identification
Aluminum	-	-
Composite	Red	J7-42-5600
Magnesium	Green	J7-42-5700
Stainless Steel	Blue	J7-42-5200

Table 11
APPROVED SUPPLIERS OF BOEING STANDARD ROTARY BRUSHES

Boeing Specification	Supplier
ST913K-()	Alvord-Polk Tool Company

(1) Make a selection of a rotary brush from Table 9.

Make sure that the brush:

- Has the correct size to clean the specified area
- Has the correct color for the type of bond surface; refer to Table 10.

CAUTION: DO NOT USE A CARBON STEEL BRUSH. DAMAGE FROM CORROSION CAN OCCUR BECAUSE OF THE POSSIBLE CONTAMINATION OF THE SURFACE OF THE MATERIAL WITH PARTICLES FROM THE BRUSH.

CAUTION: DO NOT USE A BRUSH THAT IS SPECIFIED FOR A DIFFERENT BOND SURFACE.

(2) Put the brush in a drill motor or an applicable drive.

(3) Clean the specified area:

(a) Apply the brush to the bond surface for a short time.

Make sure to keep the cleaning surface of the brush parallel to the bond surface.

(b) Examine the bond surface.

Make sure that the bond surface is clean.

(c) If the bond surface is not clean, do Step (a) and Step (b) again until the specified area is fully clean.

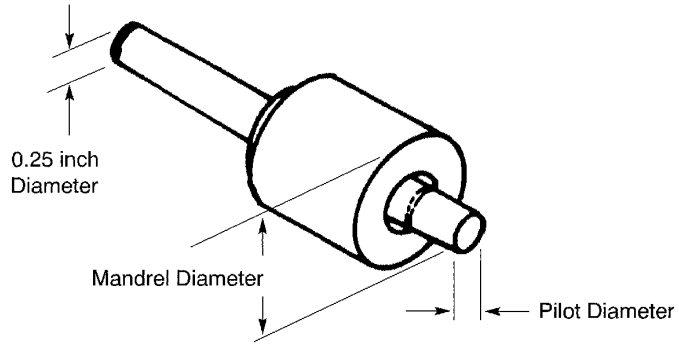
CAUTION: MAKE SURE TO KEEP THE LOSS OF MATERIAL OF THE BOND SURFACE TO A MINIMUM.

C. Cleaning Procedure 3 - Rotary Abrasive Disc

This paragraph gives the procedure to satisfactorily remove:

- Anodize
- Iridite
- Alodine
- Skydrol Resistant Finish (SRF)
- Similar hard finishes.

NOTE: Paint can also be removed, but frequent replacement of the abrasive disc is necessary.



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DIMENSIONS OF THE ST913M-() MANDREL
Figure 2

Table 12
MANDRELS FOR ABRASIVE DISCS

Pilot Diameter (inch)	Mandrel Diameter (inch)	Boeing Standard
3/32	1/2	ST913M-50-09
1/8	1/2	ST913M-50-12
5/32	1/2	ST913M-50-16
3/16	1/2	ST913M-50-19
	3/4	ST913M-75-19
	1.0	ST913M-100-19
1/4	11/32	-
	3/4	ST913M-75-25
	1.0	ST913M-100-25
5/16	3/4	ST913M-75-31
	1.0	ST913M-100-31

Table 13
APPROVED SUPPLIERS OF BOEING STANDARD MANDRELS

Boeing Specification	Supplier
ST913M-()	Manufacturing Tool Services
	West Coast Industries

(1) Make a selection of an abrasive disc.

Make sure that the disc has the correct size to clean the specified spot area.

CAUTION: DO NOT USE AN ABRASIVE DISC THAT HAS BEEN USED ON A DIFFERENT TYPE OF BOND SURFACE.

(2) Make a selection of the applicable mandrel from Table 12.

(3) Put the mandrel into a drill motor or an applicable drive.

(4) Put the disc on the mandrel.

(5) Clean the specified area:

(a) Lightly apply the disc to the surface of the material for a short time.

Make sure to keep the cleaning surface of the disc parallel to the surface of the material.

(b) Examine the surface of the disc to see if it is clogged.

If it is necessary, replace the disc.

(c) Examine the bond surface.

Make sure that the bond surface is clean.

(d) If the bond surface is not clean, do Sub-step 5(a) through Sub-step 5(c) again until the specified area is fully clean.

CAUTION: MAKE SURE TO KEEP THE LOSS OF MATERIAL OF THE BOND SURFACE TO A MINIMUM.

D. Cleaning Procedure 4 - Removal of Paint with Lacquer Thinner

NOTE: This procedure is recommended to satisfactorily remove these types of paint from clad aluminum or other metal surfaces:

- MIL-P-6889 primer
- Lacquer-based paint
- Enamel paint.

(1) Apply lacquer thinner or methyl ethyl ketone to the specified area with a clean cotton or linen cloth, or a gauze applicator until the area is fully clean.

Make sure to use a clean part of the cloth each time the thinner is applied.

CAUTION: APPLY THE THINNER ONLY TO THE SPECIFIED AREA OF THE BOND.

(2) Immediately dry the area with another clean cloth.

E. Cleaning Procedure 5 - Removal of Contamination with Cleaning Solvent

NOTE: This procedure is recommended to satisfactorily remove contamination from these types of metal:

- Bare metal
- Clad metal
- Plated metal.

Table 14
SOLVENTS

Solvent	Material	Specification	Supplier
Alcohol	Ethyl Alcohol, Denatured	AMS 3002	An available source
		ASTM E 1145, Type II	An available source
	Isopropyl Alcohol	TT-I-735, Grade A	An available source
		TT-I-735, Grade B	An available source
Ketone	Acetone	ASTM D 329	An available source
		O-A-51	An available source
	Methyl Ethyl Ketone (MEK)	ASTM D 740, Type I	An available source
	Methyl Propyl Ketone (MPK)	BMS11-9, Grades 1 and 2	Boeing QPL
Ester	SkyKleen	SkyKleen 1000	Solutia Inc.
Glycol Ether	Turco 6709	-	Henkel Corp
	Diestone DLS	-	Magchem Inc
	Diestone HFP	-	Magchem Inc
Solvent Mixture	-	BMS11-7	Boeing QPL
		A-A-59281	An available source
		FCC-55	Univar USA Inc.
		CDG-110	Univar USA Inc.
		CDG-211	Univar USA Inc
		70 percent MPK - 30 percent MEK ± 2 percent by Volume	An available source

(1) Make a selection of a solvent. Refer to Table 14.

(2) Apply the cleaning solvent to the bond surfaces with a nonmetallic brush or a cloth applicator.

(3) If it is necessary, scrub the area to remove contamination that can be seen.

CAUTION: DO NOT USE ABRASIVE MATERIALS. IF ABRASIVE MATERIALS ARE USED, DAMAGE TO THE FAYING SURFACE OCCURS.

3. BONDING OF CIRCULAR RECEPTACLE CONNECTORS IN AN UNPRESSURIZED AREA

This paragraph gives the procedures to make an electrical bond between a receptacle connector and the airplane structure or a bracket.

A. General Conditions

An electrical bond of a receptacle and the installation surface is necessary when the bond is specified for the connector.

Refer to:

- The Wiring Diagram for models 707, 727, 737, 747, 757, 767, and 777
- The 787 Schematics and Wiring Data for model 787.

The bond must be assembled again if it is specified, or if one or more of these conditions occur:

- The wire harness is replaced
- The connector is repaired or replaced
- The specified bond has an electrical resistance that is greater than the maximum permitted resistance.

Refer to:

- Paragraph 21.C. for the maximum resistance values
- Paragraph 22.H. for the test procedure for the bond.

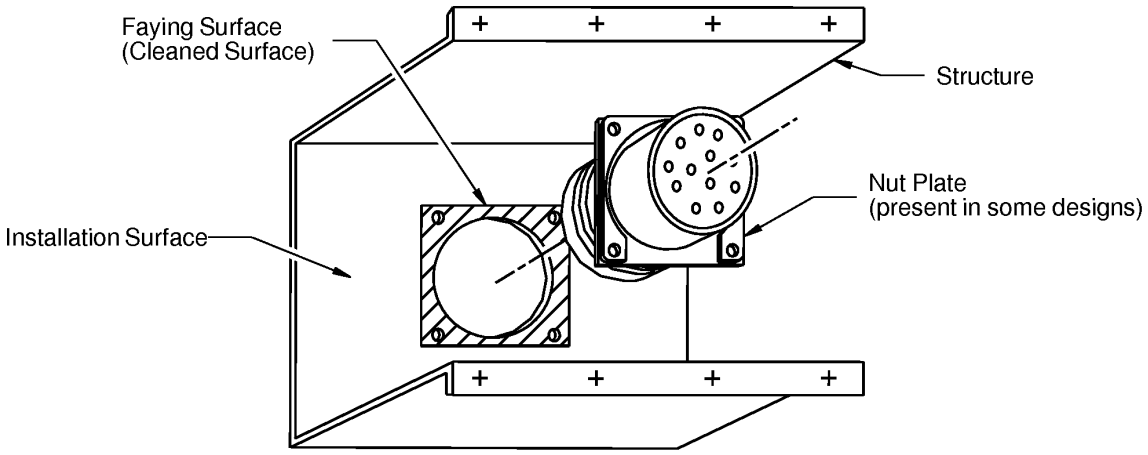
B. Surface Preparation.

Table 15
FAYING SURFACE PREPARATION

Installation Surface	Preparation Procedure	Reference
Aluminum, Alodine Finish	Cleaning Procedure 5 with BMS 11-7 Solvent or Isopropyl Alcohol	Paragraph 2.E.
Aluminum, alodine finish with damage	An Abrasive Cleaning Procedure	Table 16
	Layer of Alodine 600 on the installation surface	SOPM 20-43-03
Aluminum, Bare	An Abrasive Cleaning Procedure	Table 16
	Layer of Alodine 600 on the installation surface	SOPM 20-43-03
Aluminum, non-alodine finish	An Abrasive Cleaning Procedure	Table 16
	Layer of Alodine 600 on the installation surface	SOPM 20-43-03
Composite, Nickel Plated	Cleaning Procedure 5 with BMS 11-7 Solvent or Isopropyl Alcohol	Paragraph 2.E.
Steel, Bare	Cleaning Procedure 5 with BMS 11-7 Solvent or Isopropyl Alcohol	Paragraph 2.E.
Titanium, Bare	Cleaning Procedure 5 with BMS 11-7 Solvent or Isopropyl Alcohol	Paragraph 2.E.

Table 16
ABRASIVE CLEANING PROCEDURES

Cleaning Procedure	Reference
Cleaning Procedure 1 - Abrasives Applied Manually	Paragraph 2.A.
Cleaning Procedure 2 - Stainless Steel, Rotary Bonding Brush	Paragraph 2.B.
Cleaning Procedure 3 - Rotary Abrasive Disc	Paragraph 2.C.



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INSTALLATION SURFACE PREPARATION FOR THE BONDING OF CIRCULAR CONNECTOR RECEPTACLES
Figure 3

(1) To prepare the faying surface:

(a) Clean the faying surface of the structure.

Refer to:

- Table 15 for the procedure to clean the faying surface
- Figure 3 for the area to clean.

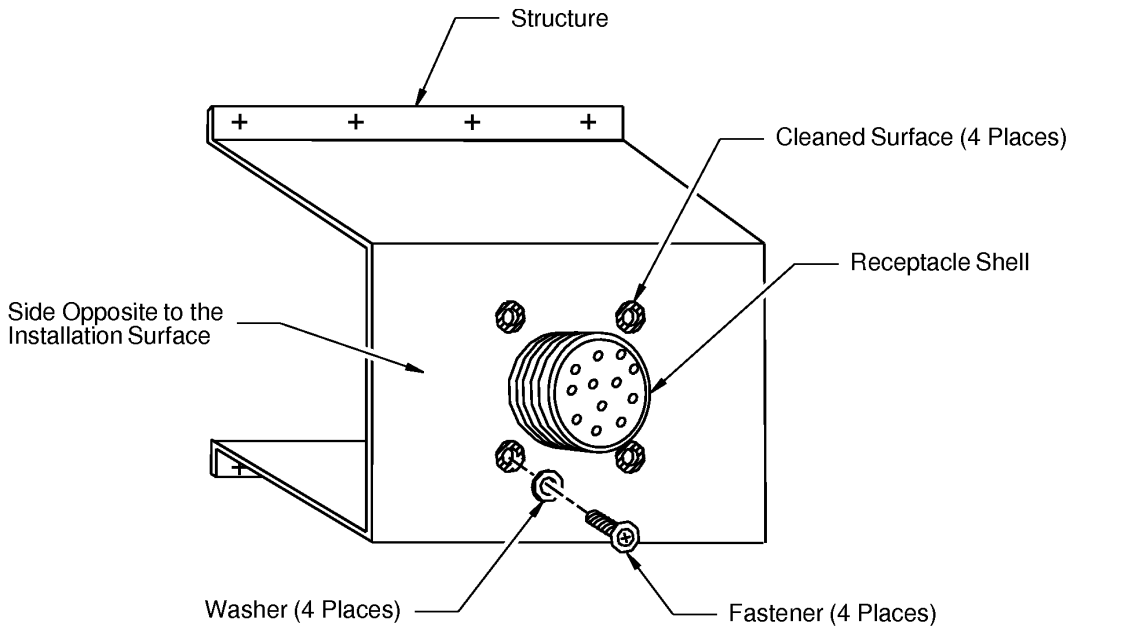
Make sure that the area where the receptacle flange touches the structure is clean.

(b) For an aluminum faying surfaces that are cleaned using Paragraph 2.A., apply Alodine to the faying surface.

(2) Clean the surface that is under the fastener head and washer.

Refer to:

- Table 15 for the procedure to clean the faying surface
- Figure 4 for the area to clean.



OPPOSITE SIDE SURFACE PREPARATION FOR THE BONDING OF CIRCULAR RECEPTACLE CONNECTORS
Figure 4

(a) If the surface is masked, remove the mask.

(b) For aluminum and steel structure, use the cleaning procedure specified in Paragraph 2.A..

Make sure that the area covered by the fastener head and the washer is clean.

CAUTION: DO NOT APPLY ALODINE TO ALUMINUM SURFACE AREA BELOW THE FASTENER HEAD AND WASHER. THESE AREAS ARE TO STAY BARE ALUMINUM.

(c) For nickel plated composite structure, prepare the faying surface with the cleaning procedure specified in Paragraph 2.E..

Make sure that the area below the fastener heads and washers is clean.

(3) Clean both sides of the receptacle. Refer to Paragraph 2.E..

C. Receptacle Installation

NOTE: Installation of the receptacle must be done within 24 hours of surface preparation and cleaning. Refer to Paragraph 3.B. If installation is not done within 24 hours, the surface must be prepared and cleaned again.

(1) Put a washer on each of the four screws. Refer to Figure 4.

(2) To attach the receptacle with lock nuts:

(a) Align the mounting holes of the receptacle flange and the installation surface.

(b) Install each screw from the side opposite to the receptacle flange.

(c) Put a washer and a lock nut on each screw.

(d) Tighten each nut until the nut and washer are against the surface of the receptacle flange.

(e) Tighten each nut a small amount until the faying surface of the receptacle flange is fully flat against the installation surface.

(f) Torque each nut on size 4 fasteners 8 to 15 inch-pounds.

(g) Torque each nut on size 6 fasteners 12 to 15 inch-pounds.

(h) For the torque values of different size fasteners, refer to SOPM 20-50-01.

(3) To attach the receptacle with a nut plate:

(a) Put the nut plate on the receptacle flange.

(b) Align the mounting holes of the nut plate, the receptacle flange, and the installation surface.

(c) From the side opposite to the receptacle flange, engage the threads of the fasteners and the threads of the nut plate.

(d) Tighten each fastener a small amount until the faying surface of the receptacle flange is fully flat against the installation surface.

(e) Torque each nut on size 4 fasteners 8 to 15 inch-pounds.

(f) Torque each nut on size 6 fasteners 12 to 15 inch-pounds.

(g) For the torque values of different size fasteners, refer to SOPM 20-50-01.

(4) Do the test of the electrical bond.

Refer to:

- Paragraph 21.C. for the maximum resistance value
- Paragraph 22.H. for the test procedure.

D. Sealing of a Receptacle Assembly

NOTE: The cure times and tack free times given in Table 17 are applicable for 77 degrees ±5 degrees F and 50 per cent Relative Humidity.

NOTE: The cure time and tack free time:

- Increase at lower temperature and lower humidity
- Decrease at higher temperature and higher humidity.

CAUTION: THE SEALING OF THE RECEPTACLE ASSEMBLY MUST BE DONE WITHIN 7 DAYS OF REMOVAL OF THE ORIGINAL FINISH. SEALING THE ASSEMBLY AFTER 7 DAYS OF REMOVAL OF THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE SEAL.

Table 17
SEALANTS FOR ELECTRICALLY BONDED RECEPTACLE CONNECTORS

Applicable Condition	Cure Time (Hours)	Tack Free Time (Hours)	Part Number	Supplier	Special Instructions
Fuel Tank	2	1	PR 1826 B-1/4	PRC-DeSoto International	Not applicable for clad aluminum
	3	2.5	PR 1826 B-1/2	PRC-DeSoto International	Not applicable for clad aluminum
	8	3	Proseal 860 B-1/6	PRC-DeSoto International	Not applicable for CRES or bare titanium
	48	24	BMS5-26 B-2 Type II	Boeing	-
			BMS5-45 B-2	Boeing	-
	72	36	BMS5-26 A-2 Type II	Boeing	-
Fuel Vapor	2	1	PR 1826 B-1/4	PRC-DeSoto International	Not applicable for clad aluminum
	3	2.5	PR 1826 B-1/2	PRC-DeSoto International	Not applicable for clad aluminum
	8	3	Proseal 860 B-1/6	PRC-DeSoto International	Not applicable for CRES or bare titanium
	20	10	BMS5-95 B-1/2	Boeing	-
	24	10	BMS5-142 B-1/2	Boeing	Not applicable for faying surfaces
		12	BMS5-37 B-2	Boeing	-
	48	24	BMS5-26 B-2 Type II	Boeing	-
			BMS5-45 B-2	Boeing	-
			BMS5-142 B-2	Boeing	Not applicable for faying surfaces
		36	BMS5-95 B-2	Boeing	-
	72	36	BMS5-26 A-2 Type II	Boeing	-

Table 17 SEALANTS FOR ELECTRICALLY BONDED RECEPTACLE CONNECTORS (Continued)

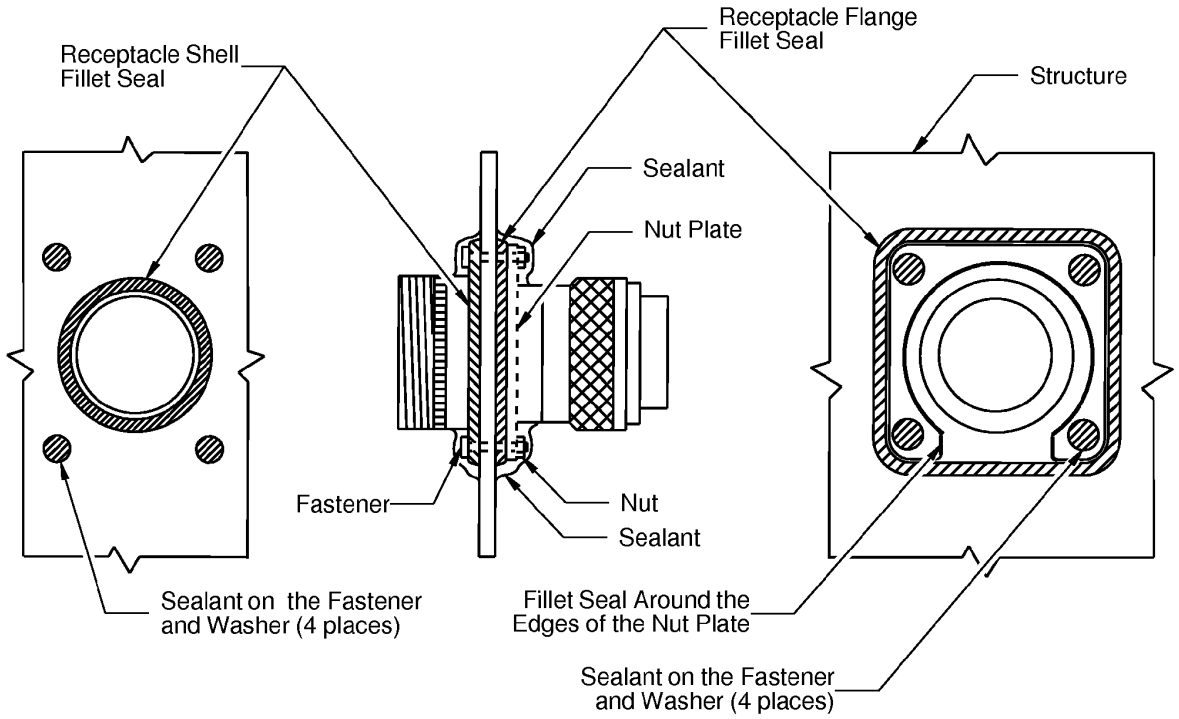
Applicable Condition	Cure Time (Hours)	Tack Free Time (Hours)	Part Number	Supplier	Special Instructions
Other Areas	2	1	PR 1826 B-1/4	PRC-DeSoto International	Not applicable for clad aluminum
	3	2.5	PR 1826 B-1/2	PRC-DeSoto International	Not applicable for clad aluminum
	8	3	Proseal 860 B-1/6	PRC-DeSoto International	Not applicable for CRES or bare titanium
	20	10	BMS5-95 B-1/2	Boeing	-
	24	10	BMS5-142 B-1/2	Boeing	Not applicable for faying surfaces
		12	BMS5-37 B-2	Boeing	-
	48	24	BMS5-26 B-2 Type II	Boeing	-
			BMS5-45 B-2	Boeing	-
			BMS5-142 B-2	Boeing	Not applicable for faying surfaces
		36	BMS5-95 B-2	Boeing	-
	72	36	BMS5-26 A-2 Type II	Boeing	-

Table 18
APPROVED SUPPLIERS OF BOEING STANDARD SEALANTS

Part Number	Supplier
BMS5-26 A-2 Type II	Courtaulds Aerospace
BMS5-26 B-2 Type II	Courtaulds Aerospace
BMS5-37 B-2	PRC-DeSoto International
BMS5-45 B-2	Le Joint Francais
	PRC-DeSoto International
	Yokohama Rubber
BMS5-95 B-1/2	PRC-DeSoto International
BMS5-95 B-2	Le Joint Francais
	PRC-DeSoto International
	Yokohama Rubber
BMS5-142 B-1/2	PRC-DeSoto International
BMS5-142 B-2	PRC-DeSoto International

Table 19
FINISH MATERIALS

Description	Specification	Supplier
Chemical Conversion Coating	Alodine 600	Henkel
		Nihon Parkerizing



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SEALING A RECEPTACLE CONNECTOR BOND IN AN UNPRESSURIZED AREA
Figure 5

(1) Make a selection of a sealant from Table 17.

NOTE: The cure times and tack free times given in Table 17 are applicable for 77 ±5 degrees F AND 50% relative humidity.

NOTE: The cure time and tack free time:

- Increase at lower temperature and lower humidity
- Decrease at higher temperature and higher humidity.

(2) Apply a fillet seal to the following areas shown in Figure 5.

- The area around the receptacle flange
- The area around the receptacle shell
- If a nut ring is used, apply a fillet seal around all edges of the nut ring flange
- The fastener, washer, and installation surface joints.

NOTE: It is permitted to seal the fastener heads and washers.

NOTE: It is permitted to seal the nut ring flange, nuts, washers, and connector receptacle barrel with sealant. Refer to Figure 5. sealant on the backshell coupling nut is permitted. Do not apply sealant to the knurled area of the backshell coupling nut.

CAUTION: THE SEALING OF THE RECEPTACLE ASSEMBLY MUST BE DONE WITHIN 7 DAYS OF REMOVAL OF THE ORIGINAL FINISH. SEALING THE ASSEMBLY AFTER 7 DAYS OF REMOVAL OF THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE SEAL.

(3) If the area adjacent to the seal has bare metal, replace the surface finish on the bare metal. Refer to Paragraph 1.D.

NOTE: If an aluminum part had an anodized surface that was removed during the surface preparation, it is permitted to manually apply chemical conversion coating on the bare metal. Refer to Table 19.

(4) Let the sealant cure.

NOTE: The full cure of a sealant is recommended, but the sealant is serviceable when:

- It is tack free
- It is in an area where wind shear does not occur.

4. BONDING OF CIRCULAR RECEPTACLE CONNECTORS IN A PRESSURIZED AREA

A. General Conditions

For the general conditions applicable to the electrical bonding of circular connectors in a pressurized area, refer to Paragraph 3.A.

B. Surface Preparation

(1) To prepare the faying surface:

(a) Clean the faying surface of the structure.

Refer to:

- Table 15 for the procedure to clean the faying surface
- Figure 5 for the area to clean.

Make sure that the area where the receptacle flange touches the structure is clean.

(b) For an aluminum faying surface that are cleaned using Paragraph 2.A., apply Alodine to the faying surface.

(2) To prepare the surface that is under the fastener head and washer:

(a) Prepare the faying surface. Refer to Table 6.

Make sure that the area covered by the fastener head and the washer is clean. Refer to Figure 5.

(3) For an aluminum faying surface that is cleaned using Paragraph 2.A., apply Alodine to the faying surface.

(4) Clean both sides of the receptacle. Refer to Paragraph 2.E.

C. Receptacle Installation

NOTE: Installation of the receptacle must be done within 24 hours of surface preparation and cleaning. If installation is not done within 24 hours, the surface must be prepared and cleaned again.

(1) Put a washer on each of the four screws.

(2) To attach the receptacle with lock nuts:

(a) Align the mounting holes of the receptacle flange and the installation surface.

(b) Install each screw from the side opposite to the receptacle flange. Refer to Figure 4.

(c) Put a washer and a lock nut on each screw.

(d) Tighten each nut until the nut and washer are against the surface of the receptacle flange.

(e) Tighten each nut a small amount until the faying surface of the receptacle flange is fully flat against the installation surface.

(f) Torque each nut on size 4 fasteners 8 to 15 inch-pounds.

(g) Torque each nut on size 6 fasteners 12 to 15 inch-pounds.

(h) For the torque values of different size fasteners, refer to SOPM 20-50-01.

(3) To attach the receptacle with a nut plate:

(a) Put the nut plate on the receptacle flange. Refer to Figure 3.

(b) Align the mounting holes of the nut plate, the receptacle flange, and the installation surface.

(c) From the side opposite to the receptacle flange, engage the threads of the fasteners and the threads of the nut plate.

(d) Tighten each fastener a small amount until the faying surface of the receptacle flange is fully flat against the installation surface.

(e) Torque each nut on size 4 fasteners 8 to 15 inch-pounds.

(f) Torque each nut on size 6 fasteners 12 to 15 inch-pounds.

(g) For the torque values of different size fasteners, refer to SOPM 20-50-01.

(4) Do the test of the electrical bond.

Refer to:

- Paragraph 21.C. for the maximum resistance value
- Paragraph 22.H. for the test procedure.

NOTE: Perform the test of the electrical bond within 24 hours of surface preparation.

(5) Apply the finish to bare metal areas around the receptacle flange and fastener head and washers. Refer to Paragraph 1.E.

NOTE: If an aluminum that had an anodized surface was cleaned and the anodized finish was removed, manually apply chemical conversion coating to the bare metal.

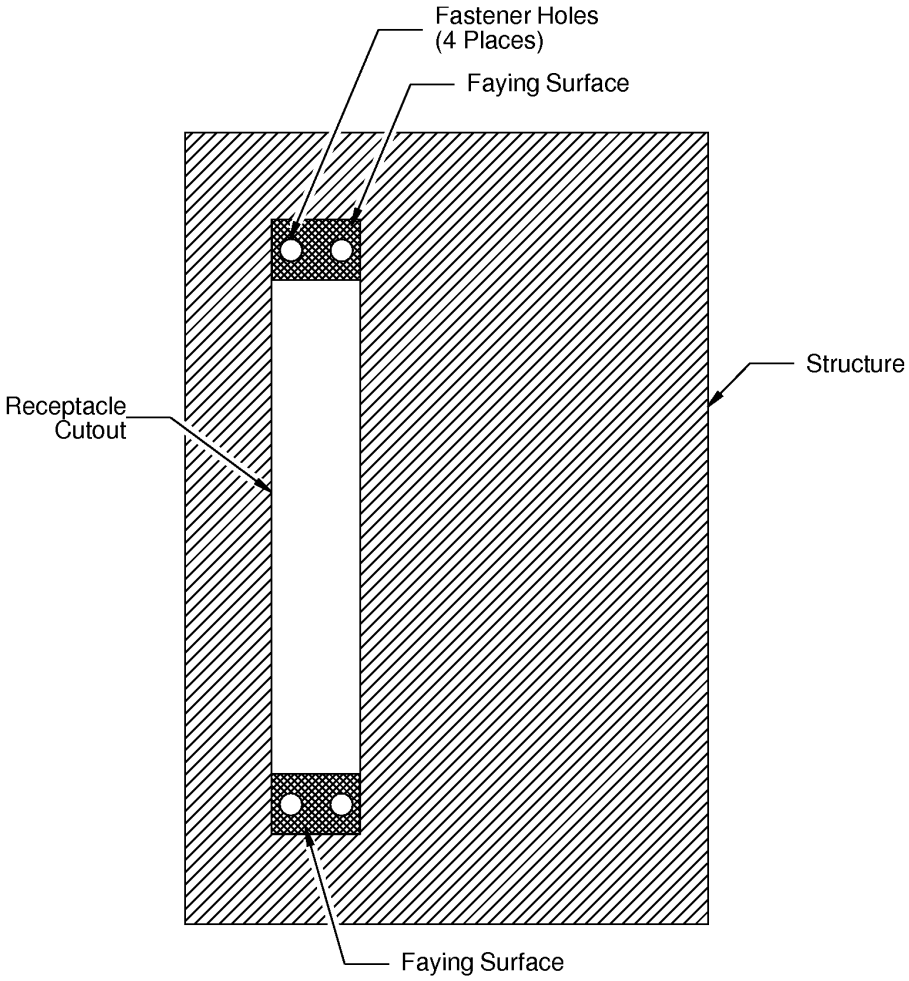
CAUTION: APPLY ALL FINISHES WITHIN 7 DAYS OF WHEN THE ORIGINAL FINISH WAS REMOVED. FINISHES APPLIED AFTER 7 DAYS OF REMOVING THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

5. BONDING OF BACC65AB, BACC65AP, AND BACC65AV RECEPTACLE CONNECTORS IN AN UNPRESSURIZED AREA

A. General Conditions

For the general conditions applicable to the electrical bonding of BACC65AB, BACC65AP, and BACC65AV receptacle connectors in an unpressurized area, refer to Paragraph 3.A.

B. Preparation of the Faying Surface



PREPARATION OF THE FAYING SURFACE
Figure 6

(1) To prepare the faying surface:

(a) Clean the faying surface of the structure.

Refer to:

- Table 15 for the procedure to clean the faying surface
- Figure 6 for the area to clean.

Make sure that the area where the receptacle flange touches the structure is clean.

(b) For an aluminum faying surface that are cleaned using Paragraph 2.A., apply Alodine to the faying surface.

(2) To prepare the surface that is under the fastener head and washer:

(a) For aluminum and steel structure, use the cleaning procedure specified in Paragraph 2.A..

Make sure that the area covered by the fastener head and the washer is clean.

CAUTION: DO NOT APPLY ALODINE TO ALUMINUM SURFACE AREA BELOW THE FASTENER HEAD AND WASHER. THESE AREAS ARE TO STAY BARE ALUMNINUM.

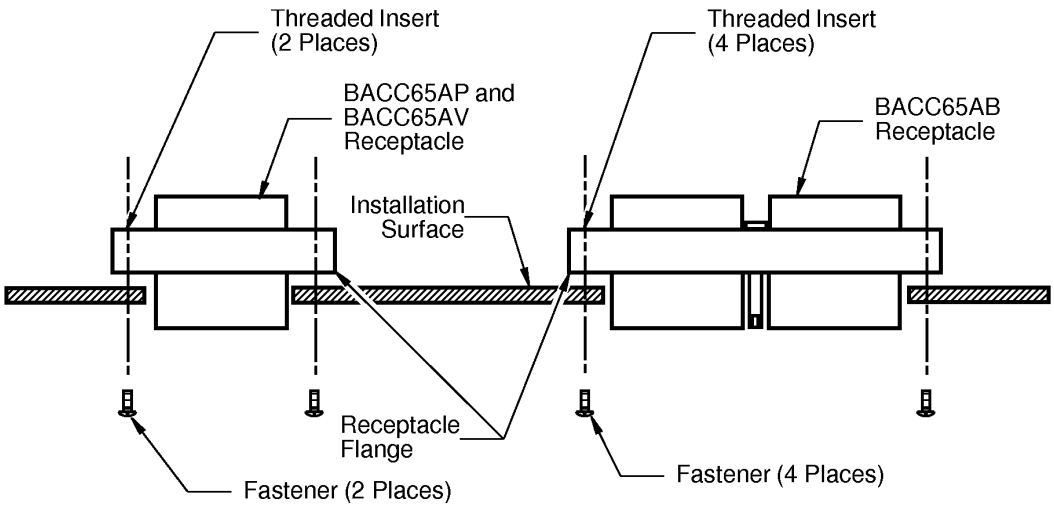
(b) For nickel plated composite structure, prepare the faying surface with the cleaning procedure specified in Paragraph 2.E..

Make sure that the area below the fastener heads and washers is clean.

(3) Clean both sides of the receptacle. Refer to Paragraph 2.E.

C. Receptacle Installation

NOTE: Installation of the receptacle must be done within 24 hours of surface preparation and cleaning. If installation is not done within 24 hours, the surface must be prepared and cleaned again.



RECEPTACLE INSTALLATION
Figure 7

(1) Align the mounting holes of the receptacle flange and the installation surface. Refer to Figure 7.

(2) Install each fastener from the side opposite to the receptacle flange.

(3) Tighten each fastener until the fastener head is against the surface of the mounting structure.

(4) Tighten each fastener a small amount until the faying surface of the receptacle flange is fully flat against the installation surface.

(5) Torque each nut on size 6 fasteners 12 to 15 inch-pounds.

(6) For the torque values of different size fasteners, refer to SOPM 20-50-01.

(7) Do a test of the electrical resistance.

Refer to:

- Paragraph 21.C. for the maximum resistance value
- Paragraph 22.H. for the test procedure.

NOTE: Perform the test of the electrical bond within 24 hours of surface preparation.

D. Sealing of a Receptacle Assembly

CAUTION: THE SEALING OF THE RECEPTACLE ASSEMBLY MUST BE DONE WITHIN 7 DAYS OF REMOVAL OF THE ORIGINAL FINISH. SEALING THE ASSEMBLY AFTER 7 DAYS OF REMOVAL OF THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE SEAL.

(1) Make a selection of a sealant from Table 17.

NOTE: The cure times and tack free times given in Table 17 are applicable for 77 degrees ± 5 degrees F and 50% Relative Humidity.

NOTE: The cure time and tack free time:

- Increase at lower temperature and lower humidity
- Decrease at higher temperature and higher humidity.

(2) Apply a fillet seal to the following areas:

- The area around the receptacle flange
- The fastener, washer, and installation surface joints.

NOTE: It is permitted to seal the fastener heads.

NOTE: It is permitted to seal the nuts and washers with sealant. Refer to Figure 7.

CAUTION: THE SEALING OF THE RECEPTACLE ASSEMBLY MUST BE DONE WITHIN 7 DAYS OF REMOVAL OF THE ORIGINAL FINISH. SEALING THE ASSEMBLY AFTER 7 DAYS OF REMOVAL OF THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE SEAL.

(3) If the area adjacent to the seal has bare metal, replace the surface finish on the bare metal. Refer to Paragraph 1.D.

NOTE: If an aluminum part had an anodized surface that was removed during the surface preparation, it is permitted to manually apply chemical conversion coating on the bare metal. Refer to Table 19.

CAUTION: APPLY ALL FINISHES WITHIN 7 DAYS OF WHEN THE ORIGINAL FINISH WAS REMOVED. FINISHES APPLIED AFTER 7 DAYS OF REMOVING THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

(4) Let the sealant cure.

NOTE: The full cure of a sealant is recommended, but the sealant is serviceable when:

- It is tack free

- It is in an area where wind shear does not occur.

6. BONDING OF BACC65AB, BACC65AP, AND BACC65AV AND MTCPQKT RECEPTACLE CONNECTORS IN A PRESSURIZED AREA

A. General Conditions

For the general conditions applicable to the electrical bonding of BACC65AB, BACC65AP, and BACC65AV receptacle connectors in a pressurized area, refer to Paragraph 3.A.

B. Preparation of the Faying Surface

(1) To prepare the faying surface:

(a) Clean the faying surface of the structure.

Refer to:

- Table 15 for the procedure to clean the faying surface
- Figure 7 for the area to clean.

Make sure that the area where the receptacle flange touches the structure is clean.

(b) For an aluminum faying surface that are cleaned using Paragraph 2.A., apply Alodine to the faying surface.

(2) To prepare the surface that is under the fastener head:

(a) If the surface is masked, remove the mask.

(b) For an aluminum faying surface that is cleaned using Paragraph 2.A., apply Alodine to the faying surface.

(3) Clean both sides of the receptacle. Refer to Paragraph 2.E.

C. BACC65AB, BACC65AP, and BACC65AV Receptacle Installation

NOTE: Installation of the receptacle must be done within 24 hours of surface preparation and cleaning. If installation is not done within 24 hours, the surface must be prepared and cleaned again.

(1) Align the mounting holes of the receptacle flange and the installation surface. Refer to Figure 7.

(2) Install each fastener from the side opposite to the receptacle flange.

(3) Tighten each fastener until the fastener head is against the surface of the mounting structure.

(4) Tighten each fastener a small amount until the faying surface of the receptacle flange is fully flat against the installation surface.

(5) Torque each nut on size 6 fasteners 12 to 15 inch-pounds.

(6) For the torque values of different size fasteners, refer to SOPM 20-50-01.

(7) Do a test of the electrical resistance.

Refer to:

- Paragraph 21.C. for the maximum resistance value
- Paragraph 22.H. for the test procedure.

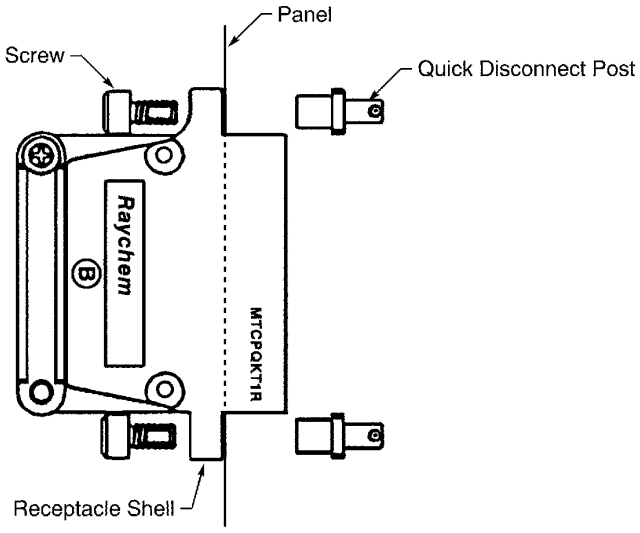
NOTE: Perform the test of the electrical bond within 24 hours of surface preparation.

(8) If the area adjacent to the seal has bare metal, replace the surface finish on the bare metal. Refer to Paragraph 1.D.

NOTE: If an aluminum part had an anodized surface that was removed during the surface preparation, it is permitted to manually apply chemical conversion coating on the bare metal. Refer to Table 19.

CAUTION: APPLY ALL FINISHES WITHIN 7 DAYS OF WHEN THE ORIGINAL FINISH WAS REMOVED. FINISHES APPLIED AFTER 7 DAYS OF REMOVING THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

D. MTCPQKT Receptacle Installation



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INSTALLATION OF THE RECEPTACLE
Figure 8

NOTE: Installation of the receptacle must be done within 24 hours of surface preparation and cleaning. If installation is not done within 24 hours, the surface must be prepared and cleaned again.

(1) Align the mounting holes of the receptacle flange and the installation surface. Refer to Figure 8.

(2) Install the quick disconnect posts on the opposite side of the receptacle flange.

(3) Torque each fastener 18 to 22 inch-pounds.

(4) Do a test of the electrical resistance.

Refer to:

- Paragraph 21.C. for the maximum resistance value

• Paragraph 22.H. for the test procedure.

NOTE: Perform the test of the electrical bond within 24 hours of surface preparation.

(5) If the area adjacent to the seal has bare metal, replace the surface finish on the bare metal. Refer to Paragraph 1.D.

NOTE: If an aluminum part had an anodized surface that was removed during the surface preparation, it is permitted to manually apply chemical conversion coating on the bare metal. Refer to Table 19.

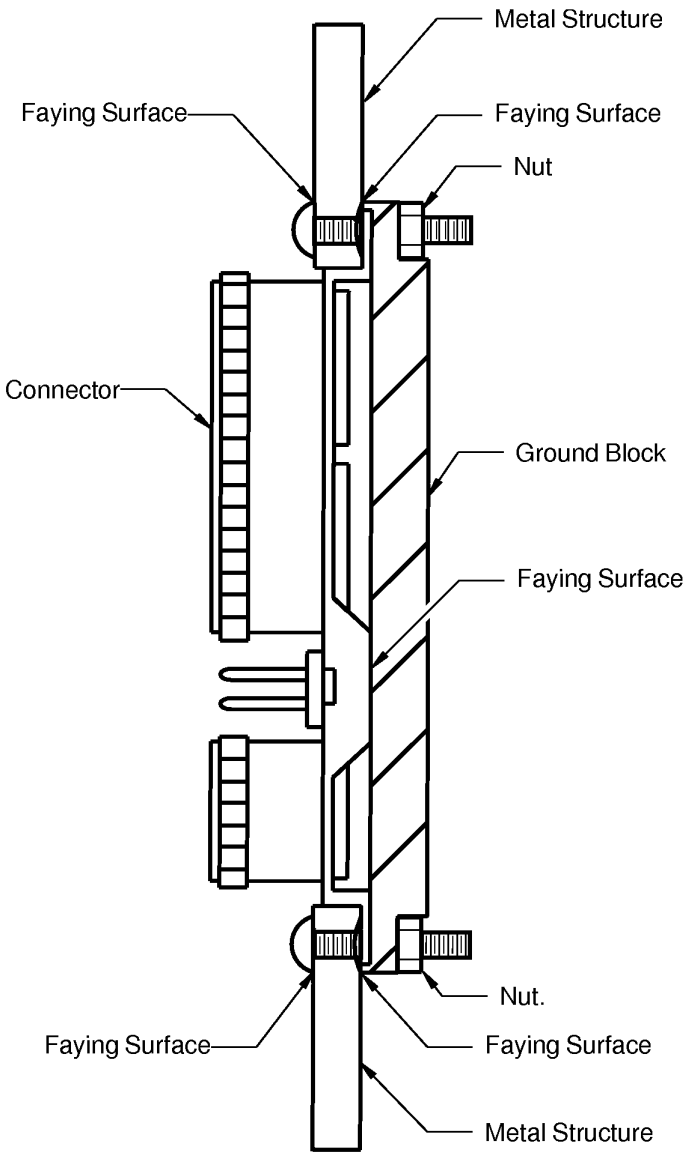
CAUTION: APPLY ALL FINISHES WITHIN 7 DAYS OF WHEN THE ORIGINAL FINISH WAS REMOVED. FINISHES APPLIED AFTER 7 DAYS OF REMOVING THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

7. BONDING OF ARINC 404 AND 600 SERIES PLUG CONNECTORS IN A PRESSURIZED AREA

A. General Conditions

For the general conditions applicable to the electrical bonding of ARINC 404 and 600 series plug connectors in a pressurized area, refer to Paragraph 3.A.

B. Preparation of the Faying Surface



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INSTALLATION OF THE ARINC 600 CONNECTOR
Figure 9

(1) To prepare the faying surface that mates with the fastener bolt head:

(a) Clean the faying surface of the structure.

Refer to:

- Table 15 for the procedure to clean the faying surface
- Figure 9 for the area to clean.

Make sure that the area where the fastener head touches the structure is clean.

(b) For an aluminum faying surface that are cleaned using Paragraph 2.A., apply Alodine to the faying surface.

(2) To prepare the surface that is under the fastener head:

(a) For an aluminum faying surface that is cleaned using Paragraph 2.A., apply Alodine to the faying surface.

(3) Clean both sides of the plug flange. Refer to Paragraph 2.E.

C. Plug Installation

NOTE: Installation of the receptacle must be done within 24 hours of surface preparation and cleaning. If installation is not done within 24 hours, the surface must be prepared and cleaned again.

(1) Align the mounting holes of the plug flange and the installation surface. Refer to Figure 9.

(2) Install each fastener from the side opposite to the plug flange.

(3) Tighten each fastener until the fastener head is against the surface of the mounting structure.

(4) Tighten each fastener a small amount until the faying surface of the receptacle flange is fully flat against the installation surface.

(5) Torque each nut 6 to 8 inch-pounds.

(6) Do a test of the electrical resistance.

Refer to:

- Paragraph 21.C. for the maximum resistance value
- Paragraph 22.H. for the test procedure.

NOTE: Perform the test of the electrical bond within 24 hours of surface preparation.

(7) Apply the finish to bare metal areas around the plug flange and fastener head and nut. Refer to Paragraph 1.E.

NOTE: If an aluminum part that had an anodized surface was cleaned and the anodized finish was removed, manually apply chemical conversion coating to the bare metal.

CAUTION: APPLY ALL FINISHES WITHIN 7 DAYS OF WHEN THE ORIGINAL FINISH WAS REMOVED. FINISHES APPLIED AFTER 7 DAYS OF REMOVING THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

8. CLAMP AND TUBE OR CONDUIT BONDS

This paragraph gives the procedures to make a sealed electrical bond between a tube or a conduit and a clamp.

A. Necessary Materials

NOTE: The cure times and the tack free times that are specified in Table are applicable for 77 degrees F ±5 degrees F and 50 percent relative humidity.

NOTE: The cure time and tack free time of ground stud sealants:

- Increase at lower temperature and lower humidity
- Decrease at higher temperature and higher humidity.

Table 20
CLAMP PART NUMBERS FOR DIFFERENT TUBE MATERIALS

Tube Material	Clamp		
	Part Number	Finish	Supplier
Aluminum	AN735DC()	MIL-C-5541, Class 3, Gold Color	QPL
Cadmium Plated Steel	AN735DC()	MIL-C-5541, Class 3, Gold Color	QPL
CRES	AN735C()	Passivated	QPL
Titanium	AN735C()	Passivated	QPL

Table 21
PARTS FOR CLAMP INSTALLATION ON ALUMINUM TUBE OR CONDUIT

Stud Size	Hardware	Part Number
10-32 (3/16)	Fastener	BACS12GU3K()
		BACS12HN3-()
	Nut, Self-Locking	BACN10YR3CD
	Washer, Corrosion Protective	NAS1149D0316H
	Washer, Pressure	NAS1149D0316H

Table 22
PARTS FOR CLAMP INSTALLATION ON STAINLESS STEEL OR TITANIUM TUBE OR CONDUIT

Stud Size	Hardware	Part Number
10-32 (3/16)	Fastener	BACS12HN3U()
	Nut, Self-Locking	BACS10JC3CM
	Washer, Corrosion Protective	BACW10BP3APU
	Washer, Pressure	BACW10BP3APU

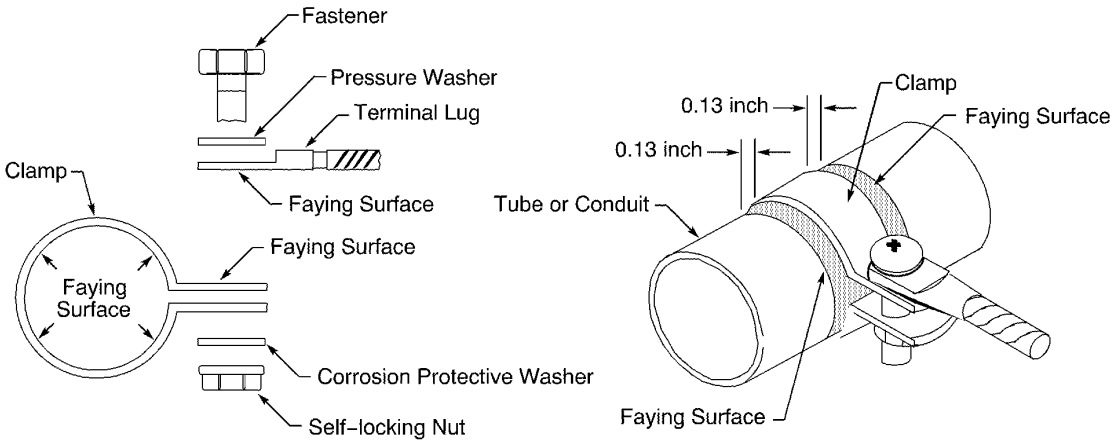
Table 23
SELECTION OF SEALANTS

Bond Location	Sealant	Supplier
Fuel Tank Areas or Areas Exposed to Fuel Vapors	BMS5-45, Class B	QPL
All Other Areas	BMS5-95, Class B	QPL
	BMS5-142, Class B	QPL

Table 24
SOLVENTS

Material	Specification	Supplier
Acetone	0-A-51	An available source
	ASTM D 329	An available source
Ethyl Alcohol, Denatured	AMS 3002	An available source
	ASTM E 1145, Type II	An available source
Alcohol, Isopropyl	TT-I-735, Grade A	An available source
	TT-I-735, Grade B	An available source
Naptha, Aliphatic	TT-N-95, Type II	An available source
Methyl Ethyl Ketone	ASTM D 740, Type I	An available source

B. Preparation of the Faying Surfaces



FAYING SURFACE PREPARATION
Figure 10

Refer to Figure 10.

(1) Clean the faying surfaces of the clamp, the tube or conduit, and the terminal. Refer to Paragraph 2.E.

Make sure that you clean these surfaces:

- The inside surface of the clamp
- The surface of the tube or conduit that touches the inside surface of the clamp
- The surface of the clamp that touches the terminal lug
- The surface of the clamp that touches the pressure washer and the corrosion protective washer
- The surface of the terminal lug that touches the pressure washer and the clamp.

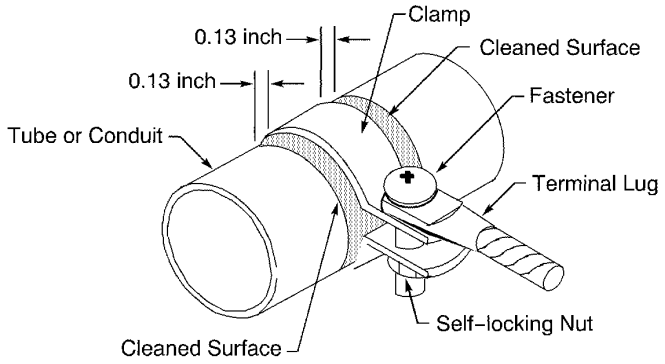
(2) If the tube or conduit has a layer of corrosion inhibiting compound, remove the compound from an area that is 0.10 inch larger on all sides than the area of the faying surface. Refer to Paragraph 2.E.

(3) Clean an area that is 0.13 inches larger on all sides than the area of the faying surface. Refer to Paragraph 2.

C. Installation of the Clamp

Table 25
TORQUE VALUES FOR SELF-LOCKING NUTS

Installation Hardware Material		Fastener Size	Torque (inch-pounds)	
Terminal Lug	Clamp		Minimum	Maximum
Tin Plated Copper	Aluminum	10-32	28	35
		1/4-28	65	70
		5/16-24	135	145
		3/8-24	180	200
		1/2-20	480	520
Nickel Plated Copper	Stainless Steel or Titanium	10-32	33	40
		1/4-28	90	105
		5/16-24	170	200
		3/8-24	300	350
		1/2-20	730	840



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CLAMP INSTALLALTION
Figure 11

Refer to Figure 11.

(1) Put the clamp on the tube or conduit assembly.
Make sure that the cleaned surface extends 0.13 inch farther than the sides of the clamp.

(2) Align the holes of the clamp and the terminal lug.

(3) Install the fastener and the self-locking nut.

(4) Torque the nut. Refer to Table 25.

CAUTION: MORE THAN THE NECESSARY AMOUNT OF TORQUE MUST NOT BE APPLIED. DAMAGE TO THE TUBE OR CONDUIT CAN OCCUR.

(5) Do a test of the electrical resistance.

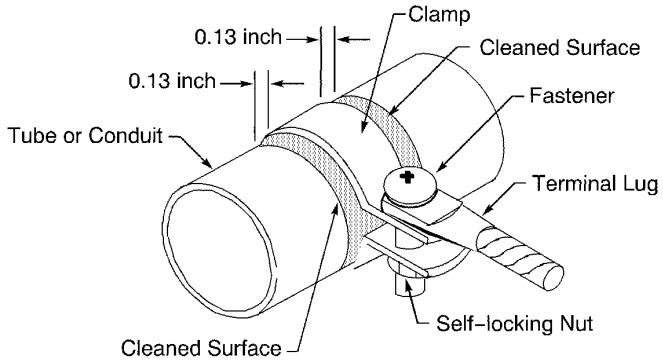
Refer to:

- Paragraph 21.G. for the maximum resistance value
- Paragraph 22.G. for the test procedure.

(6) Replace the finish of the tube or conduit. Refer to Paragraph 1.E.

CAUTION: APPLY ALL FINISHES WITHIN 7 DAYS OF WHEN THE ORIGINAL FINISH WAS REMOVED. FINISHES APPLIED AFTER 7 DAYS OF REMOVING THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

D. Sealing of the Clamp and Terminal



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CLAMP INSTALLALTION
Figure 12

Refer to Figure 12.

(1) If the original clamp and terminal were sealed then the replacement clamp and terminal must be sealed.

If the original clamp and terminal were not sealed, then go to Step 8.D.(6).

(2) Make a selection of a sealant. Refer to Table 23.

Make sure that you choose a sealant that is applicable for the area the clamp is located in.

(3) Make a selection of a tool to apply the sealant.

Make sure that the tool can:

- Make a small fillet
- Can make a smooth, continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

(4) Apply a continuous layer of sealant to: the edge of the clamp and the surface of the tube or conduit.

- The edge of the clamp and the surface of the tube or conduit
- The terminal and the clamp.

NOTE: It is satisfactory to encapsulate the fastener head, nut, and threads.

(5) Do a test of the electrical resistance.

Refer to:

- Paragraph 21.G. for the maximum resistance value
- Paragraph 22.G. for the test procedure.

(6) Replace the finish of the tube or conduit. Refer to Paragraph 1.E.

CAUTION: APPLY ALL FINISHES WITHIN 7 DAYS OF WHEN THE ORIGINAL FINISH WAS REMOVED. FINISHES APPLIED AFTER 7 DAYS OF REMOVING THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

9. ELECTRICAL BONDING - TUBE BULKHEAD FITTING INSTALLATIONS

A. General Conditions

The following data must be known before you begin this procedure:

- The procedure to prepare the tubes
- The area of the fitting and the area of the structure that need to be prepared
- The procedure to install externally swaged bulkhead hydraulic fittings
- The procedure to install flareless bulkhead fittings
- The material and the finish of the parts to be joined
- If refinishing is necessary.

B. Surface Preparation and Installation

(1) Clean the mating surfaces. Refer to Paragraph 2.E..

CAUTION: MAKE SURE THAT THE ENTIRE AREA OF THE PARTS THAT TOUCH ARE CLEAN.

CAUTION: COMPLETE THE INSTALLATION AND RESISTANCE MEASUREMENT WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE INSTALLATION IS NOT COMPLETED WITHING 24 HOURS OF SURFACE CLEANING, THE SURFACES MUST BE CLEANED AGAIN.

(a) For externally swaged bulkhead fittings, clean the mating surfaces between the structure and the fitting and the mating surfaces between the structure and the washer. Refer to Figure 13.

(b) For flareless bulkhead fittings, clean the mating surfaces between the structure and the fitting. Refer to Figure 14.

(2) If the surface finish has CIC, remove the CIC a minimum of 0.10 inch around the area where the surface finish is removed.

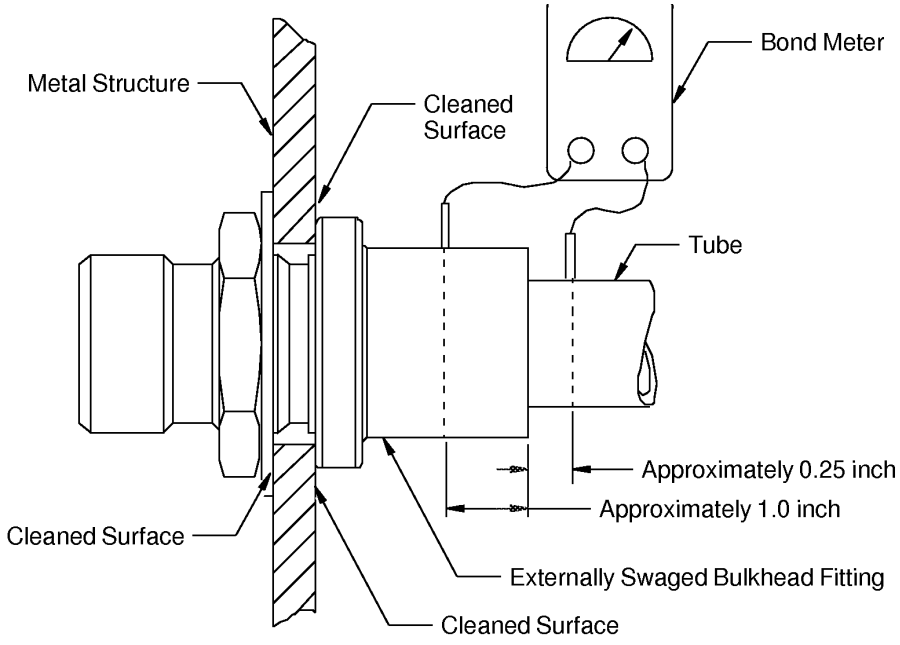
Make sure that you use the solvent cleaning method. Refer to Paragraph 2.E..

CAUTION: DO NOT ALLOW THE MATING SURFACES TO BE CONTAMINATED. CONTAMINATION CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

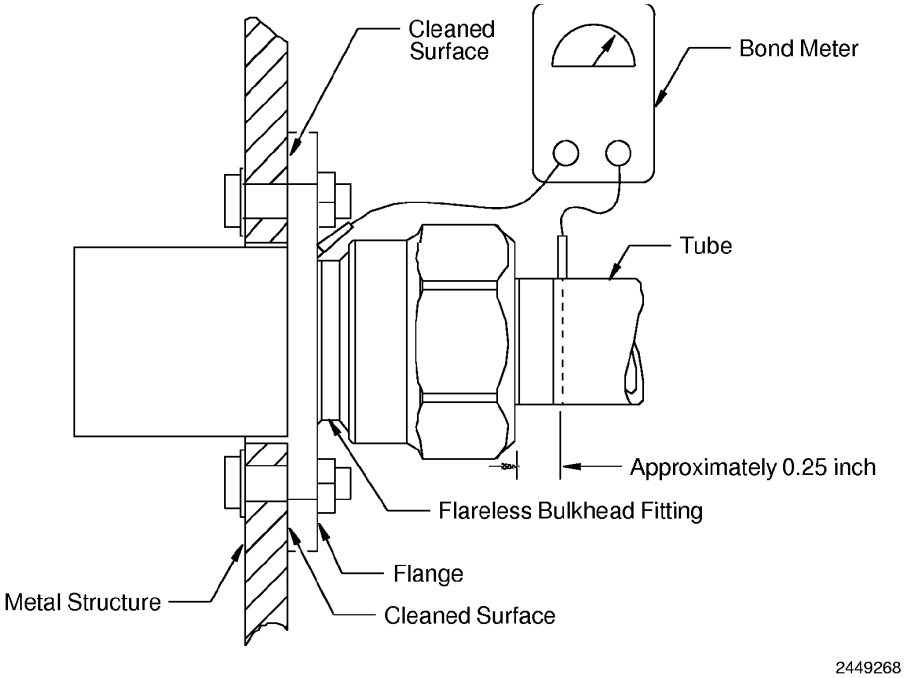
(3) Install the fittings:

(a) For externally swaged bulkhead fittings, Refer to Figure 13.

(b) For flareless bulkhead fittings, Refer to Figure 14



INSATLLATION OF AN EXTERNALLY SWAGED BULKKHEAD FITTING
Figure 13



INSTALLATION OF A FLARELESS BULKHEAD FITTING
Figure 14

(4) Perform a test of the electrical resistance between the bulkhead fitting to the tube.

Refer to:

- Paragraph 21.Q. for the maximum resistance value
- Paragraph 22.Q. for the procedure to perform the test.

(5) If the resistance is more that the maximum resistance:

(a) Disassemble the static discharge assembly installation.

(b) Perform Step 9.B.(1) through Step 9.B.(4) again.

(6) Refinish any bare structure surface. Refer to Paragraph 1.E..

10. ELECTRICAL BONDING OF CARBON FIBER REINFORCED PLASTIC (CFRP) STRUCTURE

This paragraph gives the procedure for the bond of carbon fiber reinforced plastic (CFRP) structure to a second CFRP or metal structure.

A. General Conditions

These conditions are applicable:

- Three or more fasteners are used as the ground path
- The carbon fibers in the CFRP hole must touch the fastener to make an electrical bond
- This process is used to make an electrostatic drain path for precipitation static.

NOTE: The outer surfaces of the CFRP will not make a satisfactory bond.

B. Hole Drilling

(1) Find the number and type of fasteners for the electrical bond of the structures.

(2) Find and drill the holes for the fasteners. The holes must be drilled through the two bonded structures. Refer to the applicable Structural Repair Manual (SRM) Chapter 51 for the procedure to drill the holes and install the fastener.

C. Installation

(1) Make sure that the inner fastener holes are free of primer, paint or other finishes. Clean the holes after they are drilled and before installation with solvent cleaner, refer to Paragraph 2.E..

CAUTION: MAKE SURE THAT THERE IS NO PRIMER, PAINT, OTHER FINISHES OR OTHER CONTAMINATION IN THE HOLE. PRIMER, PAINT, OTHER FINISHES, OR OTHER CONTAMINATION IN THE HOLE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

(2) Clean the fastener with solvent, refer to Paragraph 2.E..

CAUTION: MAKE SURE THAT THE SOLVENT THAT IS USED TO CLEAN IS PERMITTED FOR THE SURFACES TO CLEAN. THE SOLVENT THAT IS NOT PERMITTED CAN CAUSE DAMAGE TO THE MATERIALS.

(3) Electrically bond the surfaces with the number and type of fasteners found in Step 10.B.(1).

(4) Complete the installation in less than 24 hours after the hole is drilled. Clean the holes again if the installation is not completed in less than 24 hours after the hole is drilled.

11. ELECTRICAL BONDING THROUGH FASTENER - CLEARANCE FIT HOLE

This paragraph gives the procedures for the installation of fasteners where the bolt, nut, collar and washers make an electrical bond.

This process is used for:

- Precipitation static drain
- Electrostatic drain

A. General Conditions

These conditions are applicable:

- The fasteners, the locknut and the washer must be electrically conductive
- A faying surface bond is made below the fastener head or below the fastener nut/washer
- Two or more electrically conductive fasteners are installed in a clearance fit hole.

The following data must be known before you begin:

- The part numbers of the fasteners to be installed
- If it is necessary to seal the installed fastener

NOTE: If the original installation of the fastener was sealed, then sealing of the fastener is necessary.

B. Surface Preparation

(1) To prepare the faying surface:

(a) Disassemble the components.

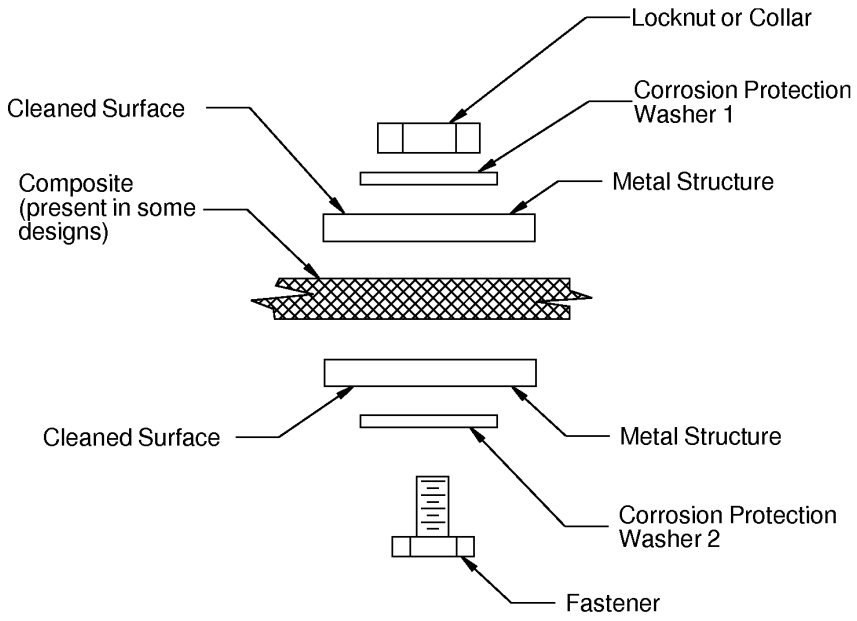
(b) Clean the faying surfaces of the structure.

Make sure that the area below washer 1 and 2 are clean, Refer to Paragraph 1.D..

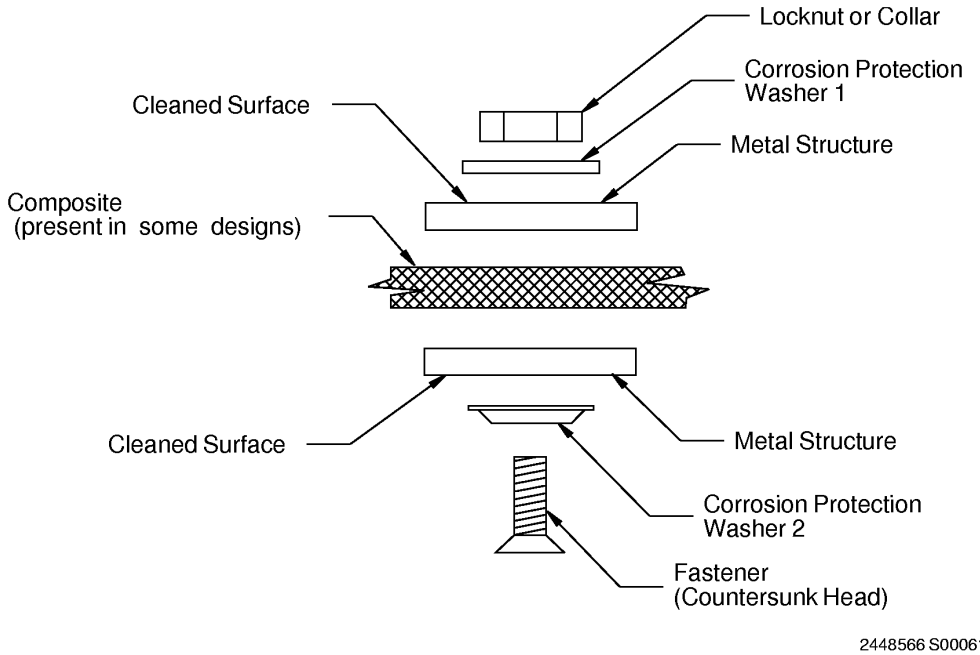
Make sure that you remove all non-conductive finishes around fastener, washers and locknut/collars.

Refer to:

- Paragraph 1.D. for the procedure to clean the faying surface
- Figure 15 and Figure 16 for the area to clean.



PRE-INSTALLED CLEARANCE FIT FASTENER
Figure 15



PRE-INSTALLED CLEARANCE FIT FASTENER COUNTERSUNK HEAD
Figure 16

(c) Clean fastener, locknut/collar and washers. Refer to Paragraph 1.D..

C. Clearance Fit Fastener Installation

If it is necessary to drill holes in the structure for fastener installation, refer to the applicable Structural Repair Manual (SRM) Chapter 51 for the procedure to drill the holes.

CAUTION: THE INSTALLATION OF THE FASTENER AND RESISTANCE MEASURE MUST BE DONE IN LESS THAN 24 HOURS AFTER SURFACE PREPARATION AND CLEANING. IF INSTALLATION IS NOT DONE IN LESS THAN 24 HOURS THEN THE SURFACE MUST BE PREPARED AND CLEANED AGAIN.

(1) For each fastener to be bonded, install:

- Fastener
- Washers
- Locknut/Collar.

Refer to Figure 15 and Figure 16

For the torque value, Refer to SOPM 20-50-01.

CAUTION: DO NOT USE A NON-CONDUCTIVE FASTENER. USE OF A NON-CONDUCTIVE FASTENER AND/OR WASHER WILL CAUSE THE MEASURED RESISTANCE VALUE TO BE MORE THAN IS ALLOWED.

(2) Do a test of electrical resistance between the clearance fit fastener and the structure.

Refer to:

- Paragraph 21.A. for the maximum resistance value
- Paragraph 22.D. for the test procedure.

(3) If the measured electrical resistance is more than the specified maximum resistance in Table 34:

(a) Disassemble the components.

(b) Prepare and clean the surfaces. Refer to Paragraph 1.D. for cleaning and Paragraph 11.B. for surface preparation.

(c) Do Step 11.C.(1) through Step 11.C.(3) again.

D. Sealing of Clearance Fit Fasteners

(1) If sealing of the fastener installation is necessary, make a selection of a sealant. Refer to Table 26.

NOTE: If the original installation of the fastener was sealed, then sealing of the fastener is necessary.

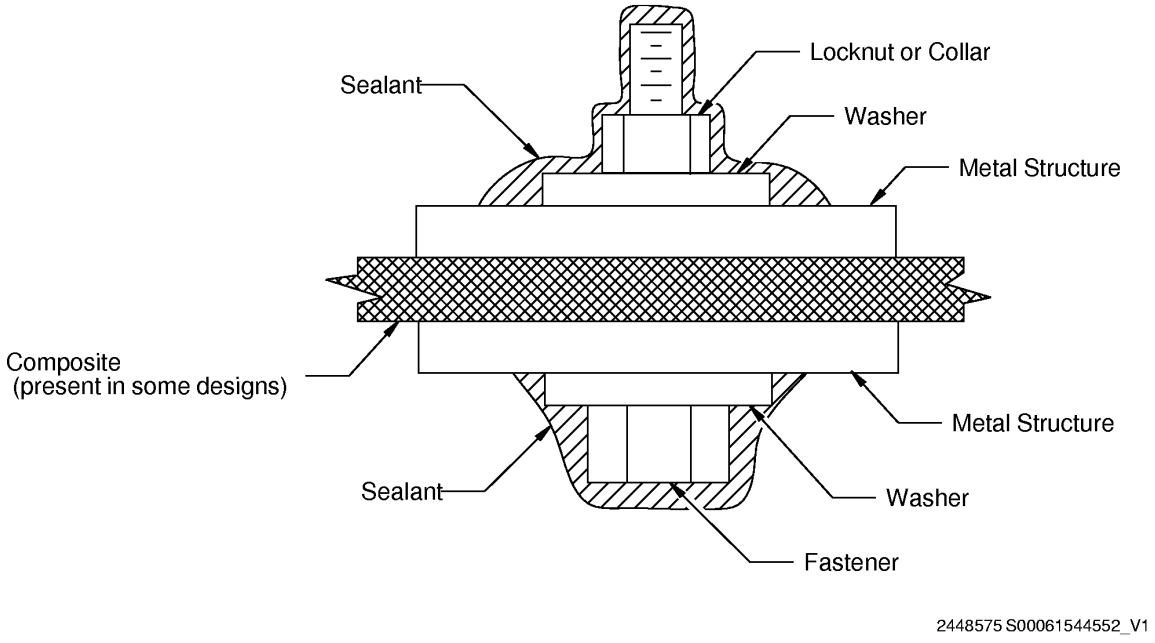
(2) To seal the fastener, Refer to Figure 17.

Make sure that the sealant:

- Is a small fillet
- Is smooth and continuous
- Does not have air bubbles or voids
- Does not have contamination in it.

Table 26
SELECTION OF SEALANT

Bond Location	Sealant
Fuel Tank or areas where fuel fumes are present	BMS 5-45, Class B
Non-Fuel Tank or areas where no fuel fumes are present	BMS 5-142, Class B
	BMS 5-95, Class B



SEALING OF CLEARANCE FIT FASTENERS
Figure 17

(3) If sealing is not necessary then continue. Refer to Paragraph 11.E..

CAUTION: THE SEALING OF THE CLEARANCE FIT FASTENER MUST BE DONE WITHIN 7 DAYS OF REMOVAL OF THE ORIGINAL FINISH. SEALING THE ASSEMBLY AFTER 7 DAYS OF REMOVAL OF THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE SEAL.

NOTE: IT IS SATISFACTORY TO HAVE SEALANT ON THE FASTENER HEAD AND LOCKNUT/COLLAR.

E. Refinishing Clearance Fit Fasteners

Apply finishes to the area that was cleaned and is not included by the fastener assembly or sealant. Refer to Paragraph 1.E..

CAUTION: USE ONLY THE SPECIFIED SOLVENTS. USING INCORRECT SOLVENTS CAN CAUSE DAMAGE TO THE ELECTRICAL BONDING SURFACE.

12. ELECTRICAL BONDING THROUGH FASTENER - INTERFERENCE FIT

This paragraph gives the procedures for installation of two or more fasteners 3/16 inch or larger in diameter that make an electrical bond in interference fit holes.

The electrical current goes through the inner edge of the holes and the shank of the fastener.

A. General Conditions

These conditions are applicable:

- The fastener must be electrically conductive
- Fasteners must be 3/16 inch or larger in diameter.

B. Interference Fit Fastener Installation

If it is necessary to drill holes in the structure for fastener installation, refer to the applicable Structural Repair Manual (SRM) Chapter 51 for the procedure to drill the holes and install the fastener.

CAUTION: INSTALLATION OF THE FASTENER AND RESISTANCE MEASURE MUST BE DONE IN LESS THAN 24 HOURS AFTER SURFACE PREPARATION AND CLEANING. IF INSTALLATION IS NOT DONE IN LESS THAN 24 HOURS THEN THE SURFACE MUST BE PREPARED AND CLEANED AGAIN.

(1) Clean the holes and the fastener. Refer to Paragraph 2.E..

Make sure that the inside of the fastener holes is bare metal.

CAUTION: MAKE SURE THAT THERE IS NO PRIMER, PAINT, FINISHES, OR OTHER CONTAMINATION IN THE HOLE. PRIMER, PAINT, FINISHES OR OTHER CONTAMINATION IN THE HOLE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

(2) Install the fastener in the hole. Refer to applicable Structural Repair Manual Chapter 51 for the procedure to install the fastener.

NOTE: The use of non-conductive fasteners will cause the resistance to be unsatisfactory.

(3) Clean the fastener:

(a) Make a selection of a solvent. Refer to Table 14.

(b) Make a selection of a wiper. Refer to Subject 20-00-11.

(c) Clean surface with solvent and wiper.

NOTE: Do not put the wiper into the solvent. Put the solvent on the wiper.

(d) Immediately wipe dry with a clean, dry wiper.

NOTE: Do not let the solvent dry in the air.

(e) Do steps (3c) through (3d) until the wiper stays clean.

(4) Do a test of electrical resistance between the interference fit fastener and the structure.

Refer to:

- Paragraph 21.I. for the maximum resistance values
- Paragraph 22.K. for the test procedure.

(5) If the measured electrical resistance is more than the specified maximum resistance in Table 44, then do these steps:

(a) Disassemble the components.

(b) Prepare and clean the surfaces. Refer to Paragraph 2.E...

(c) Do Step 12.B.(1) through Step 12.B.(4) again.

C. Refinishing Interference Fit Fasteners

Paragraph 1.E. gives the conditions when refinishing is necessary.

CAUTION: DO NOT USE AN INCORRECT SOLVENT. USING AN INCORRECT SOLVENT CAN DAMAGE THE BONDING SURFACE.

13. ELECTRICAL BONDING USING SLEEVED BOLTS - 787 ONLY

A. General Conditions

Refer to Boeing 787 Structural Repair Manual (SRM), Section B787-81205-Z0210-00, B787-A-51-43-10-00A-030A-A Section 1.A. "APPLICABILITY".

14. ELECTRICAL FAY SURFACE BONDS

A. General Conditions

The following data must be known before you begin this procedure:

- The classification of the electrical fay surface bond. Refer to Table 27
- The part numbers of the parts to be joined
- The material and the finish of the parts to be joined
- The part numbers and quantity of the fasteners used to join the parts
- The procedures used to install the fasteners
- If refinishing is necessary
- If the installation is in a fuel vapor area of the airplane.

Table 27
CATEGORIES FOR ELECTRICAL FAY SURFACE BONDS

Bond Category	Description
1	Unsealed
2	Fay Sealed
6	Fillet sealed
8	Fay Sealed Electrical Faying Surface Bond With Nondrying Corrosion Inhibiting Materail (CIM)

B. Airworthiness Limitations

These wiring configurations, installations, and procedures are given in Critical Design Configuration Control Limitations (CDCCL) related to:

- Fuel System Wiring that has Airworthiness Limitations
- Wiring that is installed adjacent to the fuel tank.

CDCCLs identify design configuration features that can decrease fuel tank ignition sources for the operational life of the airplane.

NOTE: The wiring configurations, installations, and procedures given allow the Critical Design Configuration Control Limitation (CDCCL) to decrease possible fuel tank ignition sources. If the CDCCL is not followed, the risk of a fuel tank ignition source can increase.

To find more data about CDCCLs, refer to Table 28 for the document that is applicable for the airplane model.

Table 28
BOEING DOCUMENTS FOR AIRWORTHINESS LIMITATIONS

Airplane Model	Boeing Document
707	D6-7552-AWL Airworthiness Limitations
727	D6-8766-AWL Airworthiness Limitations
737-100, -200, -200C, -300, -400, -500	D6-38278-CMR Airworthiness Limitations and Certification Maintenance Requirements
747-100, -200, -300, -SP	D6-13747-CMR Airworthiness Limitations and Certification Maintenance Requirements
737-600, -700, -700C, -800, -900, -900ER	D626A001-CMR Maintenance Planning Data Document, Section 9
747-400	D621U400-9 Maintenance Planning Data Document, Section 9
757	D622N001-9 Maintenance Planning Data Document, Section 9
767	D622T001-9-04 Special Compliance Items/Airworthiness Limitations
777	D622W001-9 Maintenance Planning Data Document, Section 9
747-8	D011U721-02-04 Special Compliance Items/Airworthiness Limitations
787	D011Z009-03-04 Special Compliance Items/Airworthiness Limitations

C. Category 1 Unsealed Fay Surface Bonds

NOTE: Installation of the parts must be done within 24 hours of surface preparation and cleaning. If installation is not done within 24 hours, the surface must be prepared and cleaned again.

(1) Clean the faying surfaces of the specified parts. Refer to Table 6 for the procedure to clean the faying surfaces.

(2) Assemble the specified parts with the specified fasteners.

(3) Do a test of the electrical bond.

Refer to:

- Paragraph 21.A. for the maximum resistance value
- Paragraph 22.D. for the test procedure.

NOTE: Perform the test of the electrical bond within 24 hours of surface preparation.

(4) If the resistance value is more than the maximum permitted value:

(a) Disassemble the parts.

(b) Do Step 14.C.(1) through Step 14.C.(3) again.

(5) If it is specified, apply the finish to bare metal areas around the parts. Refer to Paragraph 1.E.

CAUTION: APPLY ALL FINISHES WITHIN 7 DAYS OF WHEN THE ORIGINAL FINISH WAS REMOVED. FINISHES APPLIED AFTER 7 DAYS OF REMOVING THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

D. Category 2 Fay Sealed Fay Surface Bonds

NOTE: Installation of the fay surface bond must be done within 24 hours of surface preparation and cleaning. If installation is not done within 24 hours, the surface must be prepared and cleaned again.

Table 29
SEALANTS FOR A CATEGORY 2 FAY SEALED FAY SURFACE BOND

Bond Location	Sealant	Supplier
Fuel Tank Areas	BMS5-45, Class C	QPL
Non-Fuel Tank Areas	BMS5-45, Class C	QPL
	BMS5-95, Class B or Class C	QPL

(1) Clean the faying surfaces of the specified parts. Refer to Table 6 for the procedure to clean the faying surfaces.

(2) Make a selection of a sealant that is applicable for the area the bond is located in. Refer to Table 29.

(3) Make a selection of a tool to apply the sealant.

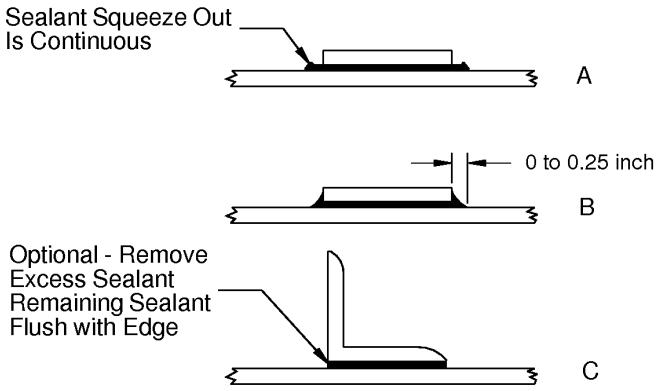
Make sure that the tool:

- Can make a small fillet
- Can make a smooth continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

(4) Apply a layer of sealant to all the surfaces of the structure and the specified parts that touch.

(5) Assemble the specified parts with the specified fasteners.

(6) Smooth out the sealant with a clean wiper or a brush.



SHAPE OF THE SEALANT
Figure 18

(7) Do a test of the electrical bond.

Refer to:

- Paragraph 21.A. for the maximum resistance value
- Paragraph 22.D. for the test procedure.

NOTE: Perform the test of the electrical bond within 24 hours of surface preparation.

(8) If it is specified, apply the finish to bare metal areas around the parts. Refer to Paragraph 1.E.

CAUTION: APPLY ALL FINISHES WITHIN 7 DAYS OF WHEN THE ORIGINAL FINISH WAS REMOVED. FINISHES APPLIED AFTER 7 DAYS OF REMOVING THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

E. Category 6 Fillet Sealed Fay Surface Bond

NOTE: Installation of the fay surface bond must be done within 24 hours of surface preparation and cleaning. If installation is not done within 24 hours, the surface must be prepared and cleaned again.

Table 30
SEALANTS FOR A CATEGORY 6 FILLET SEALED FAY SURFACE BOND

Bond Location	Sealant	Supplier
Fuel Tank Areas	BMS5-45, Class B	QPL

Table 30 SEALANTS FOR A CATEGORY 6 FILLET SEALED FAY SURFACE BOND (Continued)

Bond Location	Sealant	Supplier
Non-Fuel Tank Areas	BMS5-45, Class B	QPL
	BMS5-95, Class B	QPL
	BMS5-142, Class B	QPL

(1) Clean the faying surfaces of the specified parts. Refer to Table 6 for the procedure to clean the faying surfaces.

(2) Assemble the specified parts with the specified fasteners.

(3) Do a test of the electrical resistance.

Refer to:

- Paragraph 21.A. for the maximum resistance value
- Paragraph 22.D. for the test procedure.

(4) If the resistance value is more than the maximum permitted value:

(a) Disassemble the parts.

(b) Do Step 14.E.(1) through Step 14.E.(3) again.

(5) Make a selection of a sealant that is applicable for the area the bond is located in. Refer to Table 30.

(6) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

(7) Apply a continuous bead of sealant around the edges of the joint between the faying surfaces.

(8) Smooth out the sealant with a clean wiper or a brush.

(9) If it is specified, apply the finish to bare metal areas around the parts. Refer to Paragraph 1.E..

CAUTION: APPLY ALL FINISHES WITHIN 7 DAYS OF WHEN THE ORIGINAL FINISH WAS REMOVED. FINISHES APPLIED AFTER 7 DAYS OF REMOVING THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

F. Category 8: Fay Sealed Electrical Faying Surface Bond With Non-Drying Corrosion Inhibiting Material (CIM)

Table 31
NECESSARY MATERIALS

Material	Part Number	Supplier
Corrosion Inhibiting Material, Non-Drying Paste	BMS3-38	Boeing

NOTE: It is intended that

- This bond is for applications where the bonded joint must be easily and quickly disassembled in service
- This bond is for interior areas where temperatures do not exceed 180F
- This bond is for use on non-primary structure
- The faying bond surfaces are bare metal without chemical conversion coating.

CAUTION: THE FINISH AROUND THE BARE ELECTRICAL BOND AREA MUST BE APPLIED AND CURED BEFORE THE CIM PASTE IS APPLIED. IF CIM IS ON A SURFACE, THE FINISH WILL NOT BOND TO THAT SURFACE.

NOTE: For this process, the bare, cleaned bond area, must not be larger than the faying surface bond area plus 1/8 inch ± 1/16th inch. Refer to Figure 19.

NOTE: Installation of the fay surface bond must be done within 24 hours of surface preparation and cleaning. If installation is not done within 24 hours, the surface must be prepared and cleaned again.

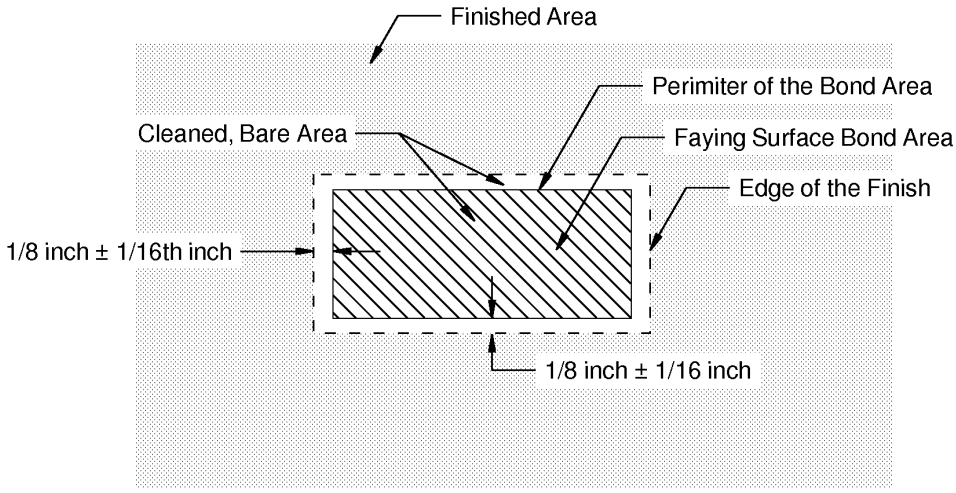
(1) Clean the faying surfaces and remove the finishes of the specified parts only in the faying surface bond area. Refer to Table 6 for the procedure to clean the faying surfaces.

Make sure that the cleaned bare area of the surface to be bonded is not larger than the faying surface bond area plus 1/8 inch ± 1/16th inch.

(2) If the finish is removed from the surface a distance of more than 3/16 inch from the perimiter of the bond area, replace the finish near the perimiter of the bond area.

Make sure that:

- The distance from the edge of the finish to the perimiter of the bond area is 1/8 inch ± 1/16 inch. Refer to Figure 19
- The finish is fully cured before you do Step 14.F.(4) through Step 14.F.(9).



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FINISHED AREA AROUND THE FAYING SURFACE BOND AREA
Figure 19

(3) Make a selection of a CIM paste from Table 31.

(4) Apply a continuous coat of CIM paste on one of the bond surfaces of a part that is to be bonded.

Make sure that the thickness of the CIM paste is 0.010 inch to 0.030 inch (0.025 cm to 0.076 cm).

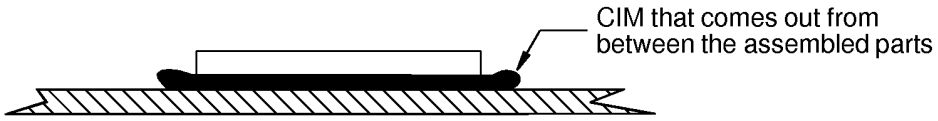
(5) Assemble the bond parts.

Make sure that:

- The CIM comes out from between the bonded parts continuously all around the edge of the bond interface
- The CIM that comes out from between the bonded parts covers the unfinished area around the perimiter of the bond area
- The threaded fasteners have the necessary torque.

NOTE: The CIM paste that comes out from between the bonded parts all around the bond area shows that sufficient CIM is between the mating surfaces.

(6) If CIM does not come out from between the assembled parts all around the perimiter of the bond area, disassemble the bonded parts and repeat Step 14.F.(4) and Step 14.F.(5). Refer to Figure 20.



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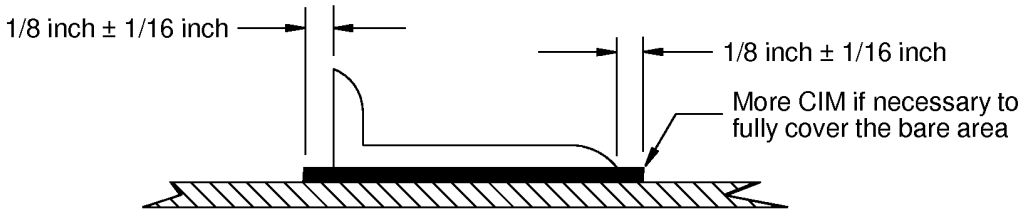
CIM THAT COMES OUT FROM BETWEEN THE ASSEMBLED PARTS
Figure 20

(7) Remove the unwanted CIM that is on the finished surface at a distance of more than 3/16 inch from the perimiter of the bond area. Refer to Figure 19

(8) If bare metal areas do not have CIM on them, apply more CIM to fully cover the bare areas around the perimiter of the bond area. Refer to Figure 21.



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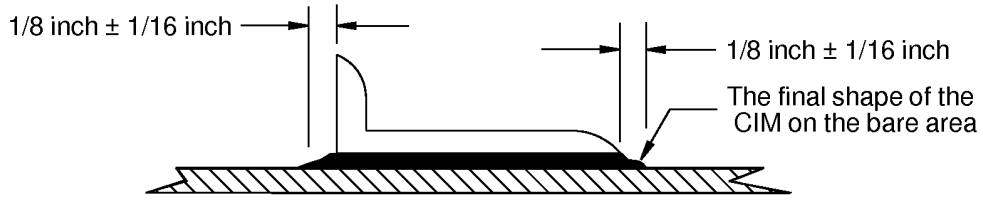
ADDITIONAL CIM APPLIED TO FULLY COVER THE BARE AREA AROUND THE PERIMITER OF THE BOND AREA
Figure 21

(9) Use a fairing tool to make the shape of the edge of the CIM on the bare area around the perimiter of the bond area.



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THE FINAL SHAPE OF THE EDGE OF THE CIM ON THE BARE AREA AROUND THE PERIMITER OF THE BOND AREA
Figure 22

Make sure that the edge of the CIM that comes out from between the assembled parts:

- Is the same all around the perimeter of the bond
- Has the shape shown in Figure 22.

(10) Do a test of the electrical resistance.

Refer to:

- Paragraph 21.A. for the maximum resistance value
- Paragraph 22.D. for the test procedure.

(11) If the resistance value is more than the maximum permitted value:

(a) Disassemble the parts.

(b) Do Step 14.F.(1) through Step 14.F.(9) again.

15. DRIVEN RIVET ELECTRICAL BOND

A. General Conditions

The following data must be known before you begin this procedure:

- The part numbers of the parts to be joined
- The material and the finish of the parts to be joined
- The procedure used to drill the holes
- The diameter of the holes for the rivets
- The part numbers and quantity of the rivets used to join the parts
- The procedures used to install the rivets
- If refinishing is necessary

B. Installation and Test

(1) Locate and drill the holes for the rivets.

(2) Clean the inside surface of the holes with solvent.

Make sure that you use the solvent cleaning procedure. Refer to Paragraph 2.E..

CAUTION: MAKE SURE THE INSIDE SURFACE OF THE RIVET HOLES IS CLEAN. PRIMER, PAINT, OR OTHER FINISHES AND CONTAMINANTS LOCATED INSIDE THE RIVET HOLES CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE DRIVEN RIVET ELECTRICAL BOND.

(3) Join the parts with the rivets.

CAUTION: COMPLETE THE INSTALLATION OF THE RIVETS WITHING 24 HOURS OF HOLE DRILLING. INSTALLATION OF THE RIVETS AFTER 24 HOURS OF HOLE DRILLING CAN RESULT IN UNSATISFACTORY PERFORMANCE OF THE ELECTRIOCAL BOND.

(4) Do a test of the electrical bond.

Refer to:

- Paragraph 21.N. for the maximum resistance value

• Paragraph 22.R. for the test procedure.

NOTE: It is satisfactory to remove a small portion of the surface finish to perform the electrical test.

NOTE: Perform the test of the electrical bond within 24 hours of surface preparation.

(5) If the resistance value is more than the maximum permitted value:

(a) Disassemble the parts.

(b) Do Step 15.B.(1) through Step 15.B.(3) again.

(6) If the finish was removed for the electrical test, apply finish to the bare metal areas. Refer to Paragraph 1.E.

CAUTION: APPLY ALL FINISHES WITHIN 7 DAYS OF WHEN THE ORIGINAL FINISH WAS REMOVED. FINISHES APPLIED AFTER 7 DAYS OF REMOVING THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

16. ELECTRICAL BONDING OF A GROUND BLOCK INSTALLATION

A. General Conditions

The following data must be known before you begin this procedure:

- The part numbers of the parts to be joined
- The material and the finish of the parts to be joined
- The procedure used to drill the holes
- The diameter of the holes for the rivets
- The part numbers and quantity of the rivets used to join the parts
- The procedures used to install the rivets
- If refinishing is necessary

B. Installation and Test

(1) Locate and drill the holes for the rivets.

(2) Clean the inside surface of the holes with solvent.

Make sure that you use the solvent cleaning procedure. Refer to Paragraph 2.E..

CAUTION: MAKE SURE THE INSIDE SURFACE OF THE RIVET HOLES IS CLEAN. PRIMER, PAINT, OR OTHER FINISHES AND CONTAMINANTS LOCATED INSIDE THE RIVET HOLES CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE GROUND BLOCK ELECTRICAL BOND.

(3) Join the parts with the rivets.

CAUTION: COMPLETE THE INSTALLATION OF THE RIVETS WITHING 24 HOURS OF HOLE DRILLING. INSTALLATION OF THE RIVETS AFTER 24 HOURS OF HOLE DRILLING CAN RESULT IN UNSATISFACTORY PERFORMANCE OF THE ELECTRIOCAL BOND.

(4) Do a test of the electrical bond.

Refer to:

- Paragraph 21.O. for the maximum resistance value
- Paragraph 22.S. for the test procedure.

NOTE: It is satisfactory to remove a small portion of the surface finish to perform the electrical test.

NOTE: Perform the test of the electrical bond within 24 hours of surface preparation.

(5) If the resistance value is more than the maximum permitted value:

(a) Disassemble the parts.

(b) Do Step 16.B.(1) through Step 16.B.(4) again.

(6) If the finish was removed for the electrical test, apply finish to the bare metal areas. Refer to Paragraph 1.E.

CAUTION: APPLY ALL FINISHES WITHIN 7 DAYS OF WHEN THE ORIGINAL FINISH WAS REMOVED. FINISHES APPLIED AFTER 7 DAYS OF REMOVING THE ORIGINAL FINISH CAN CAUSE AN UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

17. ELECTRICAL BONDING OF A STATIC DISCHARGER ASSEMBLY

A. General Conditions

The following data must be known before you begin this procedure:

- The part numbers of the parts to be joined
- The part numbers of the fasteners used to attach the static discharger assembly to the structure
- The procedure to install the fasteners
- The torque necessary for the fasteners or threaded parts
- The material and the finish of the parts to be joined
- If refinishing is necessary.

B. Necessary Materials

NOTE: The cure times and the tack free times that are specified in Table 32 are applicable for 77 degrees F ±5 degrees F and 50 percent relative humidity.

NOTE: The cure time and tack free time of ground stud sealants:

- Increase at lower temperature and lower humidity
- Decrease at higher temperature and higher humidity.

Table 32
SELECTION OF SEALANTS

Bond Location	Sealant	Supplier
Non-Fuel Tank Areas	BMS5-45, Class B	QPL
	BMS5-95, Class B	QPL
	BMS5-142, Class B	QPL

C. Surface Preparation and Installation

(1) Clean the structure surface. Refer to Paragraph 2.E..

Make sure that the entire area of the structure that will touch the static discharger assembly is clean.

CAUTION: COMPLETE THE STATIC DISCHARGER ASSEMBLY INSTALLATION AND RESISTANCE MEASUREMENT WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE INSTALLATION IS NOT COMPLETED WITHING 24 HOURS OF SURFACE CLEANING, THE SURFACES MUST BE CLEANED AGAIN.

NOTE: Static dicharger assemblies that are measured more that 24 hours after installation and have a resistance lower that the maximum allowe are satisfactory.

(2) Clean the static discharger assembly adapter plate. Refer to Paragraph 2.E..

Make sure that the entire area of the adapter plate that will touch the structure is clean.

(3) If the structure is composite aluminum coated fiber, apply a chemical conversion coat to the cleaned structure area. Refer to Paragraph 1.E..

(4) Install the static discharger assembly.

(5) Perform a test of the electrical resistance between the static discharger assembly and the structure.

Refer to:

- Paragraph 21.P. for the maximum resistance value
- Paragraph 22.T. for the procedure to perform the test.

(6) If the resistance is more that the maximum resistance:

(a) Disassemble the static discharge assembly installation.

(b) Perform Step 17.C.(1) through Step 17.C.(5) again.

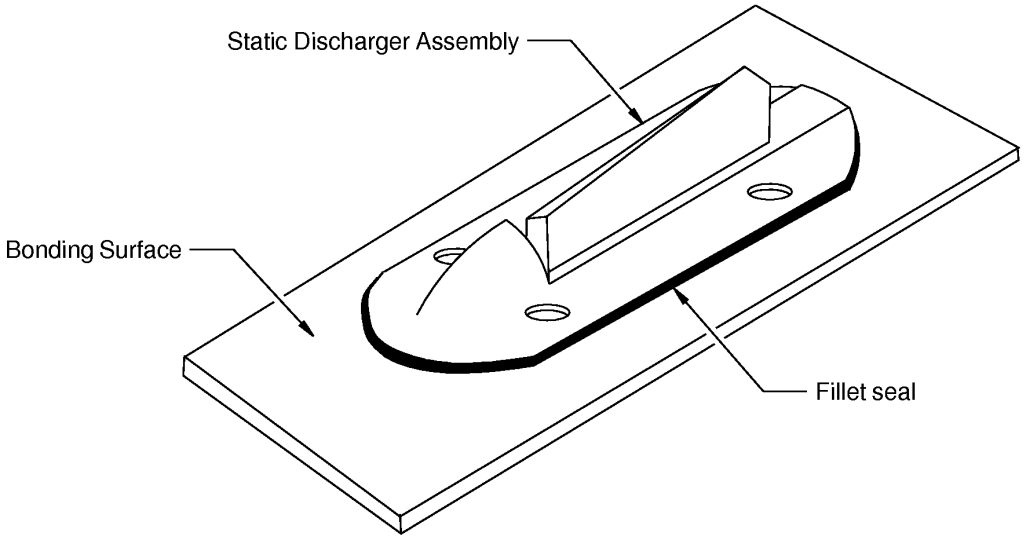
(7) Fillert seal the static discharger assembly:

(a) Make a selection of a sealant. Refer to Table 32.

(b) Apply the sealant around the edge of the statict discharger assembly. Refer to Figure 23.

Make sure that:

- The sealant has no bubbles or gaps
- The sealant is smooth and makes a continuous fillet.



FILLET SEAL OF A STATIC DISCHARGER ASSEMBLY
Figure 23

(8) Refinish any bare structure surface. Refer to Paragraph 1.E..

18. ELECTRICAL BONDING - TUBE FITTING AND COUPLING INSTALLATIONS

A. General Conditions

This paragraph gives the procedures to do the test of the bond resistance of these electrical bonds.

- externally swaged and axially swaged self-bonding coupling
- flared and flareless fittings
- rigid and flexible self-bonding couplings

The following data must be known before you begin:

- The part numbers of the tubes, ferrules and fittings to be joined
- The procedures used to prepare and clean the tubes, the ferrules, and the fittings.
- The procedures used to assemble and install the externally swaged fittings
- The procedures used to assemble and install the axially swaged fittings
- The procedures used to assemble and install the flared fittings
- The procedures used to assemble and install the flareless fittings
- The procedures used to assemble and install the rigid tube-to-tube self bonding couplings
- The procedures used to assemble and install the flexible tube-to-tube self bonding couplings
- The procedures used to assemble and install the tube-to-isolator self bonding couplings
- The procedures used to assemble and install the tube-to-component self bonding couplings
- The procedures and the materials used to apply the chemical conversion coating.

CAUTION: COMPLETE THE TUBE-TO-FITTING AND THE TUBE-TO-COUPLING ASSEMBLY AND THE RESISTANCE MEASUREMENTS WITHIN 24 HOURS OF THE PREPARATION OF THE SURFACES. RECLEANING OF THE SURFACES IS NECESSARY IF THE INSTALLATION IS NOT COMPLETED WITHIN 24 HOURS.

B. Surface Preparation and Installation

CAUTION: COMPLETE THE TUBE-TO-FITTING AND THE TUBE-TO-COUPLING ASSEMBLY AND THE RESISTANCE MEASUREMENTS WITHIN 24 HOURS OF THE PREPARATION OF THE SURFACES. RECLEANING OF THE SURFACES IS NECESSARY IF THE INSTALLATION IS NOT COMPLETED WITHIN 24 HOURS.

(1) Prepare the tubes, ferrules, and the fittings for assembly.

(2) Assemble and Install the tubes and the fittings:

CAUTION: COMPLETE THE TUBE-TO-FITTING AND THE TUBE-TO-COUPLING ASSEMBLY AND THE RESISTANCE MEASUREMENTS WITHIN 24 HOURS OF THE PREPARATION OF THE SURFACES. RECLEANING OF THE SURFACES IS NECESSARY IF THE INSTALLATION IS NOT COMPLETED WITHIN 24 HOURS.

(a) Install the externally swaged fittings.

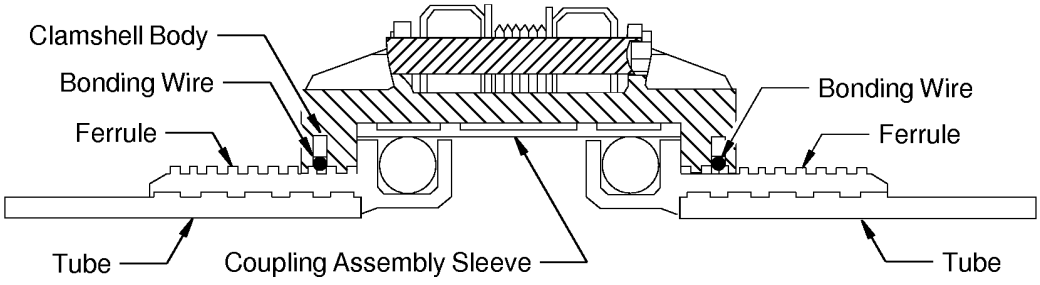
(b) Install the flare and flareless fittings.

(c) Install the axial swaged fittings.

(3) Clean the flexible couplings. Refer to Paragraph 2.E..

Make sure that these areas are clean:

- The contact areas on the bonding wire
- The entire outside periphery of the ferrule area
- The exposed bonding surfaces of the machined flange on the component
- The clamshell bond spring
- The bonding surface contact area on the sleeve.



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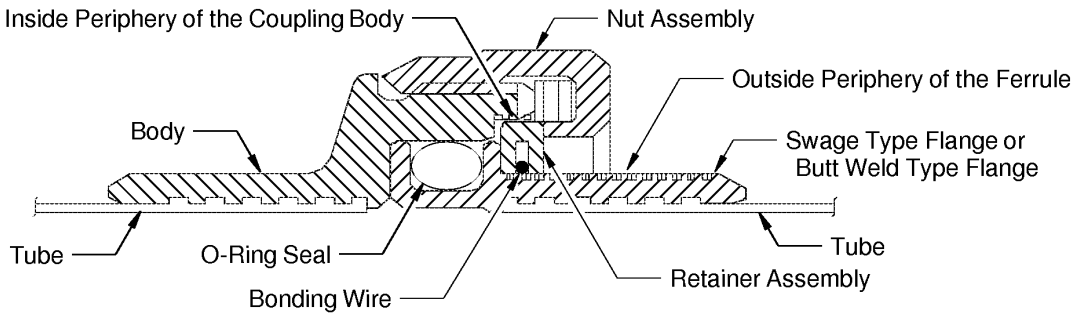
FLEXIBLE COUPLING SURFACE PREPARATION
Figure 24

(4) Clean the rigid couplings Refer to Paragraph 2.E..

Make sure that these areas are clean:

- The outside periphery of the ferrule

- The outside periphery of the exposed bonding surfaces of the machined flange on the component
- The contact area of the bonding wire
- The contact area of the split ring retainer
- The contact area of the bond spring
- The contact area of the mating bond surface on the inside periphery of the coupling body.



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RIGID COUPLING SURFACE PREPARATION
Figure 25

(5) Install the rigid self-bonding couplings.

(6) Install the flexible self-bonding couplings.

(7) Perform the tests of the electrical bond resistance between the components.

For the maximum electrical bond resistance values, refer to:

- Paragraph 21.K. for Tube-to-Tube assemblies that have externally or axially swaged, or flare or flareless fittings
- Paragraph 21.L. for Tube-to-Fitting assemblies that have externally or axially swaged, or flare or flareless fittings
- Paragraph 21.M. for these Self-Bonding Couplings: Tube-to-Tube, Tube-to-Isolator and Tube-to-Component.

For the electrical bond resistance test procedures, refer to:

- Paragraph 22.U. for the bond test of tube-to-tube bonds
- Paragraph 22.M. for the bond test of tube-to-fitting bonds
- Paragraph 22.N. for the bond test of tube-to-tube self-bonding couplings

- Paragraph 22.O. for bond test of tube-to-isolator self-bonding couplings
- Paragraph 22.P. for bond test of tube-to-component self-bonding couplings.

(8) If the resistance is more than the maximum resistance:

(a) Disassemble the installation.

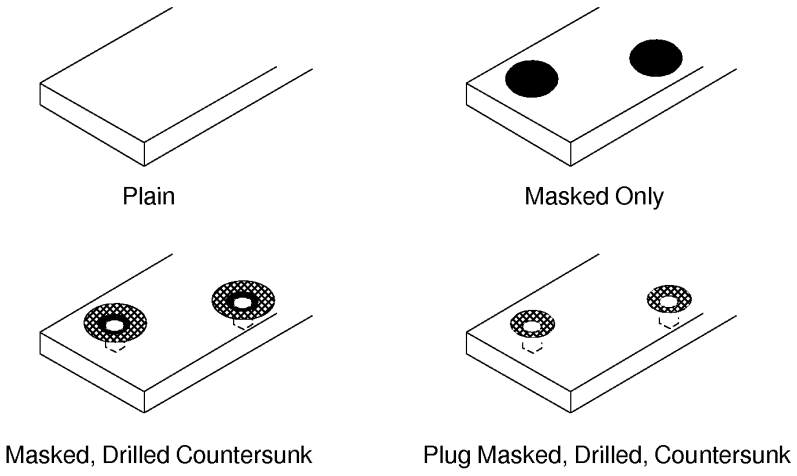
(b) Perform Step 18.B.(1) through Step 18.B.(7) again.

19. ELECTRICAL BONDING OF FASTENERS TO CONDUCTIVE FINISHES ON COMPOSITES

A. General Conditions

The following data must be known before you begin this procedure:

- The procedure to prepare the bonding surfaces
- The procedure to install a graphite panel to metal structure
- The procedure to install a removable panel to a fixed panel
- The part numbers of the fasteners
- The procedure to install the fasteners.



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THE TYPES OF PANELS THAT HAVE ANTI-STATIC COATINGS
Figure 26

B. Necessary Materials

Table 33
SELECTION OF ANTI-STATIC COATING

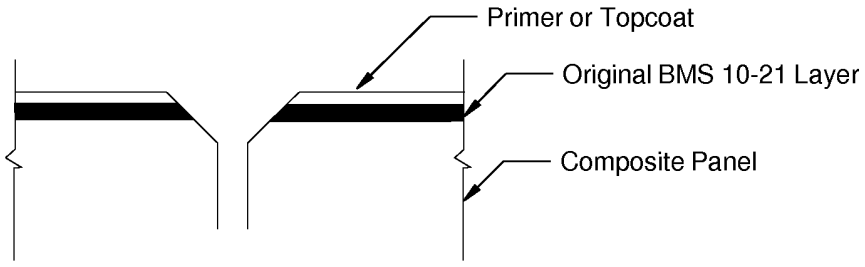
Part Number	Description	Supplier
BMS10-21, Type III	Anti-Static Coating	Boeing

C. Bonding of a Fastener to a Composite Structure that has BMS10-21, Type III Anti-Static Coating

Refer to Figure 26 to determine the type of configuration of the panel.

(1) If the panel is a plain panel:

(a) Drill and countersink the fastener holes. Refer to Figure 27.



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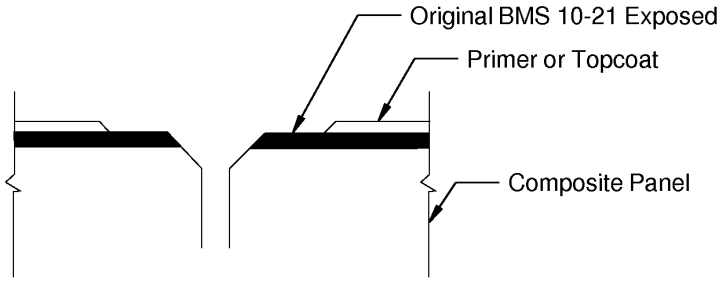
THE PLAIN COMPOSITE PANEL BEFORE ABRASIVE CLEANING
Figure 27

(b) Remove the topcoat and primer using the abrasive cleaning method. Refer to Paragraph 2.A..

Make sure that you only remove the topcoat and primer. Do not remove the black anti-static coating. Refer to Figure 28.



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THE PLAIN COMPOSITE PANEL AFTER ABRASIVE CLEANING
Figure 28

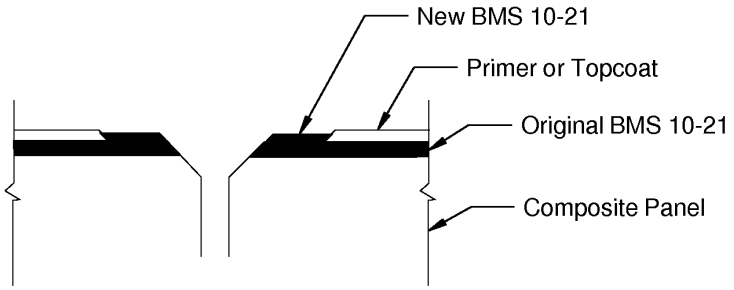
NOTE: It is satisfactory to leave small spots of primer and topcoat.

CAUTION: DO NOT REMOVE THE ANTI-STATIC COATING. REMOVAL OF THE ANTI-STATIC COATING CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

(c) Clean the abraded area and the countersunk hole using solvent. Refer to Paragraph 2.E..

(d) Apply BMS10-21, Type III to the cleaned area. Refer to Figure 29.

Make sure that the anti-static coating is countinuous from the inside of the countersink to the edge of the primer/topcoat.



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THE PLAIN COMPOSITE PANEL WITH NEW ANTI-STATIC COATING
Figure 29

(e) Allow the anti-static coating to dry in the air for a minimum of 20 minutes.

(2) If the panel is masked:

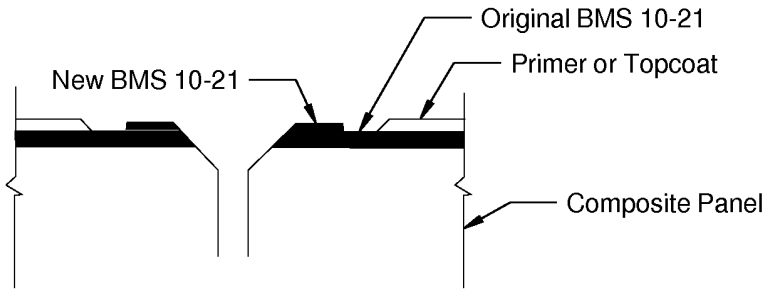
(a) Carefully remove the mask material.

(b) Drill and countersink the holes.

(c) Solvent clean the area that was masked. Refer to Paragraph 2.E..

(d) Apply a layer of BMS10-21, Type III anti-static coating.

Apply the anti-static coating continuously from the inside surface of the countersink to the panel surface. Overlap the original anti-static coating a minimum of 0.10 inch. Refer to Figure 30.



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THE MASKED COMPOSITE PANEL WITH NEW ANTI-STATIC COATING
Figure 30

(e) Allow the anti-static coating to dry in the air for a minimum of 20 minutes.

(3) If the panel is masked, drilled, and countersunk:

(a) Carefully remove the mask material to expose the original BMS10-21 ant-static coating that is inside and around the countersink.

(b) Solvent clean the exposed anti-static coating and the inside surface of the countersink. Refer to Paragraph 2.E..

(c) Make sure that the anti-static coating is continuos from the inside of the countersink to the edge of the primer and topcoat.

(4) If the panel is plug masked, drilled, and countersunk:

(a) Carefully remove the mask material.

(b) Solvent clean the anti-static coating inside the countersink. Refer to Paragraph 2.E..

(c) Make sure that the anti-static coating is countinuous from the inside of the countersink to the edge of the primer and topcoat.

(5) Solvent clean the washer and the underside of the fastener head. Refer to Paragraph 2.E..

(6) Solvent clean the washer and the underside of the fastener head. Refer to Paragraph 2.E...

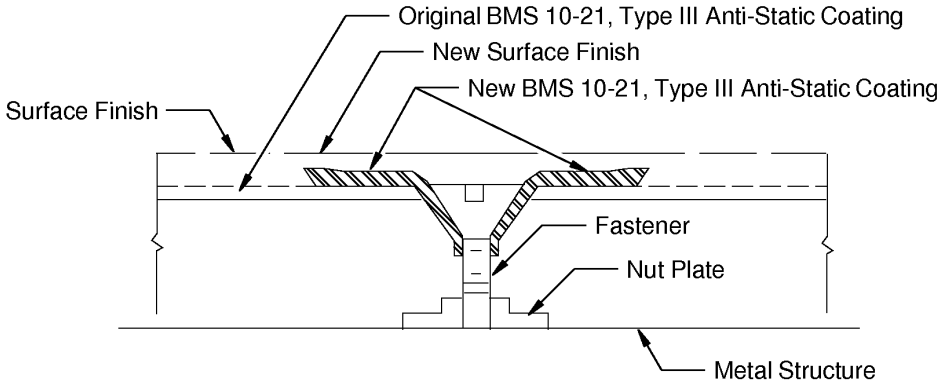
(7) Install the fasteners.

CAUTION: COMPLETE THE INSTALLATION OF THE FASTENERS WITHIN 24 HOURS OF SURFACE PREPARATION. INSTALLATIONOF THE FASTENERS AFTER 24 HOURS CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

(8) Perform a test of the electrical resistance. Refer to:

- Paragraph 21.R. for the maximum resistance value
- Paragraph 22.V. for the procedure to perform the test.

(9) If refinishing is specified, apply finish to any surface areas that were originally finished and are not covered by the fastener or the washer. Refer to Figure 31.



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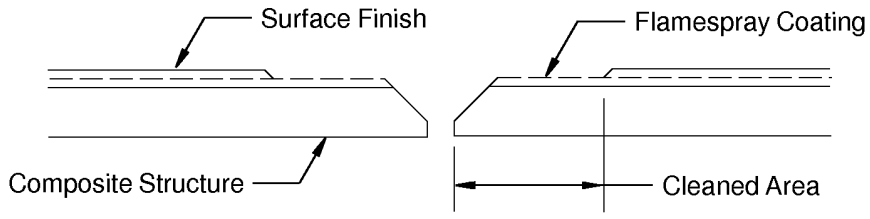
COMPLETED INSTALLATION - PLAIN AND MASKED PANEL
Figure 31

D. Bonding of a Fastener to a Composite Structure that has a Flamespray Coating

(1) Prepare the surface using an abrasive cleaning method:

Refer to:

- Paragraph 2.A., Paragraph 2.B., and Paragraph 2.C. for the abrasive cleaning procedure
- Figure 32 for the area to be cleaned.



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THE CLEANED AREA FOR A COMPOSITE PANEL THAT HAS A FLAMESPRAY COATING
Figure 32

(2) Clean the washer and the underside of the fastener head using solvent. Refer to Paragraph 2.E..

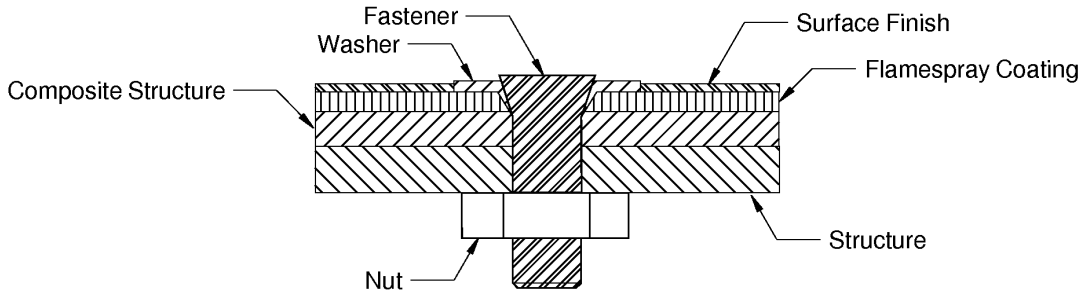
(3) Install the fasteners.

CAUTION: COMPLETE THE INSTALLATION OF THE FASTENERS WITHIN 24 HOURS OF SURFACE PREPARATION. INSTALLATIONOF THE FASTENERS AFTER 24 HOURS CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

(4) Perform a test of the electrical resistance. Refer to:

- Paragraph 21.R. for the maximum resistance value
- Paragraph 22.V. for the procedure to perform the test.

(5) If it is specified, reapply finish to any surfaces that were cleaned but are not covered by the washer. Refer to Figure 33.



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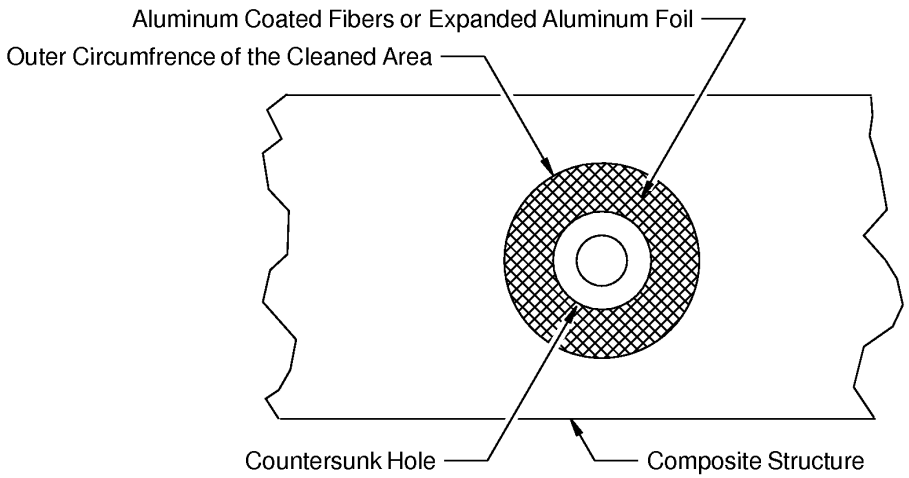
COMPLETED INSTALLATION ON A COMPOSITE PANEL THAT HAS A FLAMESPRAY COATING
Figure 33

CAUTION: REAPPLY FINISH WITHING SEVEN DAYS AFTER REMOVAL OF THE ORIGINAL FINISH. IF THE FINISH IS REAPPLIED AFTER SEVEN DAYS UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND CAN RESULT.

E. Bonding of a Fastener to a Composite Structure that has BMS8-278 Aluminum Coated Fiber or BMS8-336 Expanded Aluminum Foil Anti-Static Coating

(1) Prepare the surface using an abrasive cleaning method. Refer to Paragraph 2.A., Paragraph 2.B., and Paragraph 2.C.

(2) Make sure that the entire area under the flat portion of the washer is cleaned. Refer to Figure 34.



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THE AREA TO CLEAN FOR COMPOSITE PANELS THAT HAVE ALUMINUM COATED FIBERS OR EXPANDED ALUMINUM FOIL ANTI-STATIC COATING
Figure 34

(3) Apply a chemical conversion coating to the cleaned area.

(4) Solvent clean the washer and the underside of the fastener head. Refer to Paragraph 2.E..

(5) Install the fasteners.

CAUTION: COMPLETE THE INSTALLATION OF THE FASTENERS WITHIN 24 HOURS OF SURFACE PREPARATION. INSTALLATIONOF THE FASTENERS AFTER 24 HOURS CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

Make sure that there is no gap between the flange of the washer and the bonding surface.

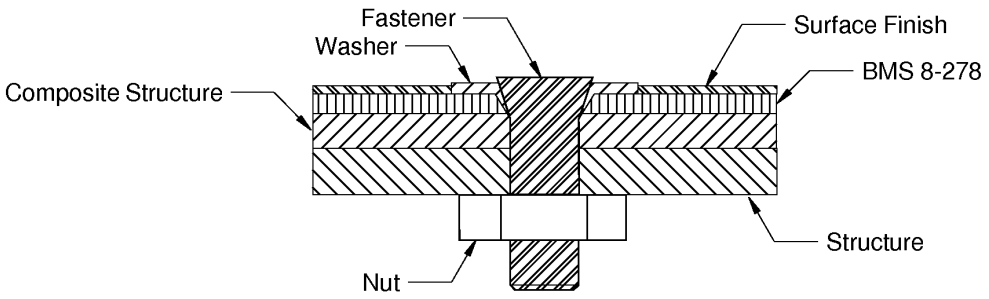
(6) Perform a test of the electrical resistance. Refer to:

- Paragraph 21.R. for the maximum resistance value
- Paragraph 22.V. for the procedure to perform the test.

(7) If it is specified, reapply the finish to any surfaces that were cleaned but are not covered by the washer.

Refer to:

- Figure 35 for composite structure that has a BMS8-278 aluminum coated fiber anti-static coating
- Figure 36 for composite structure that has a BMS8-336 expanded aluminum foil coated fiber anti-static coating.



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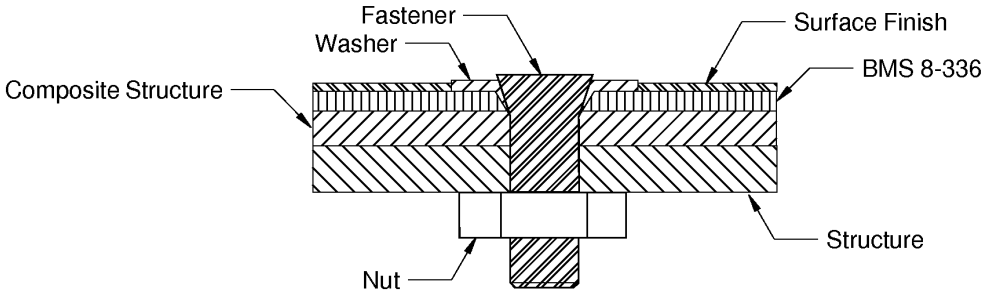
COMPLETED INSTALLATION ON A COMPOSITE STRUCTURE THAT HAS BMS8-278 ALUMINUM COATED FIBER ANTI-STATIC COATING

Figure 35



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COMPLETED INSTALLATION ON A COMPOSITE STRUCTURE THAT HAS BMS8-336 EXPANDED ALUMINUM FOIL ANTI-STATIC COATING

Figure 36

CAUTION: REAPPLY FINISH WITHING SEVEN DAYS AFTER REMOVAL OF THE ORIGINAL FINISH. IF THE FINISH IS REAPPLIED AFTER SEVEN DAYS UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND CAN RESULT.

20. ELECTRICAL BONDING OF COMPOSITE PANELS

A. General Conditions

The following data must be known before you begin this procedure:

- The procedure to prepare the bonding surfaces
- The procedure to install a graphite panel to metal structure
- The procedure to install a removable panel to a fixed panel
- The material and the finish of the parts to be joined
- If refinishing is necessary.

B. Installation and Test

(1) Prepare the surfaces of the panels that touch.

(2) Make sure that the entire area that touches is clean.

(3) Install the fasteners.

CAUTION: COMPLETE THE INSTALLATION OF THE FASTENERS WITHIN 24 HOURS OF SURFACE PREPARATION. INSTALLATION OF THE FASTENERS AFTER 24 HOURS CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

(4) Perform a test of the electrical resistance. Refer to:

- Paragraph 21.R. for the maximum resistance value
- Paragraph 22.V. for the procedure to perform the test.

(5) If the measured electrical resistance is more that the resistance specified in Paragraph 21.R.:

(a) Disassemble the parts.

(b) Perform Step 20.B.(1) through Step 20.B.(4) again.

21. MAXIMUM PERMITTED RESISTANCE OF ELECTRICAL BONDS

NOTE: Unless it is specified differently, the resistance values given in the tables in this Paragraph refer to the overall resistance as it is measured across the bond from the object to the basic structure.

NOTE: If the resistance measurement is more than the specified maximum resistance, then you must:

- Disassemble the components
- Reclean the mating surfaces
- Reassemble the components
- Retest the bond resistance.

ELECTRICAL BONDING PROCESSES

A. Resistance of Faying Surface Bonds

Table 34 specifies the maximum resistance between the different surfaces of a faying surface bond for a new installation or a repair where the faying surfaces are prepared for a bond again.

If it is specified to measure the resistance across more than one bond joint, the total bond resistance must not be more than the sum of the bond resistance values.

For the bond test of faying surfaces, refer to Paragraph 22.D..

Table 34
MAXIMUM RESISTANCE OF FAYING SURFACE BONDS

Bonded Materials	Maximum Resistance	
	(Miliohms)	(Ohms)
Aluminum to Aluminum	0.5	0.0005
Steel to Steel	0.7	0.0007
Titanium to Titanium	1.0	0.001
Composite	1000.0	1.0
Aluminum to Passivated CRES	0.5	0.0005
Aluminum to Cadmium CRES	1.0	0.001
Aluminum to Titanium	0.7	0.0007

Table 35 gives the maximum resistance values for a faying surface bond when the resistance values are reverified.

For the bond test of faying surfaces, refer to Paragraph 22.D..

Table 35
REVERIFICATION RESISTANCE VALUES OF FAYING SURFACE BONDS

Bonded Materials	Maximum Resistance	
	(Miliohms)	(Ohms)
Aluminum to Aluminum	0.5	0.0005
Steel to Steel	0.8	0.0008
Titanium to Titanium	1.1	0.0011
Composite	1000.0	1.0
Aluminum to Passivated CRES	0.5	0.0005
Aluminum to Cadmium CRES	2.5	0.0025
Aluminum to Titanium	0.8	0.0008

B. Resistance of Composite Panel Bonds

Table 36 specifies the maximum resistance of the bond of a fastener and a composite structure with conductive finish for a new installation or a repair where the faying surfaces are prepared for a bond again.

Table 37 specifies the maximum resistance of the bond of a removable composite panel with conductive finish and a fixed composite panel with conductive finish for a new installation or a repair where the faying surfaces are prepared for a bond again.

For the bond test of composite panels, refer to Paragraph 22.I.

NOTE: The resistance values in Table 36 and in Table 37 are not applicable for radomes.

Table 36
MAXIMUM RESISTANCE OF THE BOND OF A FASTENER AND A COMPOSITE STRUCTURE WITH A CONDUCTIVE FINISH

Finish Material	Maximum Resistance (Ohms)
BMS10-21 Antistatic Conductive Paint	300,000
BMS8-278 Aluminum Coated Fabric	10
Expanded Aluminum Foil	0.5
Flamespray	0.5

Table 37
MAXIMUM RESISTANCE OF THE BOND OF A REMOVABLE COMPOSITE PANEL WITH A CONDUCTIVE FINISH AND A FIXED COMPOSITE PANEL WITH A CONDUCTIVE FINISH

Finish Material	Maximum Resistance (Ohms)
BMS10-21 Antistatic Conductive Paint	300,000
Flamespray	0.5

C. Resistance of Receptacle Connector Shell Bonds

The maximum resistance between the receptacle flange and the installation surface:

- Is given in Table 38 for a new installation or a repair where the faying surfaces are prepared for a bond again.
- Is 2.5 milliohms (0.0025 ohms) for a wire harness that is in service and the wire harness components have not been replaced or repaired.
- Is 10.0 milliohms (0.010 ohm) for a 737-600, 737-700, 737-800, 737-900, or 737-900ER Wing to Body feedthrough connector that is in service and has not been replaced or repaired. If the Wing to body feedthrough connector has been replaced or repaired the maximum resistance is 0.05 miliohms (Refer to WDM 91-04-13).

Table 39 specifies the maximum bond resistance between the shield termination and the installation surface for a new installation or a repair where the faying surfaces are prepared for a bond again.

For the bond test of connector shells, refer to Paragraph 22.H.

Table 38
MAXIMUM RESISTANCE BETWEEN A CONNECTOR SHELL AND STRUCTURE

Receptacle Material	Structure Material	Maximum Resistance		Figure Reference
		(milliohm)	(ohm)	
Aluminum	Aluminum	1.0	0.001	Figure 47
Steel	Steel	2.0	0.002	Figure 47
Steel	Aluminum	1.0	0.001	Figure 47
Nickel Plated Composite	Nickel Plated Composite	3.0	0.003	Figure 47
Nickel Plated Composite	Aluminum	2.5	0.0025	Figure 47

Table 39
MAXIMUM RESISTANCE BETWEEN A SHIELD TERMINATION AND STRUCTURE

Shield Termination Method	Receptacle Material	Structure Material	Maximum Resistance		Figure Reference
			(milliohm)	(ohm)	
Strain Relief Backshell	Aluminum	Aluminum	1.5	0.0015	Figure 48
Peripheral Backshell	Aluminum	Aluminum	1.5	0.0015	Figure 49
Shield Termination Band	Aluminum	Aluminum	1.5	0.0015	Figure 50
Shield Sock Termination	Aluminum	Aluminum	1.5	0.0015	Figure 52
Strain Relief Backshell	Steel	Steel	3.0	0.003	Figure 48
Peripheral Backshell	Steel	Steel	3.0	0.003	Figure 49
Shield Termination Band	Steel	Steel	3.0	0.003	Figure 50
Shield Sock Termination	Steel	Steel	3.0	0.003	Figure 52 Figure 52
Strain Relief Backshell	Steel	Aluminum	1.5	0.0015	Figure 48
Peripheral Backshell	Steel	Aluminum	1.5	0.0015	Figure 49
Shield Termination Band	Steel	Aluminum	1.5	0.0015	Figure 50
Shield Sock Termination	Steel	Aluminum	1.5	0.0015	Figure 52
Strain Relief Backshell	Nickel Plated Composite	Nickel Plated Composit	3.5	0.0035	Figure 48
Peripheral Backshell	Nickel Plated Composit	Nickel Plated Composit	3.5	0.0035	Figure 49

Table 39 MAXIMUM RESISTANCE BETWEEN A SHIELD TERMINATION AND STRUCTURE (Continued)

Shield Termination Method	Receptacle Material	Structure Material	Maximum Resistance		Figure Reference
			(milliohm)	(ohm)	
Shield Termination Band	Nickel Plated Composit	Nickel Plated Composit	3.5	0.0035	Figure 50
Shield Sock Termination	Nickel Plated Composit	Nickel Plated Composit	3.5	0.0035	Figure 52
Strain Relief Backshell	Nickel Plated Composite	Aluminum	3.0	0.0035	Figure 48
Peripheral Backshell	Nickel Plated Composit	Aluminum	3.0	0.0035	Figure 49
Shield Termination Band	Nickel Plated Composit	Aluminum	3.0	0.0035	Figure 50
Shield Sock Termination	Nickel Plated Composit	Aluminum	3.0	0.0035	Figure 52
Metal Ground Block	Aluminum	Aluminum	1.5	0.0015	-

D. Resistance of Static Discharger Bases Installed on Composite Surfaces

Table 40 specifies the maximum bond resistance of a static discharger base that is mounted on a composite structure for a new installation or a repair where the faying surfaces are prepared for a bond again.

Table 40
MAXIMUM RESISTANCE OF STATIC DISCHARGER BASES

Discharger Base	Surface Mounted On	Maximum Resistance (Ohms)	Measured Between
Aluminum	Aluminum	0.1	Discharger and Bond Structure
	BMS8-278 Aluminum Coated Fabric	0.01	Discharger and Basic Structure
	Flamespray	0.1	Discharger and Bond Structure
Titanium	Graphite	1.0	Discharger and Bond Structure
	Epoxy	1.0	Discharger and Bond Structure

E. Resistance of Hydraulic Fitting Bonds Inside a Fuel Tank

The resistance of a hydraulic fitting bond inside a fuel tank is designated as a Critical Design Configuration Control Limitation (CDCCL).

NOTE: The wiring configurations, installations, and procedures given allow the Critical Design Configuration Control Limitation (CDCCL) to decrease possible fuel tank ignition sources. If the CDCCL is not followed, the risk of a fuel tank ignition source can increase.

For the conditions that are applicable for the data in this paragraph, refer to Paragraph 1.F..

Table 41 specifies the maximum bond resistance of a hydraulic fitting inside a fuel tank for a new installation or a repair where the faying surfaces are prepared for a bond again.

ELECTRICAL BONDING PROCESSES

Table 42 specifies the maximum bond resistance of a hydraulic tube and a bulkhead fitting inside a fuel tank for a new installation or a repair where the faying surfaces are prepared for a bond again.

For the bond test of hydraulic fittings inside a fuel tank, refer to Paragraph 22.F..

NOTE: For hydraulic union or tee fitting bonds:

- The resistance is measured from the surface of one hydraulic tube to the surface of the other through the union or the tee
- The resistance that is specified for the larger size of tube is applicable for a reducer fitting.

NOTE: For a hydraulic tube and a bulkhead fitting bond inside a fuel tank, the resistance is measured from the surface of the hydraulic tube to the surface of the bulkhead.

Table 41
MAXIMUM RESISTANCE OF A HYDRAULIC UNION OR TEE FITTING BOND INSIDE A FUEL TANK

Tube		Maximum Resistance (ohm)
Size	Material	
-04	Stainless Steel	0.012
	Titanium	0.012
-06	Aluminum	0.0013
	Stainless Steel	0.008
	Titanium	0.008
-08	Aluminum	0.00095
	Stainless Steel	0.005
	Titanium	0.005
-10	Aluminum	0.00075
	Stainless Steel	0.003
	Titanium	0.003

Table 42
MAXIMUM RESISTANCE OF A HYDRAULIC TUBE AND A BULKHEAD FITTING BOND INSIDE A FUEL TANK

Tube		Type of Fitting	Maximum Resistance (ohm)
Size	Material		
-04	Titanium	Permaswage	0.006
		Weld-On	0.012
-06	Aluminum	All	0.0007
	Titanium	Permaswage	0.004
		Weld-On	0.008
-08	Aluminum	All	0.0005
	Titanium	Permaswage	0.0025
		Weld-On	0.005

Table 42 MAXIMUM RESISTANCE OF A HYDRAULIC TUBE AND A BULKHEAD FITTING BOND INSIDE A FUEL TANK (Continued)

Tube		Type of Fitting	Maximum Resistance (ohm)
Size	Material		
-10	Aluminum	All	0.00041
	Titanium	Permaswage	0.0015
		Weld-On	0.003

F. Resistance of Bulkhead Fitting Bonds

The maximum resistance between the basic structure and the bulkhead fitting is 0.001 ohm for a new installation or a repair where the faying surfaces are prepared for a bond again.

G. Resistance of Clamp and Conduit or Tube Bonds

Table 43 specifies the maximum resistance between a conduit or a tube and a clamp that holds the conduit or the tube for a new installation or a repair where the faying surfaces are prepared for a bond again.

For the bond test of hydraulic fittings inside a fuel tank, refer to Paragraph 22.G.

Table 43
MAXIMUM RESISTANCE OF BONDS BETWEEN A CONDUIT OR TUBE AND A CLAMP

Electrical Bond	Maximum Resistance (ohm)
Conduit or Tube to a Clamp	0.0015

H. Resistance of S280W555-() and YHLZG-() Ground Module Bonds

The maximum resistance from the basic structure to the body of the ground module is 0.001 ohm for a new installation or a repair where the faying surfaces are prepared for a bond again.

For the bond test of S280W555-() and YHLZG-() ground modules, refer to Paragraph 22.J.

I. Resistance of Interference Fit Fastener

Table 44 specifies the maximum resistance between two metal surfaces using an interference fit fasteners for new installation or a repair.

For the bond test of a interference fit fastener, refer to Paragraph 22.K..

Table 44
MAXIMUM RESISTANCE OF INTERFERENCE FIT FASTENERS

Fastener Quantity	Maximum Resistance Milliohms	Maximum Resistance Ohms
2 or 3	1	0.001
4 or more	0.5	0.0005

ELECTRICAL BONDING PROCESSES

J. Resistance of Bonds with Sleeved Bolts

When a resistance measurement is specified, the maximum resistance of bonds with sleeved bolts is 1 milliohm (0.001 ohm).

For the bond test of bonds with sleeved bolts, refer to Paragraph 22.K..

K. Maximum Resistance of a Tube-to-Tube Electrical Bond - Externally or Axially Swaged, or Flare or Flareless Fittings

NOTE: This procedure is intended for testing a union fitting with both tubes or a tee fitting with all three tubes that were assembled (swaged) within a 24 hour time period.

NOTE: If the resistance measurement of a tube-to-fitting has previously been accomplished in accordance with Paragraph 22.M. and met the requirements in Table 47, it is not necessary to measure the tube-to-tube resistance in accordance with Paragraph 22.U., it is only necessary to measure the remaining tube-to-fitting connection in accordance with Paragraph 22.M..

The tube-to-tube resistance across the fitting shall not exceed the values specified in Table 45 or Table 46 when tested in accordance with Paragraph 22.U..

Table 45
TUBE-TO-TUBE RESISTANCE ACROSS EXTERNALLY SWAGED AND FLARE AND FLARELESS FITTINGS

Tube		Maximum Resistance	
Material	Size	(Miliohms)	(Ohms)
Aluminum	-06	1.30	0.00130
	-08	0.95	0.00095
	-10	0.75	0.00075
	-12	0.60	0.00060
	-16	0.40	0.00040
	-20	0.20	0.00020
CRES	-04	12.0	0.012
	-06	8.0	0.008
	-08	5.0	0.005
	-10	3.0	0.003
Titanium	-04	12.0	0.0120
	-06	8.0	0.0080
	-08	5.0	0.0050
	-10	3.0	0.0030
	-12	2.6	0.0026
	-16	1.7	0.0017
	-20	1.3	0.0013

Table 46
TUBE-TO-TUBE RESISTANCE ACROSS AXIALLY SWAGED FITTINGS

Tube		Maximum Resistance	
Material	**Size**	**(Miliohms)**	**(Ohms)**
Aluminum	-04	0.13	0.00013
	-06	0.14	0.00014
	-08	0.10	0.00010
	-10	0.10	0.00010
	-12	0.08	0.00008
	-16	0.05	0.00005
Titanium	-04	6.1	0.0061
	-06	5.0	0.0050
	-08	2.5	0.0025
	-10	2.0	0.0020
	-12	1.7	0.0017
	-16	0.91	0.00091

L. Maximum Resistance of a Tube-to-Fitting Electrical Bond - Externally or Axially Swaged, or Flare or Flareless Fittings

NOTE: This procedure is intended for the test of the electrical bond resistance from a tube to a union, or from a tube to a tee, where the tube-to tee fitting, or the tube-to-union fitting has been assembled (swaged) within a 24 hour time period.

The tube-to-fitting resistance shall not exceed the values specified in Table 47 or Table 48 when tested in accordance with Paragraph 22.M..

Table 47
TUBE-TO-FITTING RESISTANCE ACROSS EXTERNALLY SWAGED AND FLARE AND FLARELESS FITTINGS

Tube		Maximum Resistance	
Material	**Size**	**(Miliohms)**	**(Ohms)**
Aluminum	-06	0.70	0.0007
	-08	0.50	0.0005
	-10	0.41	0.00041
	-12	0.30	0.0003
	-16	0.20	0.0002
	-20	0.10	0.0001
CRES	-04	6.00	0.006
	-06	4.00	0.004
	-08	2.50	0.0025
	-10	1.50	0.0015

Table 47 TUBE-TO-FITTING RESISTANCE ACROSS EXTERNALLY SWAGED AND FLARE AND FLARELESS FITTINGS (Continued)

Tube		Maximum Resistance	
Material	**Size**	**(Miliohms)**	**(Ohms)**
Titanium	-04	6.00	0.006
	-06	4.00	0.004
	-08	2.50	0.0025
	-10	1.50	0.0015
	-12	1.30	0.0013
	-16	0.81	0.00081
	-20	0.64	0.00064

Table 48
TUBE-TO-FITTING RESISTANCE ACROSS AXIALLY SWAGED FITTINGS

Tube		Maximum Resistance	
Material	**Size**	**(Miliohms)**	**(Ohms)**
Aluminum	-04	0.07	0.00007
	-06	0.07	0.00007
	-08	0.05	0.00005
	-10	0.05	0.00005
	-12	0.04	0.00004
	-16	0.03	0.00003
Titanium	-04	3.8	0.0038
	-06	2.0	0.0020
	-08	2.0	0.0020
	-10	2.0	0.0020
	-12	2.0	0.0020
	-16	2.0	0.0020

M. Maximum Resistance of a Tube-to-Tube, a Tube-to-Isolator or a Tube-to-Component Electrical Bond - Self-Bonding Couplings

The electrical bond resistance across a tube-to-tube, a tube-to-isolator or a tube-to-component self-bonding coupling shall not exceed the values specified in Table 49 when tested in accordance with Paragraph 22.N., Paragraph 22.O., or Paragraph 22.P..

Table 49
TUBE-TO-TUBE, TUBE-TO-ISOLATOR OR TUBE-TO-COMPONENT RESISTANCE ACROSS SELF-BONDING COUPLINGS

Coupling			Maximum Resistance	
Type	Applicable Part Numbers	Supplier	(Miliohms)	(Ohms)
Rigid	15J17	Hydraflow	100	0.1
Flexible	CA371	Eaton	1000	1.0
	CA372	Eaton	1000	1.0
	Z58359A	Inflex	1000	1.0

N. Resistance of Driven Rivet Electrical Bonds

The maximum resistance between the surfaces of a driven rivet electrical bond is 0.5 miliohms (0.0005 ohms).

O. Resistance of Ground Block Installations

The maximum resistance between the surfaces of a driven rivet electrical bond is 1 miliohm (0.001 ohms).

P. Resistance of Static Discharger Assemblies

The maximum resistance between the base of a static discharger assembly and the structure is shown in Table 50.

Table 50
RESISTANCE OF A STATIC DISCHARGER ASSEMBLY

Bond Surface Material	Static Discharger Base Material	Maximum Resistance	
		Miliohms	Ohms
Aluminum Coated Fiber	Aluminum	10	0.01
Flamespray	Aluminum	100	0.1
CFRP	Titanium	1000	1.0
Aluminum	Aluminum	0.5	.0005

Q. Resistance of Tube Bulkhead Fitting Installations

The maximum resistance between the bulkhead fitting and the tube is shown in Table 51.

The maximum resistance between the bulkhead fitting and the structure is 1 milliohm (0.001 ohms).

Table 51
RESISTANCE OF A TUBE BULKHEAD FITTING INSTALLATION

Tube			Maximum Resistance	
Material	Size	Configuration	(miliohms)	(ohms)
Aluminum	-06	-	0.70	0.0007
	-08	-	0.50	0.0005
	-10	-	0.41	0.00041
	-12	-	0.30	0.0003
	-16	-	0.20	0.0002
	-20	-	0.10	0.0001
Titanium	-04	Flareless	12.00	0.012
		Permanent	6.00	0.006
	-06	Flareless	8.00	0.008
		Permanent	4.00	0.004
	-08	Flareless	5.00	0.005
		Permanent	2.50	0.0025
	-10	Flareless	3.00	0.003
		Permanent	1.50	0.0015
	-12	Permanent	1.30	0.0013
	-16	Permanent	0.81	0.00081
	-20	Permanent	0.64	0.00064

R. Resistance of Fasteners to Conductive Finishes on Composite Panels

For the maximum resistance of fasteners to conductive finishes, Refer to Table 52.

Table 52
THE MAXIMUM RESISTANCE BETWEEN FASTENERS AND CONDUCTIVE FINISHES ON COMPOSITE PANELS

Conductive Finish	Maximum Resistance (ohms)
BMS10-21, Type III Anti-Static Coating	300,000
BMS8-278 Aluminum Coated Fiber	10
BMS8-336 Expanded Aluminum Foil	0.5
Flamespray	0.5

For the procedure to perform the test, refer to Paragraph 22.V..

S. Resistance of Composite Panels

If the bond is between a graphite panel and metal structure, the maximum resistance is 100 ohms.

If the bond is between a fixed panel and a removable panel, refer to Table 53.

Table 53
RESISTANCE BETWEEN FIXED PANELS AND A REMOVABLE PANELS THAT HAVE CONDUCTIVE COATINGS

Conductive Coating	Maximum Resistance (ohms)
BMS10-21, Type III Anti-Static Coating	300,000
Flamespray	0.5

For the procedure to perform the test, refer to Paragraph 22.W..

22. TEST PROCEDURES FOR ELECTRICAL BONDS

A. General Conditions for Bond Resistance Tests

For a bond that has a jumper or a designated ground wire, a control point that is used to measure the resistance must be:

- In the cleaned area for the terminal
- 0.25 inch maximum from the terminal.

Two points must be used to calibrate the meter to zero ohms:

- One point is on one side of the cleaned area
- The other point is on the opposite side of the same cleaned area.

NOTE: Either of the two points can be used as the control point.

B. Conditions for Bond Resistance Tests

Bond resistance meters are acceptable if all of these conditions occur:

- The meter is calibrated
- The meter has an accuracy of ±5 percent of the reading in the range specified by the manufacturer of the equipment
- For digital equipment, the accuracy is certified to ±5 percent, and ±1 percent of the display count
- The meter has a four probe design
- The meter has different probes for current and potential.

NOTE: The satisfactory alternatives to measure resistances that are greater than 1 ohm are:

- An ohmmeter
- A multimeter.

NOTE: To measure AC and DC current return grounds:

- With Model M1 bond resistance meter, it is not necessary to disconnect each plug from the equipment
- With other bond resistance meters, it is necessary to disconnect each plug from the equipment.

Refer to Table 54 for bond resistance meters that Boeing uses for areas considered as non-hazardous that meet the conditions.

Table 54
BOND RESISTANCE METERS FOR AREAS CONSIDERED AS NON-HAZARDOUS

Part Number	Supplier
DLRO 247000-47	Biddle
DLRO 247000-7	Biddle
Model M	BCD Electronics
Model M1B	BCD Electronics
Model T207 Type W	Avtron
Model T477W	Avtron

WARNING: DO NOT USE A METER ON A SQUIB OR AN ELECTRO-EXPLOSIVE DEVICE.

WARNING: DO NOT USE A METER LISTED IN TABLE 54 ON A SQUIB OR AN ELECTRO-EXPLOSIVE DEVICE. DO NOT USE BIDDLE BOND RESISTANCE METERS DLR024700-47 OR DLR0274000-7 OR AVTRON MODEL T207 TYPE W IN AREAS SUBJECT TO COMBUSTION, FIRE OR EXPLOSION.

C. Conditions for Bond Resistance Tests - Areas Subject to Combustion Fire or Explosion

Bond resistance meters are acceptable if all of these conditions occur:

- The meter is calibrated
- The meter has an accuracy of ±5 percent of the reading in the range specified by the manufacturer of the equipment
- For digital equipment, the accuracy is certified to ±5 percent and ±1 percent of the display count
- The meter has been approved by the Factory Mutual Approval Standard 3610, or qualified to Underwriter's Laboratory (UL) Standard 913 for Class 1, Division 1, Group A atmosphere.

WARNING: BEFORE A METER IS USED IN A COMBUSTION, FIRE OR EXPLOSION HAZARD AREA, MAKE SURE THAT DANGEROUS VAPORS ARE NOT IN THE AREA. INJURY CAN OCCUR.

WARNING: THE PROBES OF A METER MUST NOT BE PUT DIRECTLY ON:

- THE TERMINAL OF AN EXPLOSIVE SQUIB
- A PART OF THE CIRCUIT THAT IS CONNECTED TO AN EXPLOSIVE SQUIB
- THE CASE OF AN EXPLOSIVE SQUIB.

Refer to Table 55 for the bond resistance meters that Boeing uses for areas subject to combustion, fire or explosion that meet these conditions.

NOTE: To measure AC and DC current return grounds:

- With Model M1 bond resistance meter, it is not necessary to disconnect each plug from the equipment
- With other bond resistance meters, it is necessary to disconnect each plug from the equipment.

Table 55
BOND RESISTANCE METERS FOR AREAS SUBJECT TO COMBUSTION, FIRE OR EXPLOSION

Part Number	Supplier
Model M1	BCD Electronics
Model M1B	BCD Electronics
Model T477W	Avtron

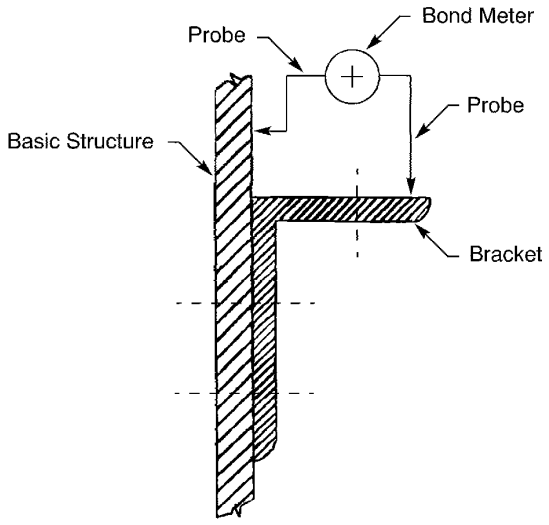
WARNING: DO NOT USE A METER ON A SQUIB OR AN ELECTRO-EXPLOSIVE DEVICE.

WARNING: DO NOT USE THE BOND RESISTANCE METERS LISTED IN TABLE 55 ON A SQUIB OR AN ELECTRO-EXPLOSIVE DEVICE.

D. Bond Test for Faying Surfaces

(1) For the test points for a bracket to structure bond:

Refer to Paragraph 21.A. for the maximum resistance values. The location of the test points for a bracket to structure bond is shown in Figure 37.



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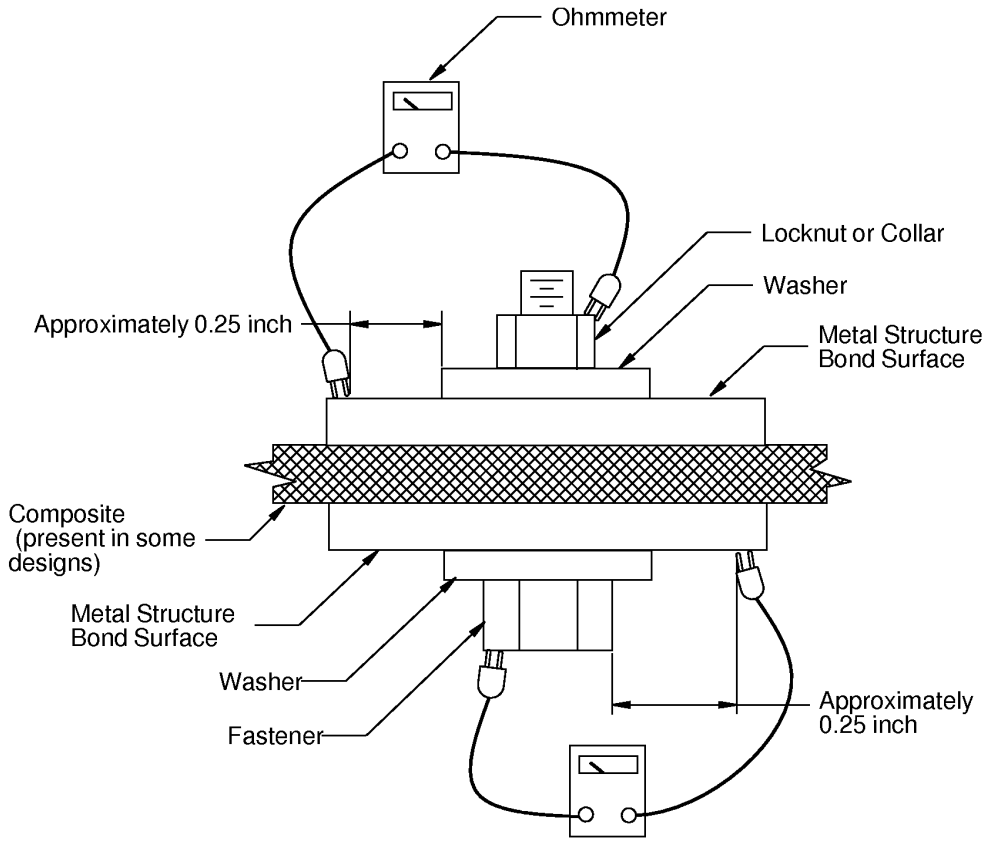
TEST POINTS FOR A BRACKET TO STRUCTURE BOND
Figure 37

(2) For the test points for a fastener or locknut/collar to structure bond:

Refer to Paragraph 21.A. for the maximum resistance. The location of the test points for a fastener or locknut/collar is shown in Figure 38



TEST POINTS FOR A FASTENER OR LOCKNUT/COLLAR TO A STRUCTURE BOND
Figure 38

(3) If the bonding surface of the metal structure has a surface finish, then remove a sufficient area of the surface finish to let the probe touch the bonding surface. To remove the finish, Refer to Paragraph 1.D.

NOTE: AN ALTERNATE PROCEDURE WOULD BE TO CAREFULLY PIERCE THE SURFACE FINISH WITH THE PROBES TO LET THE PROBE TOUCH THE BONDING SURFACE.

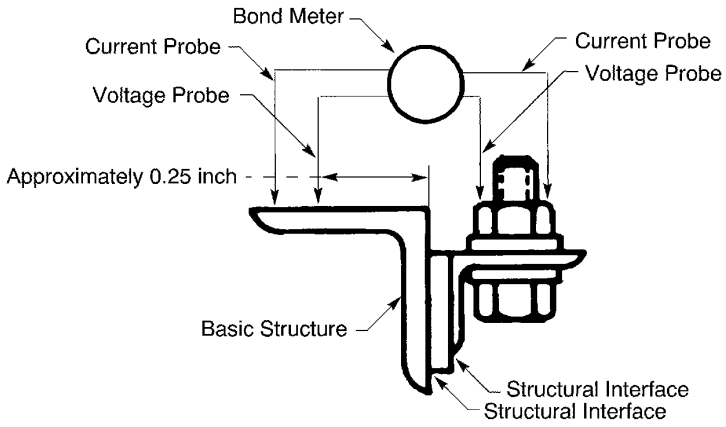
E. Bond Test of a Current Return Ground

Refer to:

- Subject 20-20-10 for the maximum resistance values.

The location of the test points is shown in:

- Figure 39 for a pre-installed standard ground stud
- Figure 40 for a direct standard ground stud.



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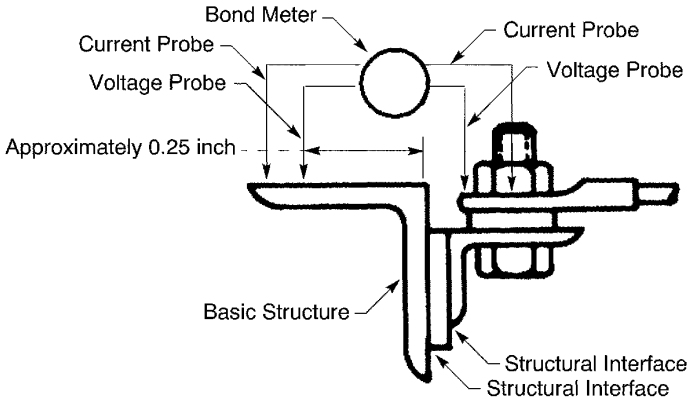
TEST POINTS FOR A PRE-INSTALLED STANDARD GROUND STUD
Figure 39



2445603 S00061544595_V1

TEST POINTS FOR A DIRECT STANDARD GROUND STUD
Figure 40

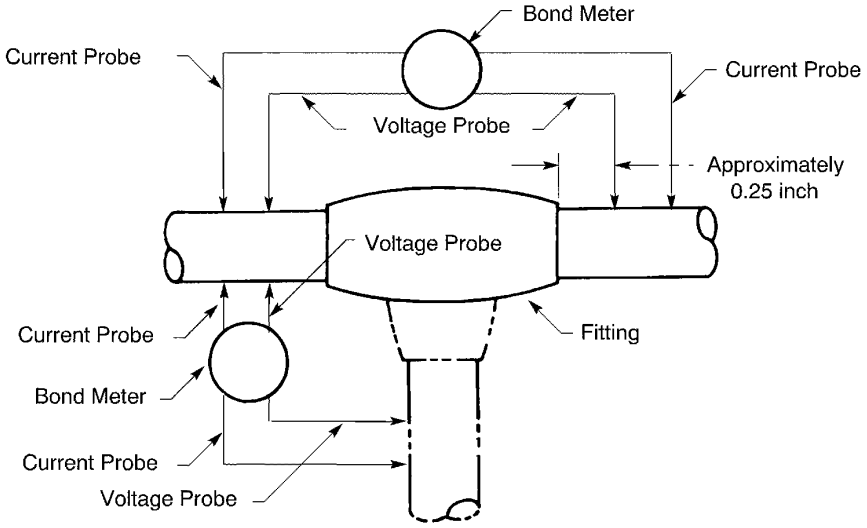
F. Bond Test of Hydraulic Fittings in Fuel Tank

Refer to:

- Paragraph 21.E. for the conditions of the test
- Table 41 or Table 42 for the maximum resistance values.

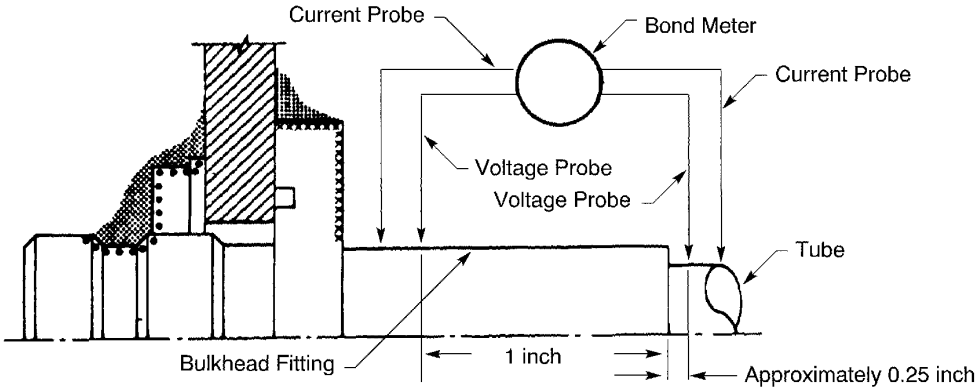
The location of the test points is shown in:

- Figure 41 for a union or tee fitting
- Figure 42 for a permaswage bulkhead fitting
- Figure 43 for a welded bulkhead fitting
- Figure 44 for a permaswage bulkhead fitting and basic structure
- Figure 45 for a welded bulkhead fitting and basic structure.



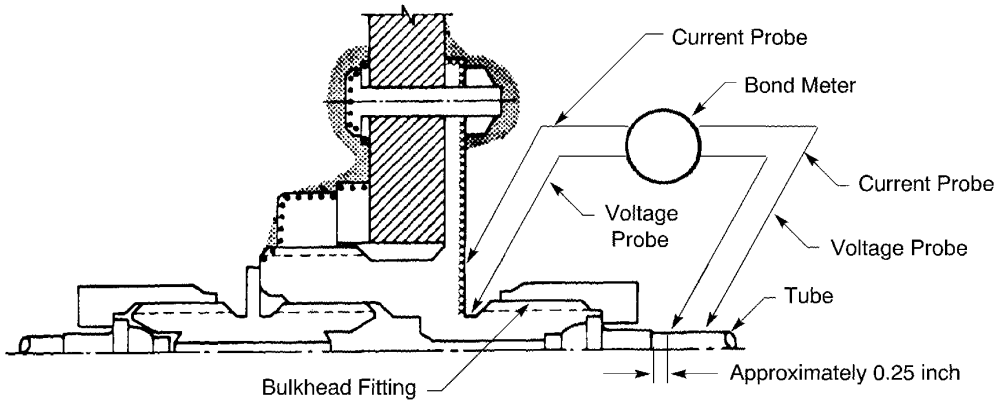
2445604 S00061544596_V1

TEST POINTS FOR A HYDRAULIC UNION OR TEE FITTING
Figure 41



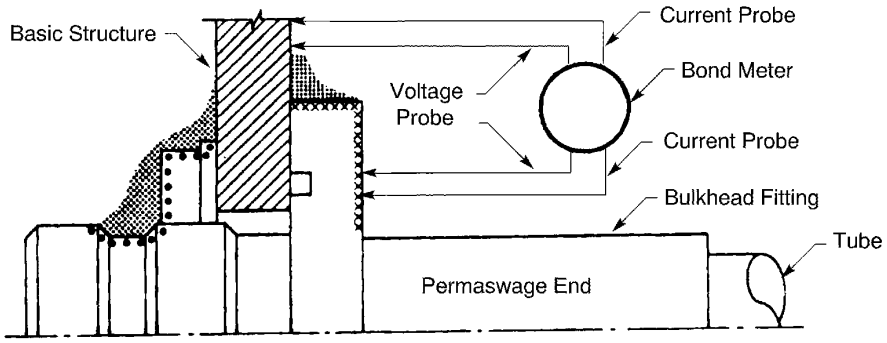
2445605 S00061544597_V1

TEST POINTS FOR A PERMASWAGE BULKHEAD FITTING
Figure 42



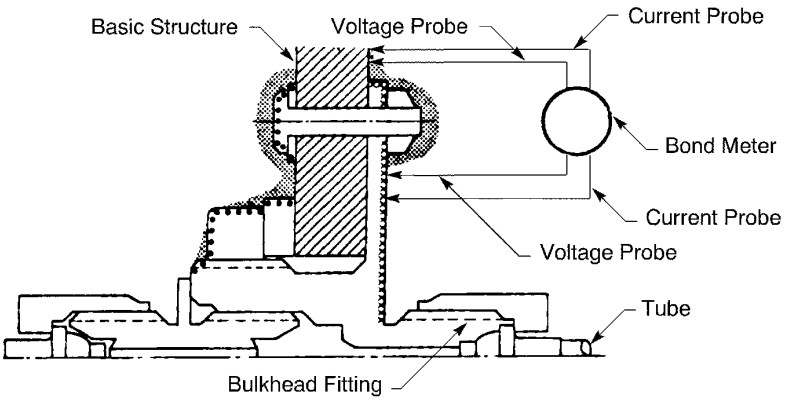
2445606 S00061544598_V1

TEST POINTS FOR A WELDED BULKHEAD FITTING
Figure 43



2445607 S00061544599_V1

TEST POINTS FOR A PERMASWAGE BULKHEAD FITTING AND BASIC STRUCTURE
Figure 44



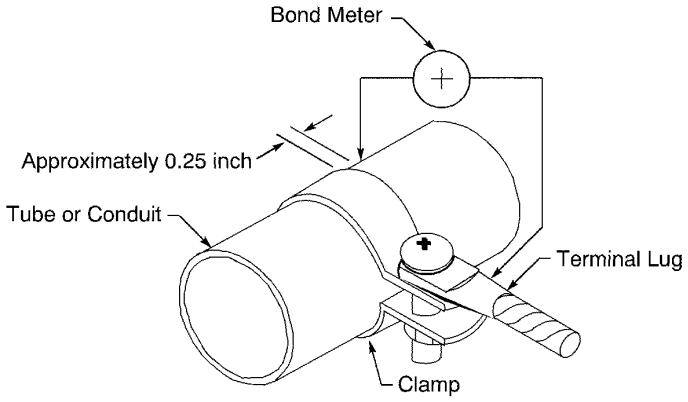
2445608 S00061544600_V1

TEST POINTS FOR A WELDED BULKHEAD FITTING AND BASIC STRUCTURE
Figure 45

G. Bond Test of a Clamp on a Conduit or a Tube

Refer to:

- Paragraph 22.A. for the general conditions for a bond test
- Paragraph 22.B. for the conditions and bond meters for a bond test in a not explosion hazard area
- Paragraph 22.C. for the conditions and bond meters for a bond test in an explosion hazard area.
- Paragraph 21.G. for the maximum resistance values.



2447302 S00061544601_V1

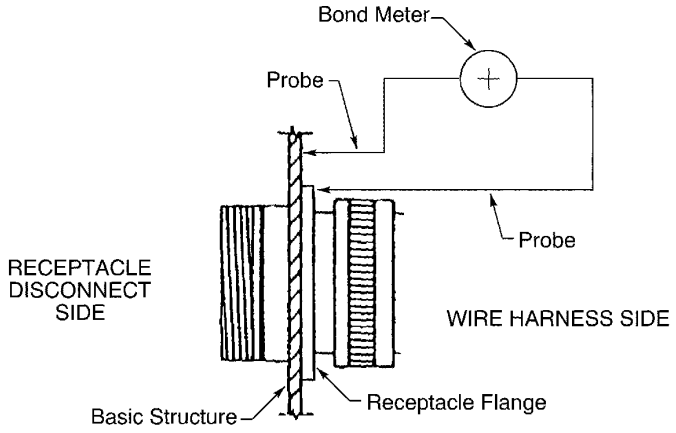
TEST POINTS FOR A CLAMP AND CONDUIT OR TUBE BOND
Figure 46

H. Bond Test of Receptacle Connector Shells

Refer to Paragraph 21.C. for the maximum resistance values.

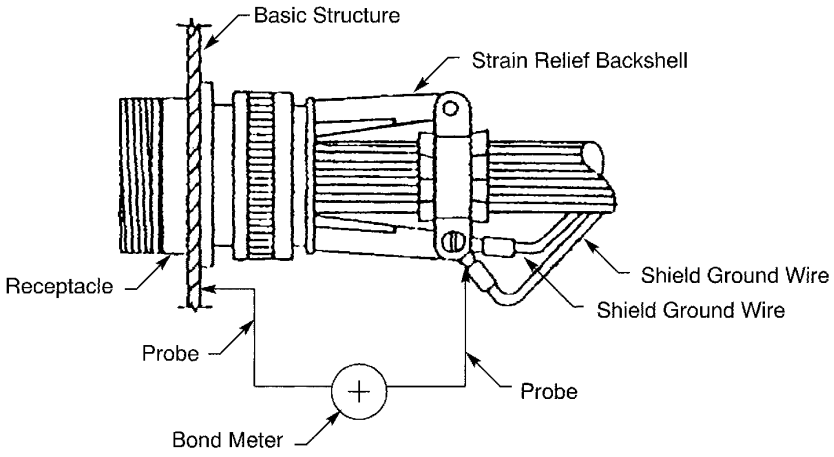
The location of the test points is shown in:

- Figure 47 for the bond of the receptacle and the installation surface
- Figure 48 for shield termination on a receptacle with a strain relief backshell
- Figure 49 for shield termination on a receptacle with a peripheral backshell
- Figure 50 for shield termination on a receptacle with a backshell and a shield terminator band
- Figure 51 for a special configuration of stainless steel plug and receptacle
- Figure 52 for a receptacle with a shield sock termination.



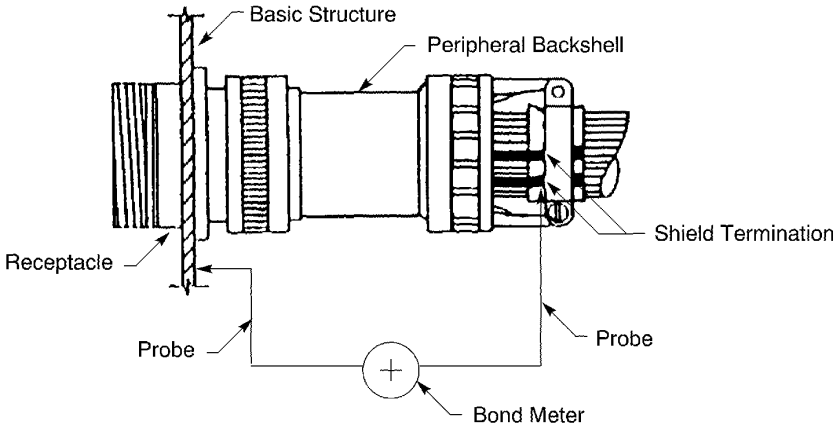
2446921 S00061544602_V1

TEST POINTS FOR A RECEPTACLE CONNECTOR AND STRUCTURE BOND
Figure 47



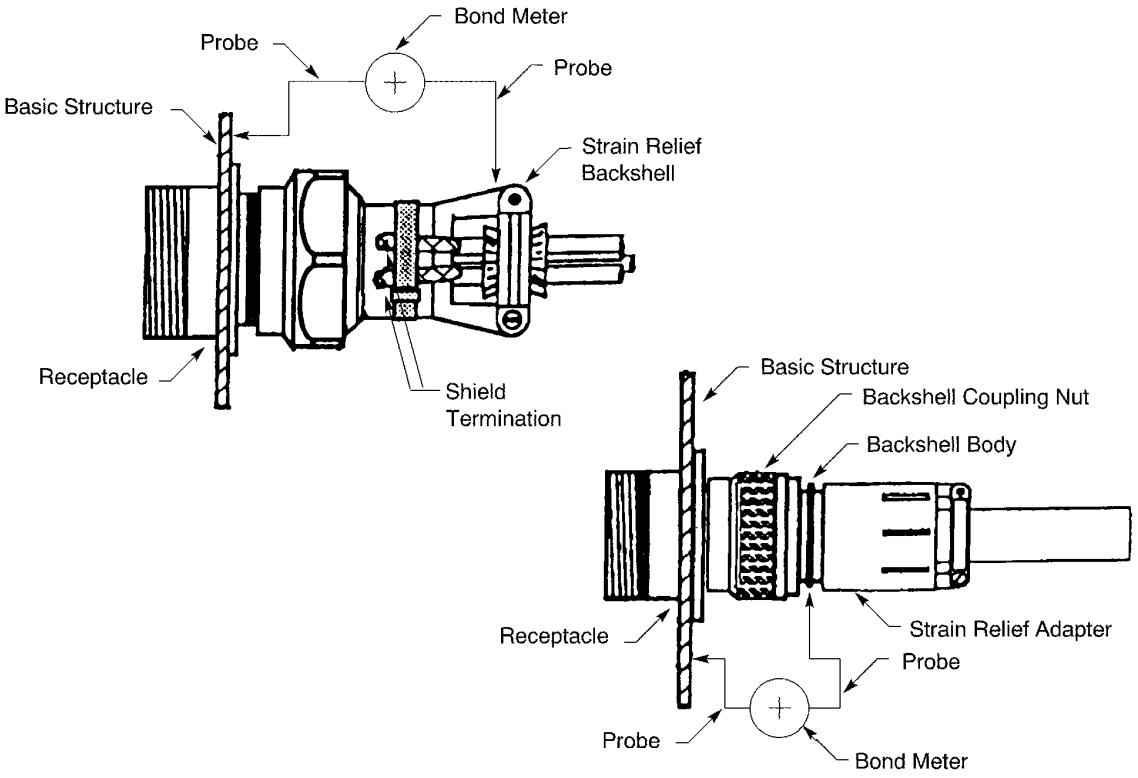
2445609 S00061544603_V1

TEST POINTS FOR A CONNECTOR WITH A STRAIN RELIEF BACKSHELL
Figure 48



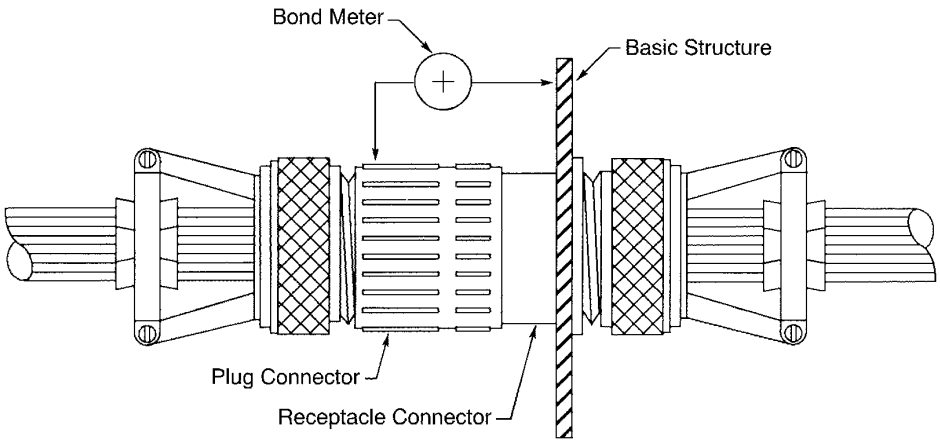
2445610 S00061544604_V1

TEST POINTS FOR A CONNECTOR WITH A PERIPHERAL BACKSHELL
Figure 49



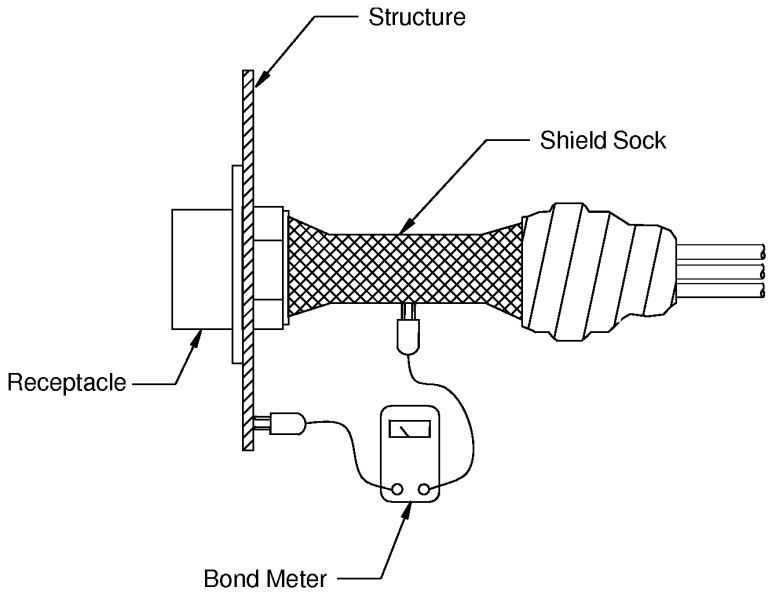
2445611 S00061544605_V1

TEST POINTS FOR THE CONNECTORS WITH A SHIELD TERMINATOR BAND
Figure 50



2446922 S00061544606_V1

TEST POINTS FOR A STAINLESS STEEL PLUG AND STRUCTURE BOND
Figure 51



2448917 S00061544607_V1

TEST POINTS FOR A SHIELD SOCK TERMINATION
Figure 52

ELECTRICAL BONDING PROCESSES

CAUTION: DO NOT PUSH THE TEST PROBES THROUGH THE SHIELD SOCK. DAMAGE TO THE WIRE HARNESS CAN OCCUR.

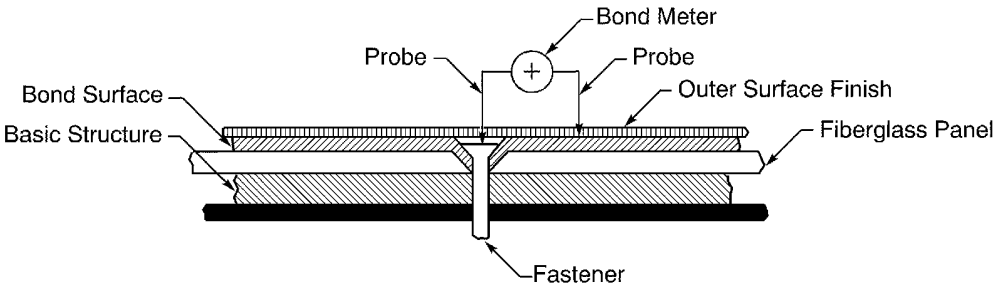
I. Bond Test of Composite Panels

Refer to:

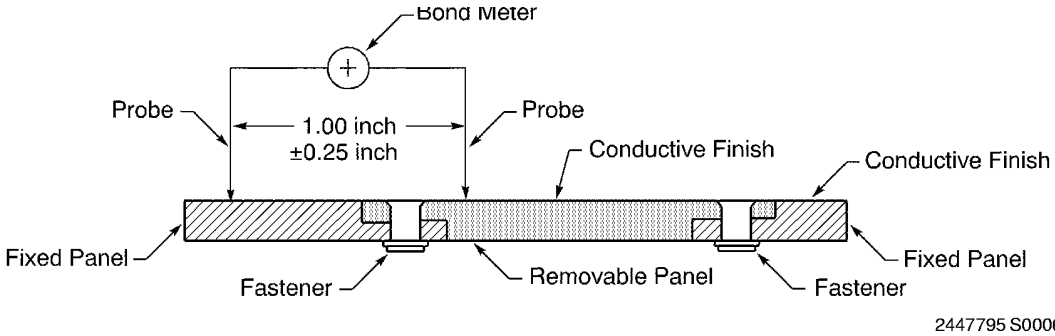
- Paragraph 22.A. for the general conditions for a bond test
- Paragraph 22.B. for the conditions and bond meters for a bond test in a not explosion hazard area
- Paragraph 22.C. for the conditions and bond meters for a bond test in an explosion hazard area
- Paragraph 21.B. for the maximum resistance values.

The location of the test points is shown in:

- Figure 53 for a fastener and a composite panel with a conductive finish
- Figure 54 for a removable panel with a conductive finish and a fixed panel with a conductive finish.



TEST POINTS FOR A FASTENER AND A COMPOSITE PANEL WITH A CONDUCTIVE FINISH
Figure 53



TEST POINTS FOR A REMOVABLE PANEL WITH A CONDUCTIVE FINISH AND A FIXED PANEL WITH A CONDUCTIVE FINISH
Figure 54

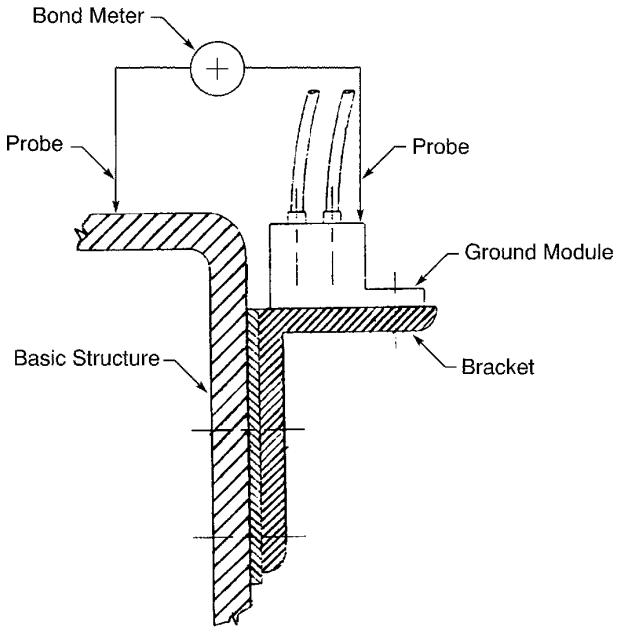
J. Bond Test of S280W555-() and YHLZG-() Ground Modules

Refer to Paragraph 21.H. for the maximum resistance.

If designated grounds are terminated in a ground module, it is not necessary to measure the resistance between each individual wire and the basic structure. The ground module and the basic structure are sufficient as test points. Refer to Figure 55.

NOTE: To measure the resistance in a stow bin, the test points are either of these pairs:

- The ground module and the adjacent support structure of the stow bin
- The ground stud and the adjacent support structure of the stow bin.



2445612 S00061544611_V1

TEST POINTS FOR A GROUND MODULE
Figure 55

K. Bond Test for Interference Fit Fastener

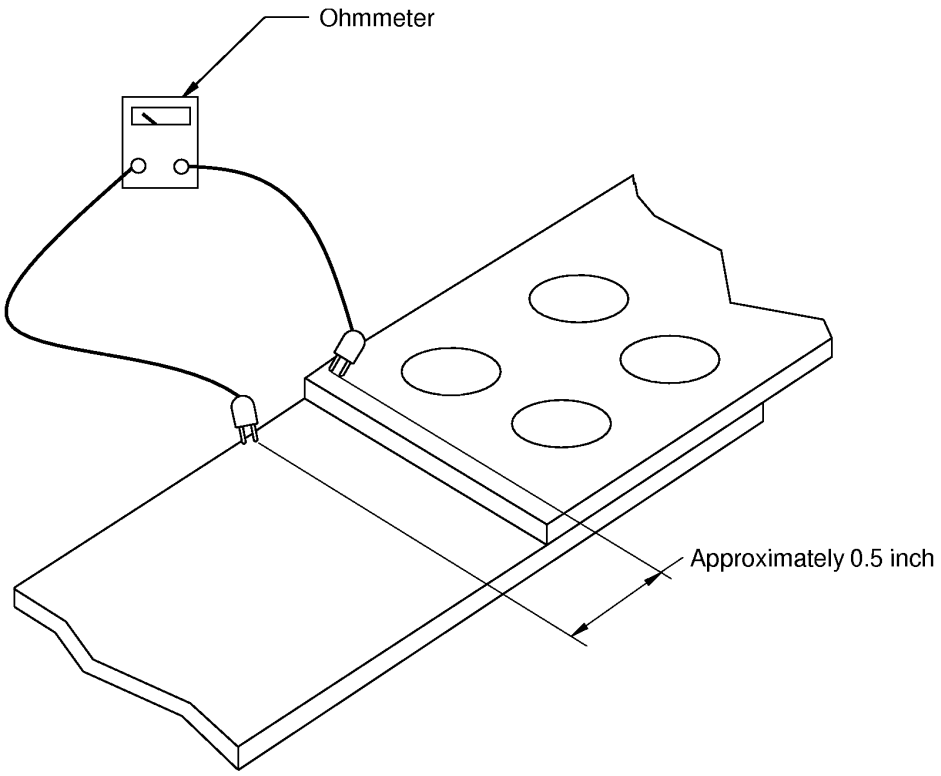
For the bond test of Interference Fit fastener, follow these steps:

(1) If the bonding surface of the metal structure has a surface finish, then remove a sufficient area of the surface to allow the probe to touch the bonding surface. To remove the finish, Refer to Paragraph 1.D.

NOTE: An alternate procedure would be to carefully pierce the surface finish with the probes to let the probe touch the bonding surface.

(2) Place the ohmmeter probes on the electrical bonded surfaces as shown in Figure 56.

NOTE: The distance between the test probes can be more than the value shown in Figure 56. If the measured resistance at the increased distance is more than allowed, then do the test again with the probes at the distance shown.



2448580 S00061544612_V1

BOND TEST FOR INTERFERENCE FIT FASTENER
Figure 56

L. Bond Test for Bonds with Sleeved Bolts

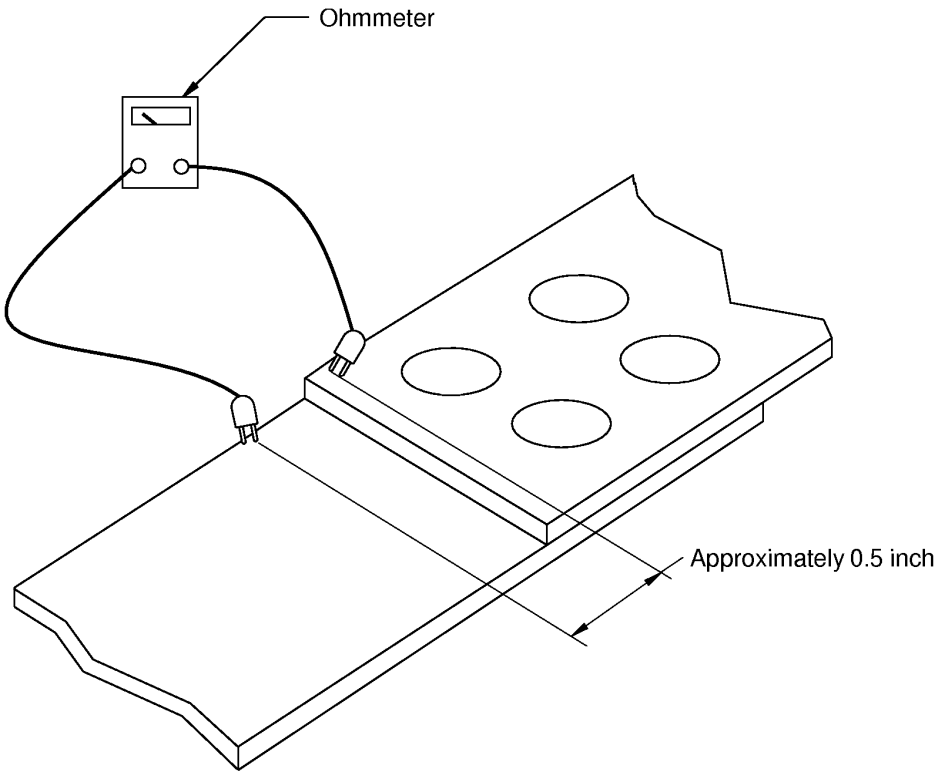
For the bond test of Bonds with Sleeved Bolts, follow these steps:

(1) If the bonding surface of the structure has a surface finish, then remove a sufficient area of the surface to allow the probe to touch the bonding surface. To remove the finish, Refer to Paragraph 1.D.

NOTE: An alternate procedure would be to carefully pierce the surface finish with the probes to let the probe touch the bonding surface.

(2) Place the ohmmeter probes on the electrical bonded surfaces as shown in Figure 57.

NOTE: The distance between the test probes can be more than the value shown in Figure 57. If the measured resistance at the increased distance is more than allowed, then do the test again with the probes at the distance shown.

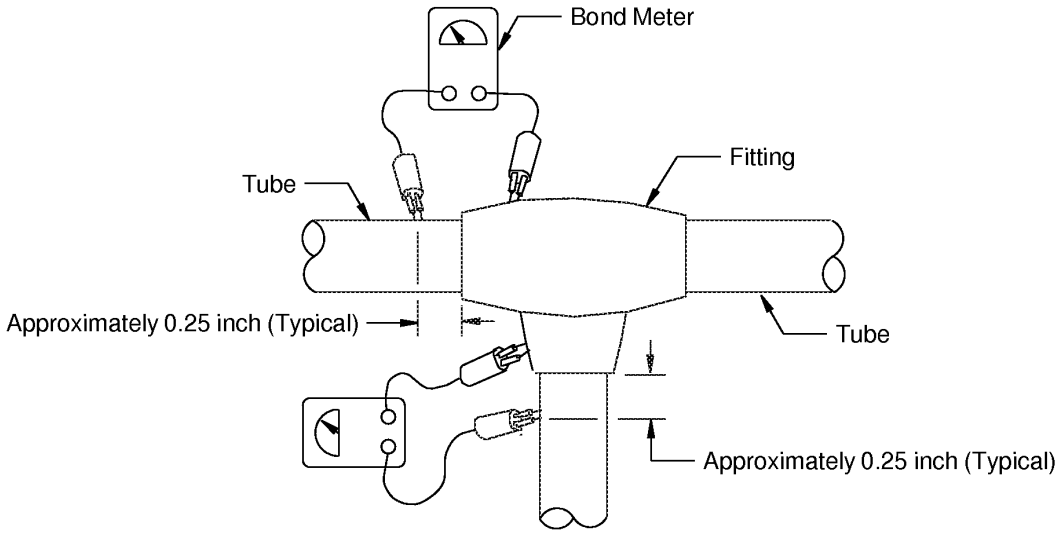


2448580 S00061544612_V1

BOND TEST FOR BONDS WITH SLEEVED BOLTS
Figure 57

M. Electrical Bond Test of a Tube to a Tee Fitting or a Tube to a Union Fitting

(1) Place the bond meter probes on the electrical bonded surfaces as shown in Figure 58.



RESISTANCE ACROSS TUBE-TO-TEE OR TUBE-TO-UNION FITTINGS
Figure 58

(2) Verify the resistance value shown on the bond meter is less than or equal to the resistance requirement specified in Paragraph 21.L..

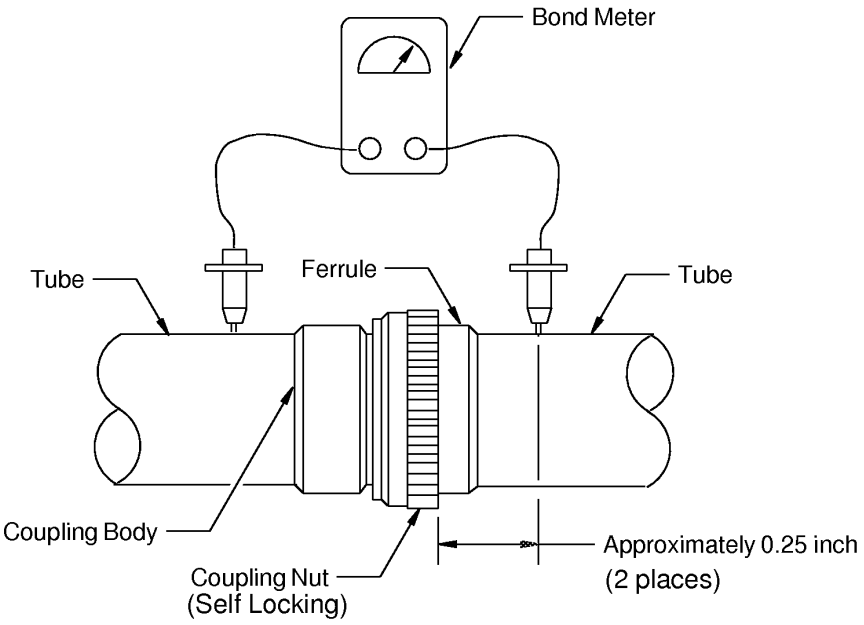
(3) A part from which the original finish has been removed for testing must be refinished within seven days after the original finish is removed:

(a) if an aluminum part included an anodized surface, and the finish was removed during the surface preparation, apply the chemical conversion coating on the areas of the faying surface where the finish has been removed.

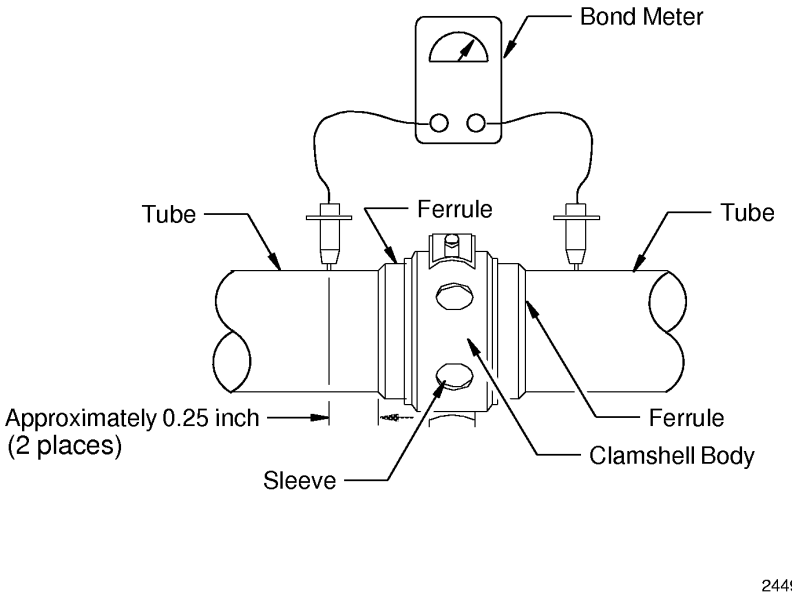
(b) Reapply all other original finishes on the areas of the surface where the finish has been removed.

N. Electrical Bond Test Across a Self-Bonding Coupling - a Tube to a Tube

(1) Place the bond meter probes on the electrical bonded surfaces as shown in Figure 59.



RESISTANCE ACROSS RIGID COUPLING (TUBE-TO-TUBE)
Figure 59



RESISTANCE ACROSS FLEXIBLE COUPLINGS (TUBE-TO-TUBE)
Figure 60

(2) Verify the resistance value shown on the bond meter is less than or equal to the resistance requirement specified in Paragraph 21.M..

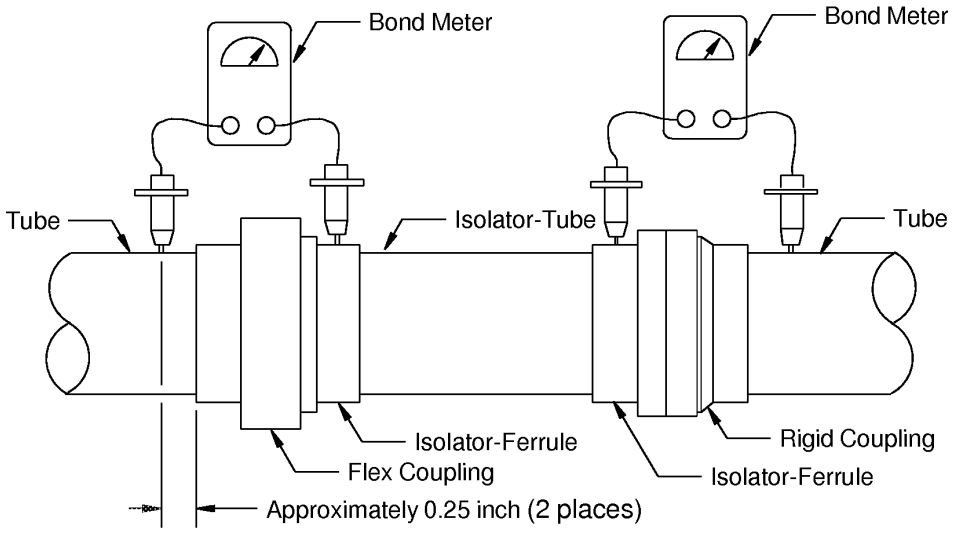
(3) A part from which the original finish has been removed for testing must be refinished within seven days after the original finish is removed:

(a) if an aluminum part included an anodized surface, and the finish was removed during the surface preparation, apply the chemical conversion coating on the areas of the faying surface where the finish has been removed.

(b) Reapply all other original finishes on the areas of the surface where the finish has been removed.

O. Electrical Bond Test Across a Self-Bonding Coupling - a Tube to an Isolator

(1) Place the bond meter probes on the electrical bonded surfaces as shown in Figure 61.



2449264 S00061544616_V1

RESISTANCE ACROSS TUBE-TO-ISOLATOR-FERRULE
Figure 61

(2) Verify the resistance value shown on the bond meter is less than or equal to the resistance requirement specified in Paragraph 21.M..

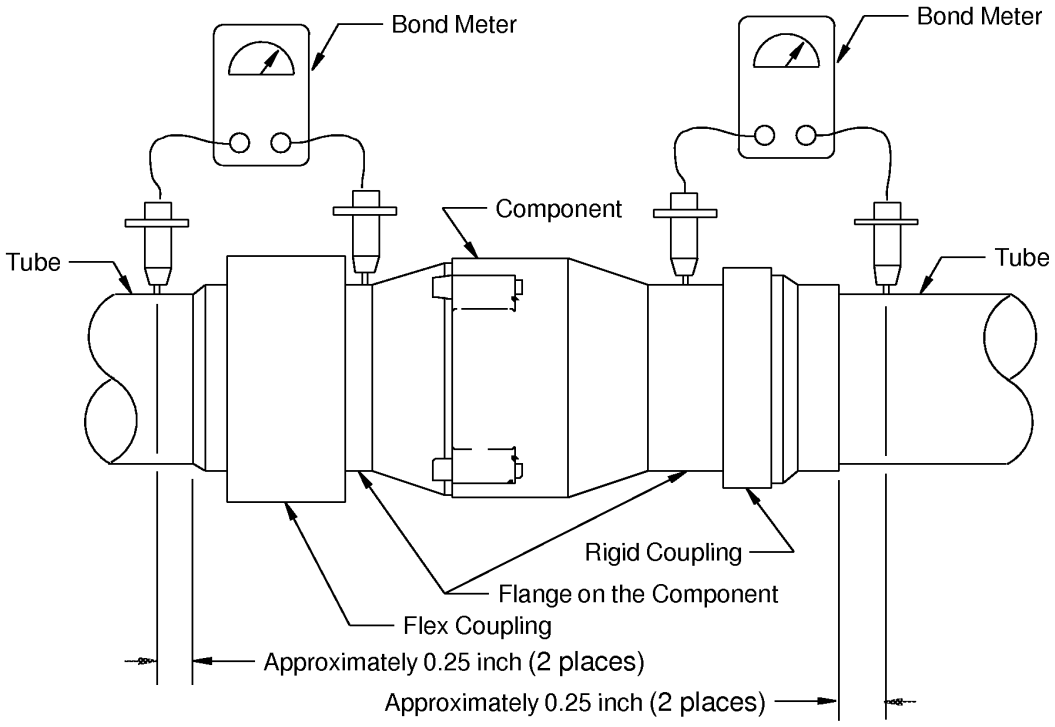
(3) A part from which the original finish has been removed for testing must be refinished within seven days after the original finish is removed:

(a) if an aluminum part included an anodized surface, and the finish was removed during the surface preparation, apply the chemical conversion coating on the areas of the faying surface where the finish has been removed.

(b) Reapply all other original finishes on the areas of the surface where the finish has been removed.

P. Electrical Bond Test Across a Self-Bonding Coupling - a Tube to a Component

(1) Place the bond meter probes on the electrical bonded surfaces as shown in Figure 62.



2449265 S00061544617_V1

RESISTANCE ACROSS TUBE-TO-COMPONENT
Figure 62

(2) Verify the resistance value shown on the bond meter is less than or equal to the resistance requirement specified in Paragraph 21.M..

(3) A part from which the original finish has been removed for testing must be refinished within seven days after the original finish is removed:

(a) if an aluminum part included an anodized surface, and the finish was removed during the surface preparation, apply the chemical conversion coating on the areas of the faying surface where the finish has been removed.

(b) Reapply all other original finishes on the areas of the surface where the finish has been removed.

ELECTRICAL BONDING PROCESSES

Q. Bond Test of a Tube Bulkhead Fitting Installation

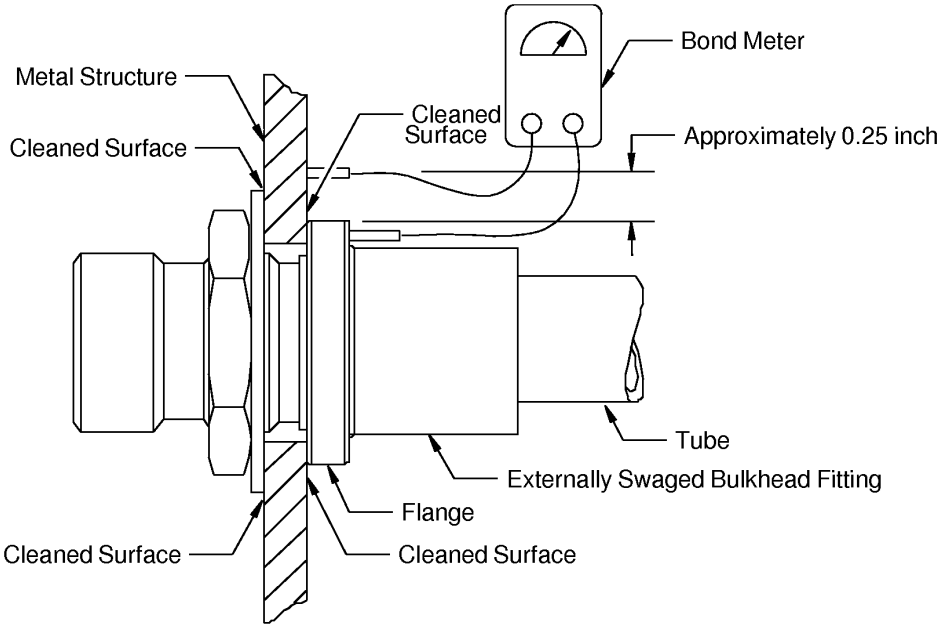
For the bond test of a tube bulkhead fitting installation, follow these steps:

(1) If the bonding surface of the structure has a surface finish, then remove a sufficient area of the surface to allow the probe to touch the bonding surface. To remove the finish, Refer to Paragraph 1.D.

NOTE: An alternate procedure would be to carefully pierce the surface finish with the probes to let the probe touch the bonding surface.

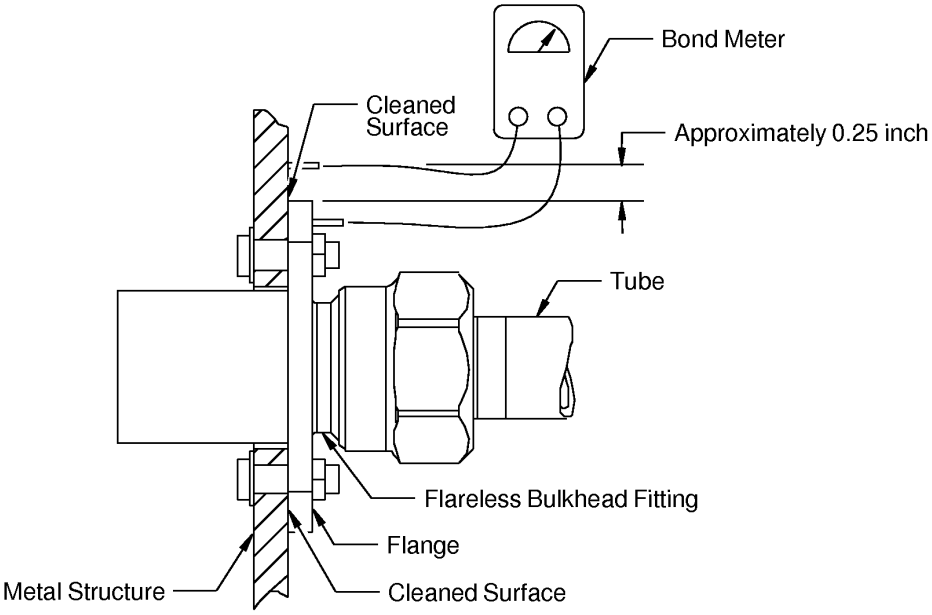
(2) Place the bond meter probes on the electrical bonded surfaces as shown in:

- Figure 63 for an externally swaged bulkhead fitting
- Figure 64 for a flareless bulkhead fitting.



2449269 S00061544618_V1

RESISTANCE FROM EXTERNALLY SWAGED BULKHEAD FITTING ENDS TO STRUCTURE
Figure 63



RESISTANCE FROM FLARELESS BULKHEAD FITTING ENDS TO STRUCTURE
Figure 64

(3) Re-apply the finish to any bare metal areas used for the test within seven days of removing the original finish. Refer to Paragraph 1.E..

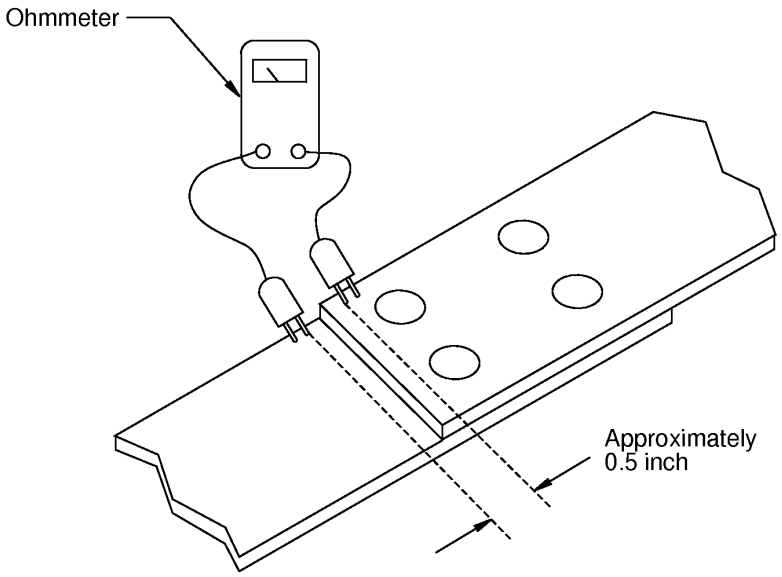
R. Bond Test of Driven Rivet Electrical Bonds

For the bond test of a driven rivet electrical bond, follow these steps:

(1) If the bonding surface of the structure has a surface finish, then remove a sufficient area of the surface to allow the probe to touch the bonding surface. To remove the finish, Refer to Paragraph 1.D.

NOTE: An alternate procedure would be to carefully pierce the surface finish with the probes to let the probe touch the bonding surface.

(2) Place the ohmmeter probes on the electrical bonded surfaces as shown in Figure 65.



2449248 S00061544620_V1

RESISTANCE MEASUREMENT OF A DRIVEN RIVET ELECTRICAL BOND
Figure 65

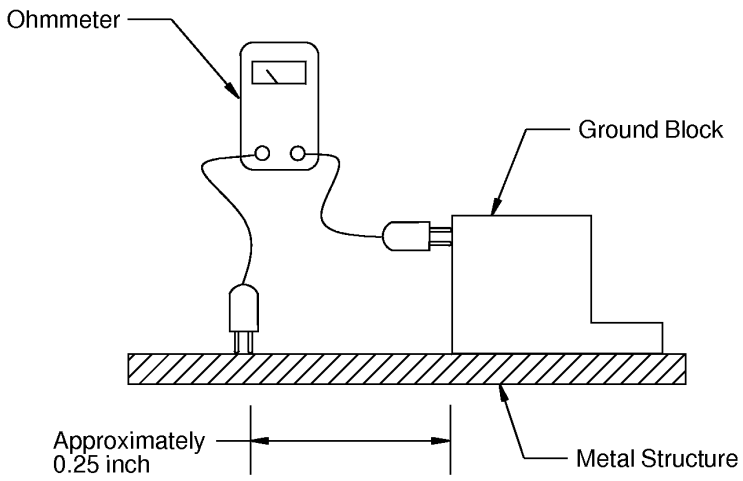
S. Bond Test of a Ground Block Installation

For the bond test of a ground block, follow these steps:

(1) If the bonding surface of the structure has a surface finish, then remove a sufficient area of the surface to allow the probe to touch the bonding surface. To remove the finish, Refer to Paragraph 1.D.

NOTE: An alternate procedure would be to carefully pierce the surface finish with the probes to let the probe touch the bonding surface.

(2) Place the ohmmeter probes on the electrical bonded surfaces as shown in Figure 66.



2449256 S00061544621_V1

RESISTANCE MEASUREMENT OF A GROUND BLOCK INSTALLATION
Figure 66

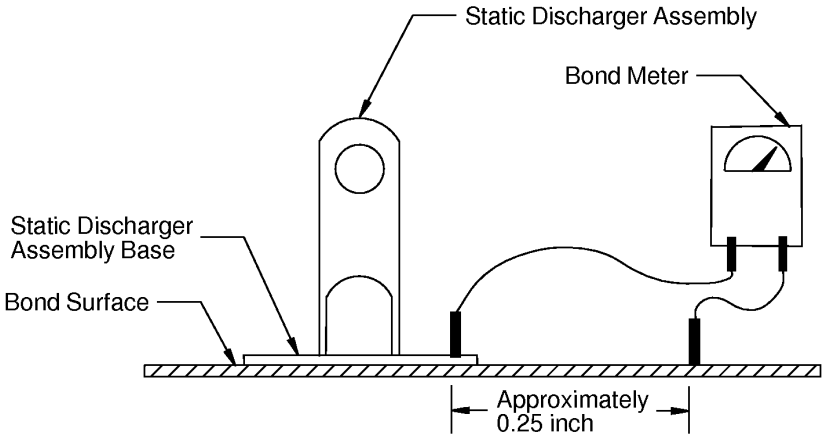
T. Bond Test of a Static Discharger Assembly

For the bond test of a static discharger assembly, follow these steps:

(1) If the bonding surface of the structure has a surface finish, then remove a sufficient area of the surface to allow the probe to touch the bonding surface. To remove the finish, Refer to Paragraph 1.D.

NOTE: An alternate procedure would be to carefully pierce the surface finish with the probes to let the probe touch the bonding surface.

(2) Place the bond meter probes on the electrical bonded surfaces as shown in Figure 67.

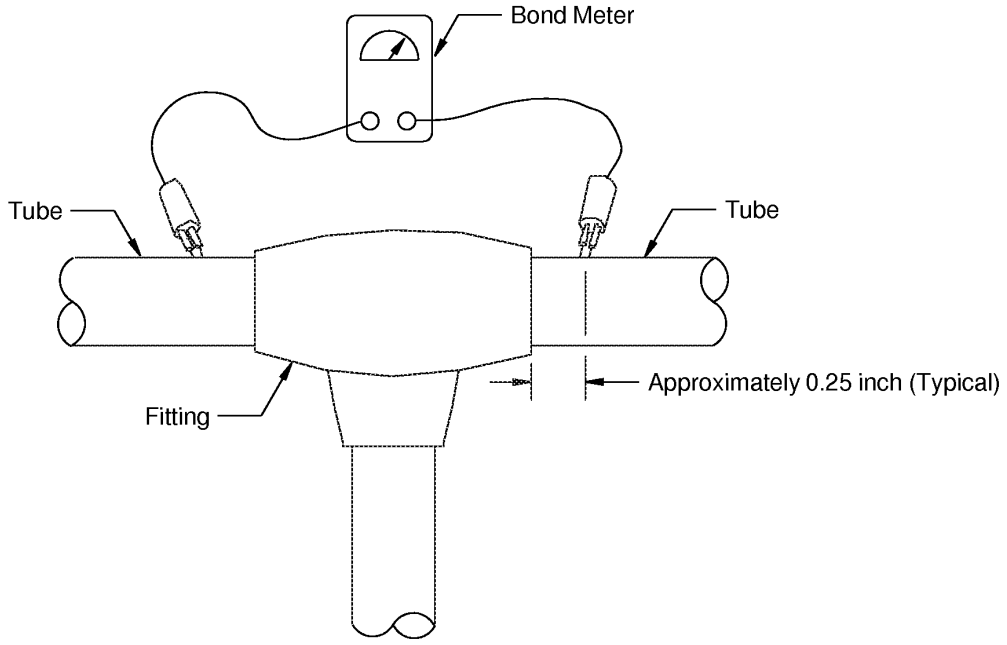


2449266 S00061544622_V1

BOND TEST OF A STATIC DISCHARGER ASSEMBLY
Figure 67

U. Bond Test of a Tube-to-Tube Electrical Bond Across a Tee or a Union Fitting

(1) Place the bond meter probes on the electrical bonded surfaces as shown in Figure 68.



RESISTANCE ACROSS A TEE OR A UNION FITTING
Figure 68

(2) Verify the resistance value shown on the bond meter is less than or equal to the resistance requirement specified in Paragraph 21.K..

(3) A part from which the original finish has been removed for testing must be refinished within seven days after the original finish is removed:

(a) if an aluminum part included an anodized surface, and the finish was removed during the surface preparation, apply the chemical conversion coating on the areas of the faying surface where the finish has been removed.

(b) Reapply all other original finishes on the areas of the surface where the finish has been removed.

V. Bond Test of Fasteners to Conductive Finishes on Composite Panels

(1) Make a selection of a bond meter.

Refer to:

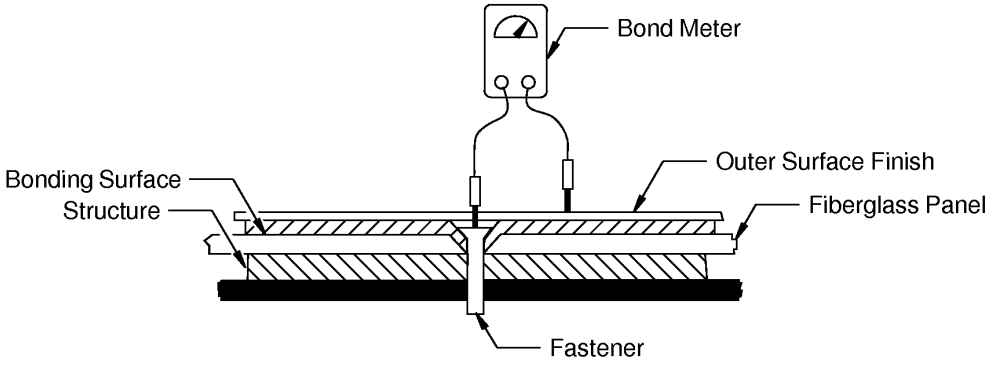
- Paragraph 22.B. for non-explosion hazard areas
- Paragraph 22.C. for explosion hazard areas.

ELECTRICAL BONDING PROCESSES

WARNING: USE OF THE WRONG TEST EQUIPMENT CAN CAUSE A FIRE OR AN EXPLOSION.

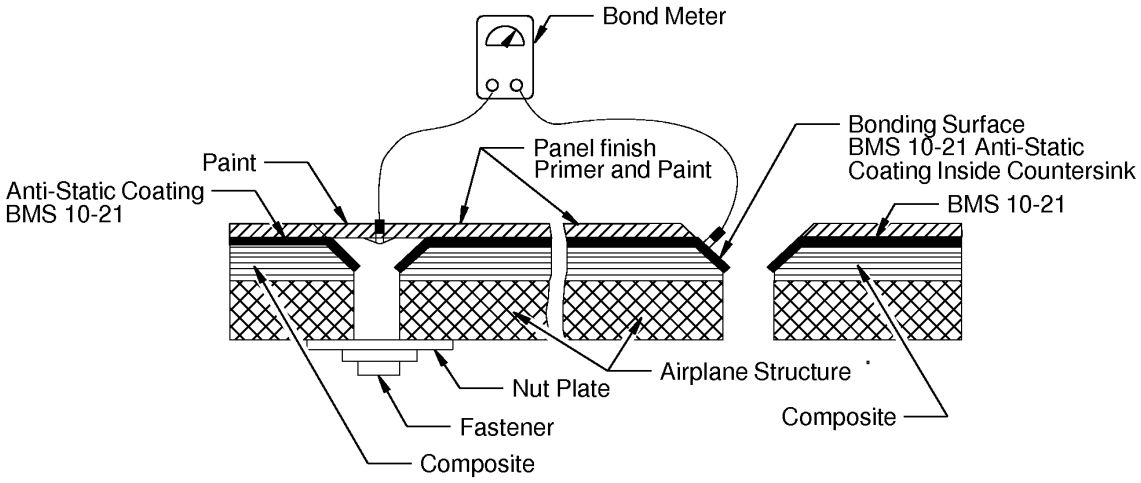
WARNING: BEFORE A METER IS USED IN AN EXPLOSION HAZARD AREA, MAKE SURE THAT DANGEROUS VAPORS ARE NOT IN THE AREA. INJURY CAN OCCUR.

(2) If the panel is installed on the airplane, refer to Figure 69 or Figure 70 to perform the test.



2449271 S00061544626_V1

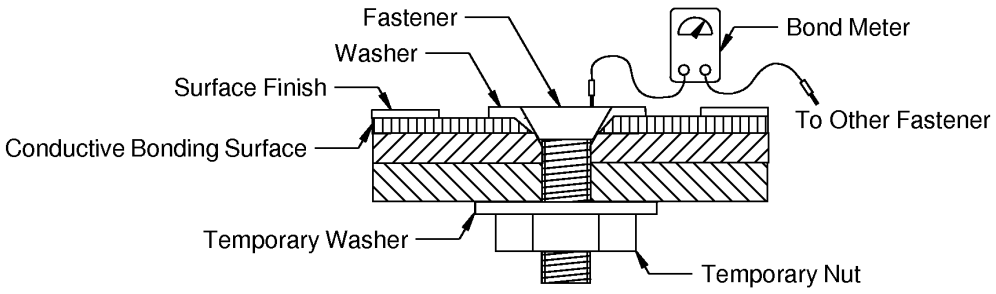
FASTENER TO CONDUCTIVE SURFACE TEST METHOD FOR INSTALLED PANELS
Figure 69



2449275 S00061544627_V1

FASTENER TO COUNTERSUNK CONDUCTIVE SURFACE TEST METHOD FOR INSTALLED PANELS
Figure 70

(3) If the panel is not installed on the airplane, install a temporary fastener and a temporary washer and nut to perform the test. Refer to Figure 71.



2449272 S00061544628_V1

FASTENER TO FASTNER TEST METHOD FOR UNINSTALLED PANELS
Figure 71

(a) Install a temporary fastener and a temporary washer and nut to perform the test. Refer to Figure 71.

(b) Perform the test. Refer to Figure 71.

(c) Remove the temporary fasteners.

(d) Clean the areas thast touch using the solvent cleaning method. Refer to Paragraph 2.E.

(e) Install the panel on the airplane using new fasteners.

W. Bond Test of Composite Panels

(1) Make a selection of a bond meter.

Refer to:

- Paragraph 22.B. for non-explosion hazard areas
- Paragraph 22.C. for explosion hazard areas.

WARNING: USE OF THE WRONG TEST EQUIPMENT CAN CAUSE A FIRE OR AN EXPLOSION.

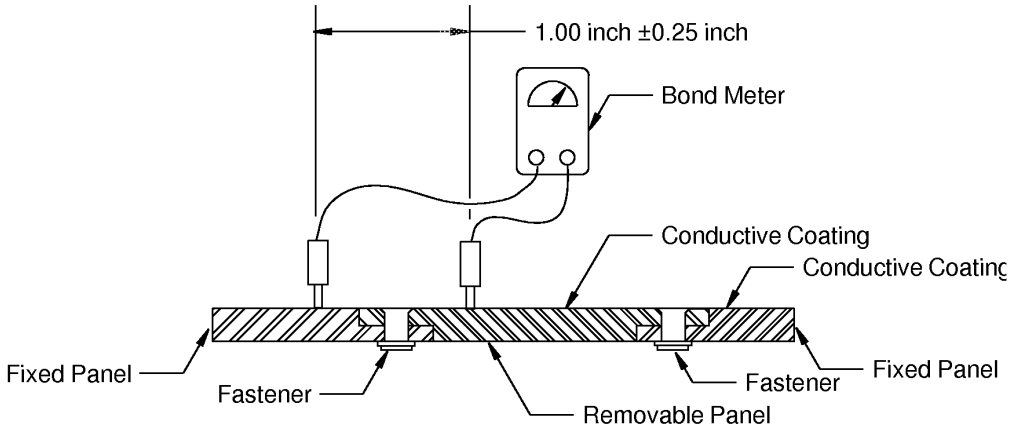
WARNING: BEFORE A METER IS USED IN AN EXPLOSION HAZARD AREA, MAKE SURE THAT DANGEROUS VAPORS ARE NOT IN THE AREA. INJURY CAN OCCUR.

(2) If the bonding surface of the structure has a surface finish, then remove a sufficient area of the surface to allow the probe to touch the bonding surface. To remove the finish, Refer to Paragraph 1.D.

NOTE: An alternate procedure would be to carefully pierce the surface finish with the probes to let the probe touch the bonding surface.

(3) For the resistance measurement between a graphite panel and metal structure, place the ohmmeter probes on the graphite panel and the metal structure.

(4) For the resistance measurement between a fixed panel and a removable panel, place the bond meter probes on the electrical bonded surfaces as shown in Figure 72.



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TEST METHOD FOR FIXED AND REMOVABLE PANELS WITH CONDUCTIVE COATINGS
Figure 72

(5) Re-apply the finish to any bare metal areas used for the test within seven days of removing the original finish. Refer to Paragraph 1.E..

23. GROUND PATH RESISTANCE MEASUREMENT PROCEDURES

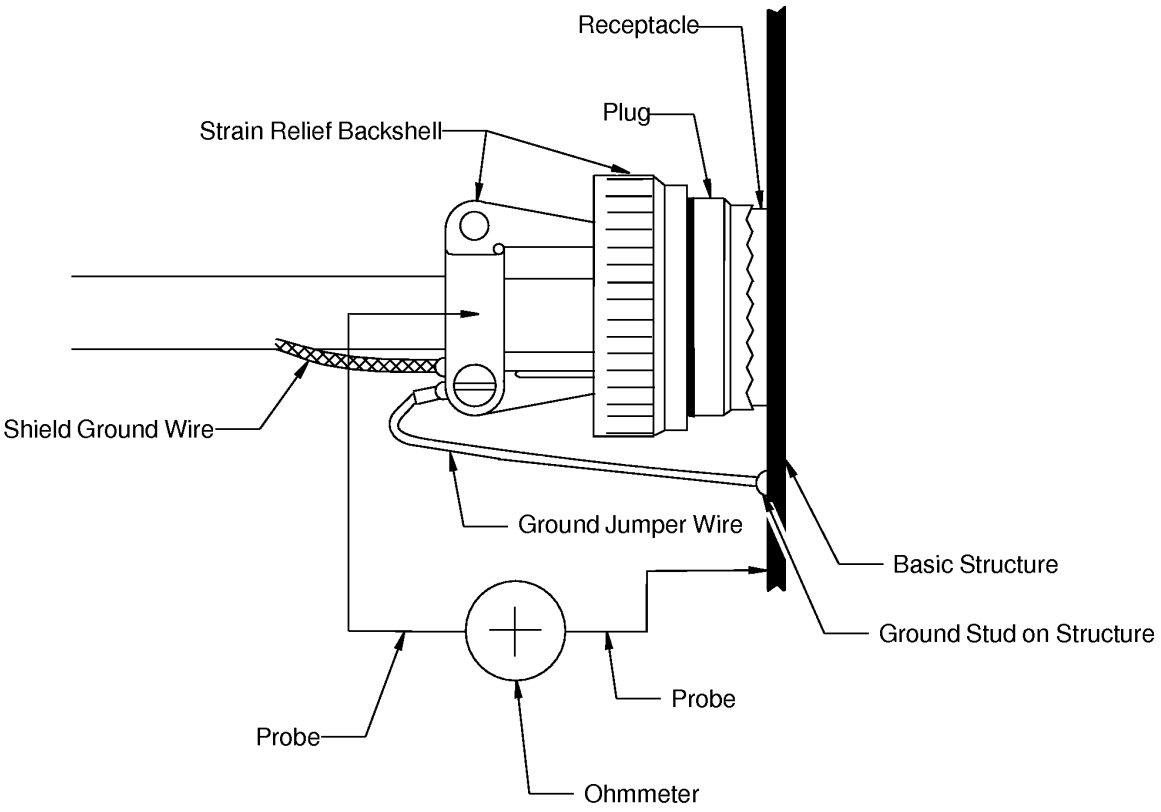
A. Plug to Structure Ground Path Resistance Measurement

(1) Make a selection of a bond resistance meter. Refer to Paragraph 22.C..

NOTE: The meter needs to have an accuracy of less than 1 milliohm resistance value.

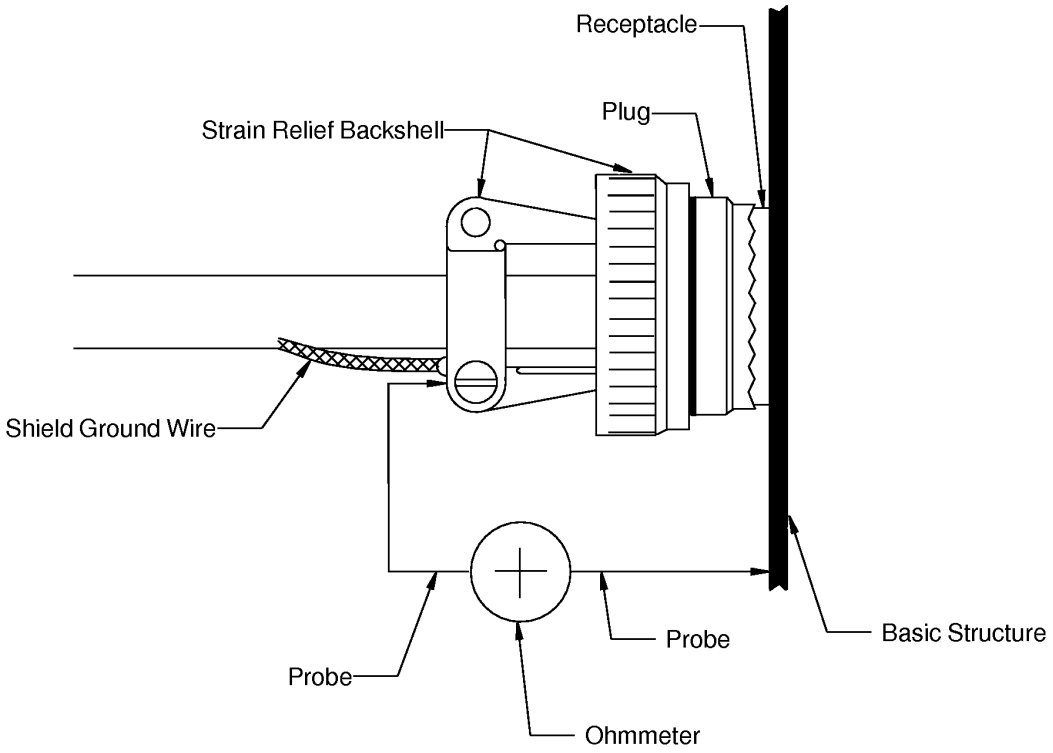
(2) If there is a ground jumper wire, place one of the meter probes on the plug backshell and place another one on the basic structure where the ground stud is installed. Refer to Figure 73.

NOTE: The meter probe placed on the basic structure in which the ground stud is installed may be placed on primary structure.



TEST POINTS FOR GROUND JUMPER RESISTANCE MEASUREMENT
Figure 73

(3) If there is no ground jumper wire, place one of the meter probes on the plug backshell and place another one on the basic structure near the receptacle. Refer to Figure 74.



TEST POINTS FOR ZERO GROUND RESISTANCE MEASUREMENT
Figure 74

(4) Measure and read the resistance values.

NOTE: Make sure that the resistance values are not greater than 3.0 milliohms.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

TABLE OF CONTENTS

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

1. GENERAL DATA

A. Definitions

Table 1
DEFINITIONS

Term	Definition
Basic Structure	The major, electrically integral, metallic part of an airplane
Bond Category 1	An unsealed electrical bond made without sealant.
Bond Category 2	A fay sealed electrical bond that is sealed when the electrical bond is made. Sealant is applied to components before they are assembled.
Bond Category 6	A fillet sealed electrical bond that is sealed after the electrical bond is made. Sealant is applied to the assembled components.
Carbon Fiber Reinforced Plastic (CFRP)	A strong, lightweight, composite material consisting of a plastic matrix (often an epoxy) embedded with carbon filament thread fibers or fabric.
Direct Ground Stud	A ground stud that has the terminals installed when the ground stud is installed. The nut that holds the terminal also holds the ground stud to the structure.
Electrical Bond	A stable connection between two objects that has the result of electrical conductivity between those objects
Explosion Hazard Area	A work area, or the area of an airplane or another manufactured product that is identified by the responsible organization as a hazard because of the combustible or explosive substances in the area
Faying Surface	A surface that is prepared to have the correct fit against a second surface so that an electrical bond is made between the two surfaces
Ground	An electrically conductive path between a component or an electrical circuit and the basic structure, or a connection between the conductive frame or housing of an object and the earth-ground connection point in a facility
Ground Stud	The part that is used to make an electrically conductive joint between a terminal and the structure.
Pre-Installed Ground Stud	A ground stud installation without terminals. Pre-Installed ground studs allow terminals to be removed without removing the ground stud.
Surface Finish	A finish that is on a bonding surface and is necessary to be removed before an electrical bond is made.

B. General Conditions for Ground Stud Assembly

These conditions are applicable:

- After the ground stud is clean, the ground stud installation must occur in less than 24 hours
- Clean the ground stud again with solvent if it becomes dirty before the installation occurs. Refer to Subject 20-20-00
- Clean the ground stud again with solvent if the installation did not occur in less than 24 hours. Refer to Subject 20-20-00
- If the ground stud has damaged threads, the ground stud must be removed and replaced with a new undamaged ground stud.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

CAUTION: DO NOT LET THE GROUND STUD BECOME DIRTY BEFORE INSTALLATION. UNSATISFACTORY PERFORMANCE OF THE GROUND STUD ELECTRICAL CONNECTION CAN OCCUR.

The steady state operating current conducted through an electrical ground stud installation must not be more than the values given in Table 2.

Table 2
MAXIMUM STEADY STATE OPERATING CURRENT FOR GROUND STUD INSTALLATIONS

Fastener Size	Maximum Current (Amperes)
#10	35
1/4	100
5/16	200
3/8	245

C. Applicable Conditions for the Seal of a Ground Stud Ground Assembly

For the conditions that are applicable for a ground assembly in a flammable leakage zone, refer to 20-30-00.

For a location that is not a flammable leakage zone, the ground assembly must be sealed if the initial configuration of the ground assembly is sealed.

D. Necessary Materials

NOTE: The cure times and the tack free times that are specified in Table are applicable for 77 degrees F ±5 degrees F and 50 percent relative humidity.

NOTE: The cure time and tack free time of ground stud sealants:

- Increase at lower temperature and lower humidity
- Decrease at higher temperature and higher humidity.

Table 3
SEALANTS FOR CATEGORY 2 FAY SEALED GROUND STUDS

Location	Part Number	Application Time (Hours)	Squeeze Out Life (Hours)	Cure Time (Hours)	Tack Free Time (Hours)
Fuel Tank Areas	BMS5-45, Class C-24	8	24	168 (7 days)	-
	BMS5-45, Class C-48	12	48	336 (14 days)	-
	BMS5-45, Class C-168	48	168 (7 days)	1344 (56 days)	-
	BMS5-45, Class B-2	2	6	24	12

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

Table 3 SEALANTS FOR CATEGORY 2 FAY SEALED GROUND STUDS (Continued)

Location	Part Number	Application Time (Hours)	Squeeze Out Life (Hours)	Cure Time (Hours)	Tack Free Time (Hours)
Non-Fuel Tank Areas	BMS5-45, Class C-24	8	24	168 (7 days)	-
	BMS5-45, Class C-48	12	48	336 (14 days)	-
	BMS5-45, Class C-168	48	168 (7 days)	1344 (56 days)	-
	BMS5-45, Class B-2	2	6	24	12
	BMS5-95, Class B-1/2	1/2	1/2	20	10
	BMS5-95, Class B-2	2	6	48	36
	BMS5-95, Class C-20	12	20	312 (13 days)	-
	BMS5-95, Class C-80	24	80	840 (35 days)	-
	BMS5-95, Class C-168	48	168 (7 days)	1344 (56 days)	-
	BMS5-95, Class C-336	96	336 (14 days)	2688 (112 days)	-

Table 4
SEALANTS FOR CATEGORY 6 FILLET SEALED GROUND STUDS

Location	Part Number	Application Time (Hours)	Squeeze Out Life (Hours)	Cure Time (Hours)	Tack Free Time (Hours)
Fuel Tank Areas	BMS5-45, Class B-1/2	1/2	-	12	10
	BMS5-45, Class B-2	2	6	24	12
Non-Fuel Tank Areas	BMS5-45, Class B-1/2	1/2	-	12	10
	BMS5-45, Class B-2	2	6	24	12
	BMS5-95, Class B-1/2	1/2	1/2	20	10
	BMS5-95, Class B-2	2	6	48	36
	BMS5-142, Class B-2	2	-	24	12

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

Table 5
APPROVED SUPPLIERS OF GROUND STUD SEALANTS

Sealant	Supplier
BMS5-45	QPL
BMS5-95	QPL
BMS5-142	QPL

Table 6
SOLVENTS

Material	Specification	Supplier
Acetone	0-A-51	An available source
	ASTM D 329	An available source
Ethyl Alcohol, Denatured	AMS 3002	An available source
	ASTM E 1145, Type II	An available source
Alcohol, Isopropyl	TT-I-735, Grade A	An available source
	TT-I-735, Grade B	An available source
Naptha, Aliphatic	TT-N-95, Type II	An available source
Methyl Ethyl Ketone	ASTM D 740, Type I	An available source

E. Surface Cleaning Methods

Table 7
SURFACE CLEANING METHODS FOR STANDARD PRE-INSTALLED, DIRECT, AND NUT PLATE DIRECT GROUND STUD INSTALLATION

Bond Category	Surface Material	Surface Finish	Cleaning Method Refer to Subject 20-20-00.	
			Description	Reference
1,2, and 6	Aluminum Alloy	Anodized	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

Table 7 SURFACE CLEANING METHODS FOR STANDARD PRE-INSTALLED, DIRECT, AND NUT PLATE DIRECT GROUND STUD INSTALLATION (Continued)

Bond Category	Surface Material	Surface Finish	Cleaning Method Refer to Subject 20-20-00.	
			Description	Reference
1,2,and 6	Aluminum Alloy	Bare with or without grease, oil, CIC, oxide film contamination or other contaminants	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc
1,2, and 6	Aluminum Alloy	Chemical Conversion Coating	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc
1,2, and 6	Aluminum Alloy	Paint, Primer, or Enamel	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc
1 and 6	Aluminum	Chemical conversion coating with or without grease, oil, CIC, or other contaminants	Solvent Cleaning	Solvent Cleaning
2	Aluminum	Chemical conversion coating with or without grease, oil, CIC, or other contaminants	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc
1,2, and 6	Clad Aluminum	Bare metal with or without grease, oil, CIC, or other contaminants	Solvent Cleaning	Solvent Cleaning

Table 7 SURFACE CLEANING METHODS FOR STANDARD PRE-INSTALLED, DIRECT, AND NUT PLATE DIRECT GROUND STUD INSTALLATION (Continued)

Bond Category	Surface Material	Surface Finish	Cleaning Method Refer to Subject 20-20-00.	
			Description	Reference
1,2, and 6	Steel	Bare metal with or without grease, oil, CIC, or other contaminants	Solvent Cleaning	Solvent Cleaning
		Paint, Primer, or Enamel	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc
		Cadmium plating with or without grease, oil, CIC, or other contaminants	Solvent Cleaning	Solvent Cleaning
1,2, and 6	Titanium	Bare with or without grease, oil, CIC, or other contaminants	Solvent Cleaning	Solvent Cleaning
		Paint, Primer, or Enamel	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc

F. Airworthiness Limitations

These wiring configurations, installations, and procedures are given in Critical Design Configuration Control Limitations (CDCCL) related to:

- Fuel System Wiring that has Airworthiness Limitations
- Wiring that is installed adjacent to the fuel tank.

CDCCLs identify design configuration features that can decrease fuel tank ignition sources for the operational life of the airplane.

NOTE: The wiring configurations, installations, and procedures given allow the Critical Design Configuration Control Limitation (CDCCL) to decrease possible fuel tank ignition sources. If the CDCCL is not followed, the risk of a fuel tank ignition source can increase.

To find more data about CDCCLs, refer to Table 8 for the document that is applicable for the airplane model.

Table 8
BOEING DOCUMENTS FOR AIRWORTHINESS LIMITATIONS

Airplane Model	Boeing Document
707	D6-7552-AWL Airworthiness Limitations
727	D6-8766-AWL Airworthiness Limitations
737-100, -200, -200C, -300, -400, -500	D6-38278-CMR Airworthiness Limitations and Certification Maintenance Requirements
747-100, -200, -300, -SP	D6-13747-CMR Airworthiness Limitations and Certification Maintenance Requirements
737-600, -700, -700C, -800, -900, -900ER	D626A001-CMR Maintenance Planning Data Document, Section 9
747-400	D621U400-9 Maintenance Planning Data Document, Section 9
757	D622N001-9 Maintenance Planning Data Document, Section 9
767	D622T001-9-04 Special Compliance Items/Airworthiness Limitations
777	D622W001-9 Maintenance Planning Data Document, Section 9
747-8	D011U721-02-04 Special Compliance Items/Airworthiness Limitations
787	D011Z009-03-04 Special Compliance Items/Airworthiness Limitations

2. GROUND STUD REMOVAL

A. Identification of a Ground Stud

(1) If the ground stud is sealed:

(a) Make a selection of a scraper that is made of wood or plastic.

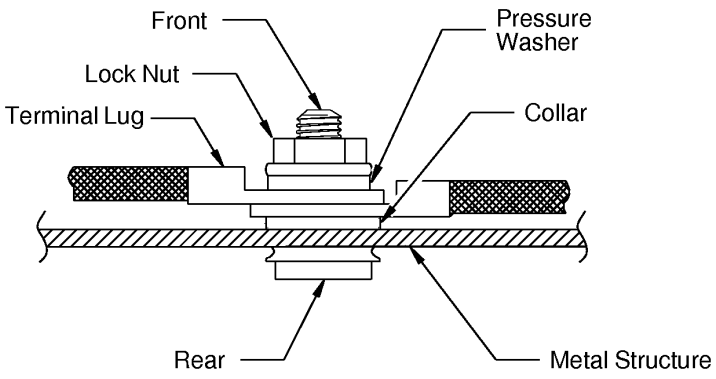
CAUTION: DO NOT USE A SCRAPER MADE OF A MATERIAL THAT IS HARDER THAN THE STRUCTURE THAT THE GROUND STUD IS INSTALLED IN. A SCRAPER MADE OF A HARDER MATERIAL CAN CAUSE DAMAGE TO THE STRUCTURE.

(b) Carefully remove the sealant from on and around the ground stud.

(2) Identify the type of ground stud:

Refer to Figure 1 through Figure 5 to identify the type of ground stud.

NOTE: There can be a different number of terminal lugs than the number of terminal lugs shown in Figure 1 through Figure 7.



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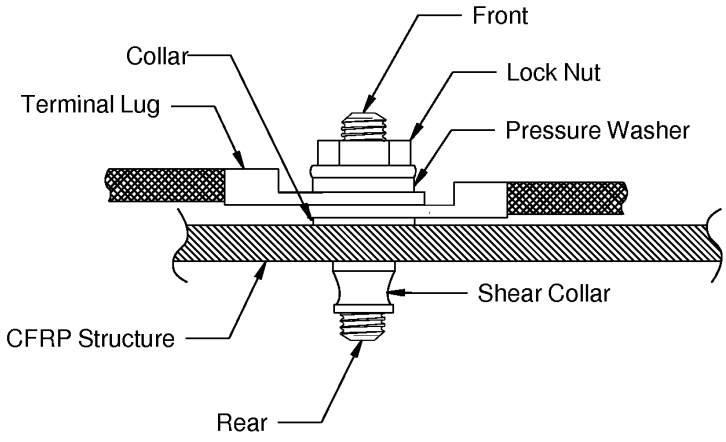
BACS53B AND MIL-T-83454/4 PRE-INSTALLED GROUND STUD
Figure 1



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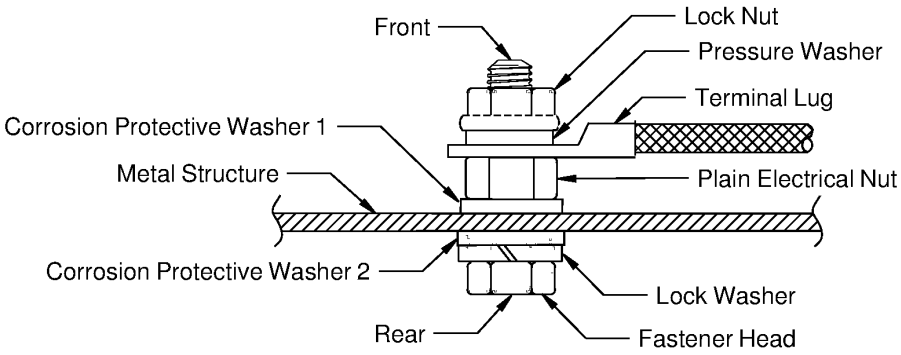
BACS53F PRE-INSTALLED GROUND STUD
Figure 2

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION



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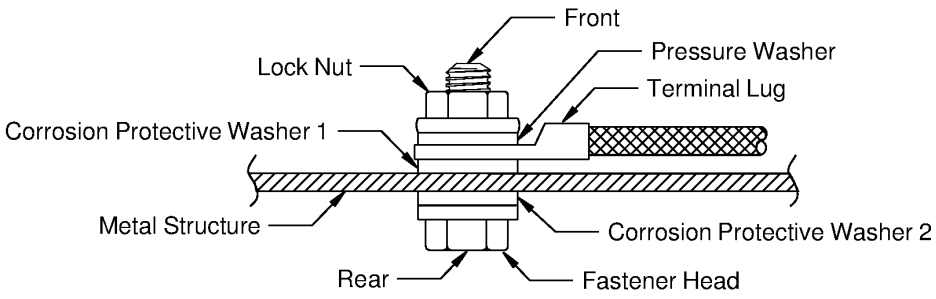
STANDARD PRE-INSTALLED GROUND STUD
Figure 3

CAUTION: IF ONE OR BOTH OF THE CORROSION PROTECTIVE WASHERS SHOWN IN FIGURE 3 ARE NOT PART OF THE INITIAL, AS DELIVERED, GROUND STUD ASSEMBLY, DO NOT INCLUDE THESE CORROSION PROTECTIVE WASHERS IN THE REASSEMBLY OF THE GROUND STUD.

CAUTION: MAKE SURE THAT THE CONFIGURATION OF THE REASSEMBLED GROUND STUD IS THE SAME AS THE INITIAL GROUND STUD INSTALLATION. THE ELECTRICAL RESISTANCE OF THE GROUND STUD INSTALLATION MUST NOT INCREASE.



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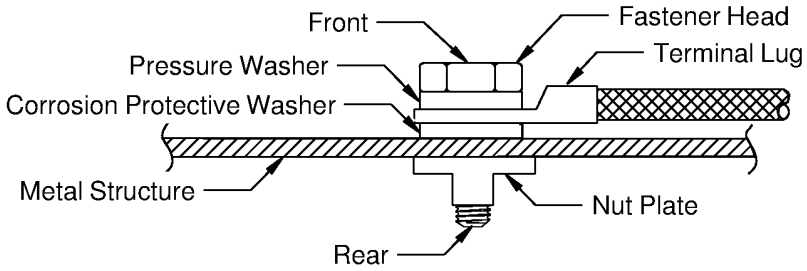
DIRECT STANDARD GROUND STUD
Figure 4

CAUTION: IF ONE OR BOTH OF THE CORROSION PROTECTIVE WASHERS SHOWN IN FIGURE 4 ARE NOT PART OF THE INITIAL, AS DELIVERED, GROUND STUD ASSEMBLY, DO NOT INCLUDE THESE CORROSION PROTECTIVE WASHERS IN THE REASSEMBLY OF THE GROUND STUD.

CAUTION: MAKE SURE THAT THE CONFIGURATION OF THE REASSEMBLED GROUND STUD IS THE SAME AS THE INITIAL GROUND STUD INSTALLATION. THE ELECTRICAL RESISTANCE OF THE GROUND STUD INSTALLATION MUST NOT INCREASE.



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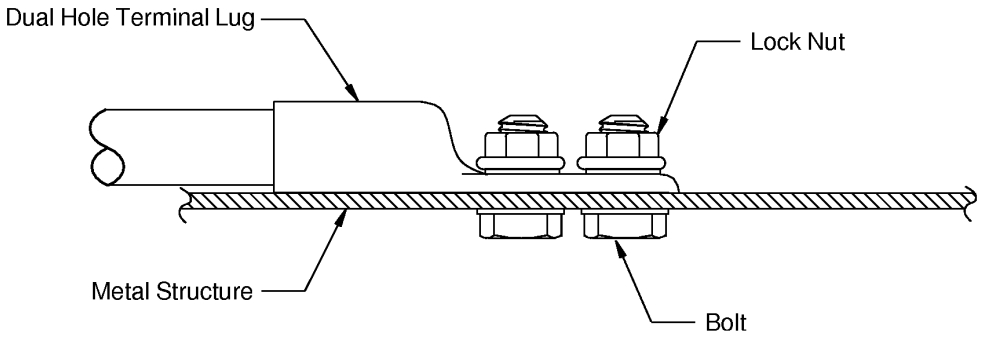
NUT PLATE DIRECT GROUND STUD
Figure 5

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

CAUTION: IF THE CORROSION PROTECTIVE WASHER SHOWN IN FIGURE 5 IS NOT PART OF THE INITIAL, AS DELIVERED, GROUND STUD ASSEMBLY, DO NOT INCLUDE A CORROSION PROTECTIVE WASHER IN THE REASSEMBLY OF THE GROUND STUD.

CAUTION: MAKE SURE THAT THE CONFIGURATION OF THE REASSEMBLED GROUND STUD IS THE SAME AS THE INITIAL GROUND STUD INSTALLATION. THE ELECTRICAL RESISTANCE OF THE GROUND STUD INSTALLATION MUST NOT INCREASE.



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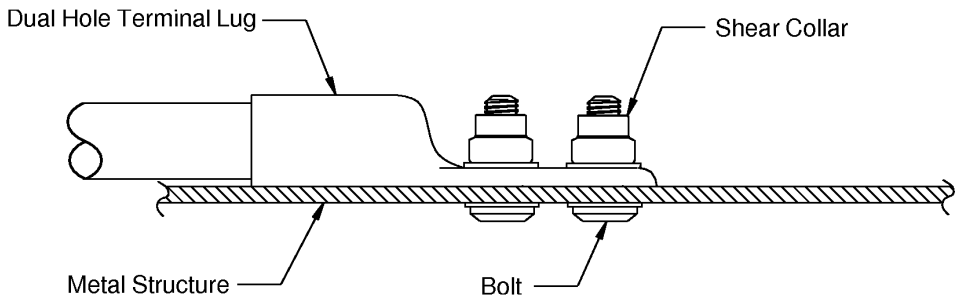
NON-PERMANENT DUAL HOLE TERMINAL DIRECT GROUND STUD
Figure 6



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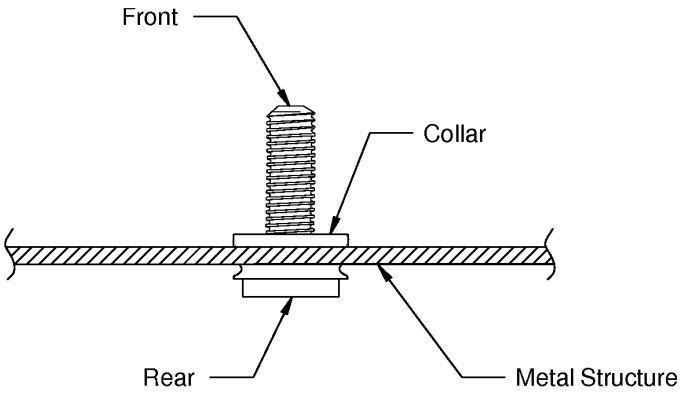
PERMANENT DUAL HOLE TERMINAL DIRECT GROUND STUD
Figure 7

B. Removal of a BACS53B or MIL-T-83454/4 Pre-Installed Ground Studs Using a Spot Facer

Table 9
GROUND STUD REMOVAL TOOLS

Tool	Supplier
21/32 inch diameter Spot Facer	An available source

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION



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REMOVAL OF THE BACS53B OR MIL-T-83454/4 GROUND STUD
Figure 8

(1) Remove the locknut and the terminal lugs from the front of the ground stud. Refer to Figure 1.

(2) Make a selection of a 21/32 inch diameter spot facer, put the front of the ground stud in the 3/16 inch diameter spot facer pilot hole. Refer to Table 9 and Figure 8.

(3) Remove the ground stud collar material until there is 0.002 inches of material remaining.

Make sure that you protect adjacent equipment from debri contamination. Refer to Subject 20-00-08.

CAUTION: DO NOT REMOVE MATERIAL TO THE SURFACE OF THE STRUCTURE. DAMAGE TO THE STRUCTURE SURFACE CAN OCCUR.

WARNING: MAKE SURE THAT YOU OBEY ALL THE RECOMMENDED SAFETY PRECAUTIONS FOR THE USE OF METAL CUTTING TOOLS ON AIRPLANES THAT ARE IN SERVICE. IF THE SAFETY PRECAUTIONS ARE NOT OBEYED, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR. REFER TO SUBJECT 20-00-10.

(4) Drive the ground stud out of the panel using a hammer and discard the ground stud.

Make sure that you protect adjacent equipment from debri contamination. Refer to Subject 20-00-08.

(5) Carefully remove the pieces of the ground stud that remain in the hole.

(6) Measure and record the diameter of the ground stud hole.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

C. Removal of a BACS53B or MIL-T-83454/4 Pre-Installed Ground Studs Using a Bucking Bar

(1) Remove the locknut, pressure washer, and the terminal lugs from the front of the ground stud. Refer to Figure 1.

(2) Place a bucking bar on the rear of the ground stud and drive the ground stud out from the front using a hammer. Refer to Figure 1.

CAUTION: BE CAREFUL AND DO NOT CAUSE DAMAGE TO THE SURFACE WITH THE BUCKING BAR OR THE HAMMER. DAMAGE TO THE SURFACE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE REPLACEMENT GROUND STUD.

WARNING: MAKE SURE THAT YOU OBEY ALL THE RECOMMENDED SAFETY PRECAUTIONS FOR THE USE OF BUCKING BARS ON AIRPLANES THAT ARE IN SERVICE. IF THE SAFETY PRECAUTIONS ARE NOT OBEYED, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR. REFER TO SUBJECT 20-00-10.

(3) Drill through the ground stud using a piloted drill with a 0.312 inch diameter and a 0.260 inch diameter pilot.

Make sure that you protect adjacent equipment from metal debri contamination. Refer to Subject 20-00-08.

CAUTION: DO NOT REMOVE MATERIAL ON THE SURFACE OF THE STRUCTURE OR ON THE INSIDE OF THE HOLE. DAMAGE TO THE STRUCTURE AND UNSATISFACTIRY PERFORMANCE OF THE REPLACEMENT GROUND STUD CAN OCCUR.

(4) Carefully remove any remaining pieces of the ground stud.

Make sure that you protect adjacent equipment from metal debri contamination. Refer to Subject 20-00-08.

(5) Measure and record the diameter of the ground stud hole.

D. Removal of a BACS53B or MIL-T-83454/4 Pre-Installed Ground Studs Using a Micro Shaver

Table 10
GROUND STUD REMOVAL TOOLS

Tool	Part Number	Supplier
Micro Shaver	ZT405IR	Zephyr
Micro Shaver Cutter	ZT108-2	Zephyr
Hacksaw	-	An available source

NOTE: An equivalent tool is a satisfactory alternative.

(1) Remove the lock nut, pressure washer, and terminal lugs from the front of the ground stud. Refer to Figure 1.

(2) Use a hacksaw or other suitable metal cutting tool to remove the ground stud flush to the collar. Refer to Figure 8.

Make sure that you protect adjacent equipment from metal debri contamination. Refer to Subject 20-00-08.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

WARNING: MAKE SURE THAT YOU OBEY ALL THE RECOMMENDED SAFETY PRECAUTIONS FOR THE USE OF METAL CUTTING TOOLS ON AIRPLANES THAT ARE IN SERVICE. IF THE SAFETY PRECAUTIONS ARE NOT OBEYED, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR. REFER TO SUBJECT 20-00-10.

CAUTION: BE CAREFUL AND DO NOT CAUSE DAMAGE TO THE SURFACE WITH THE METAL CUTTING TOOLS. DAMAGE TO THE SURFACE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE REPLACEMENT GROUND STUD.

(3) Remove the ground stud collar material.

(a) Make a selection of a micro shaver from Table 10.

NOTE: An equivalent tool is a satisfactory alternative.

(b) Set the micro shaver on high and cut the ground stud collar in increments of 0.002 inch. Continue to cut the collar until there is approximately 0.002 inches of the collar material that remains.

Make sure that you protect adjacent equipment from metal debri contamination. Refer to Subject 20-00-08.

WARNING: MAKE SURE THAT YOU OBEY ALL THE RECOMMENDED SAFETY PRECAUTIONS FOR THE USE OF METAL CUTTING TOOLS ON AIRPLANES THAT ARE IN SERVICE. IF THE SAFETY PRECAUTIONS ARE NOT OBEYED, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR. REFER TO SUBJECT 20-00-10.

CAUTION: DO NOT REMOVE MATERIAL ON THE SURFACE OF THE STRUCTURE OR ON THE INSIDE OF THE HOLE. DAMAGE TO THE STRUCTURE AND UNSATISFACTIRY PERFORMANCE OF THE REPLACEMENT GROUND STUD CAN OCCUR.

(4) Carefully remove the ground stud.

Make sure that you protect adjacent equipment from metal debri contamination. Refer to Subject 20-00-08.

(5) Measure and record the diameter of the ground stud hole.

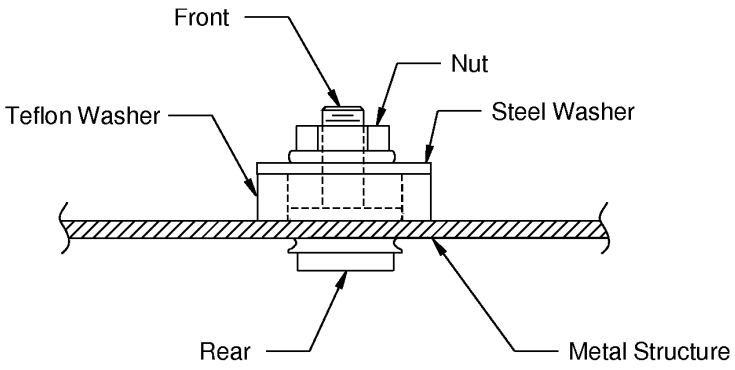
E. Rear Removal of a BACS53B or MIL-T-83454/4 Pre-Installed Ground Stud that has Front and Rear Access

Table 11
GROUND STUD REMOVAL TOOLS

Tool	Part Number	Supplier
0.125 inch drill bit	ZT405IR	Zephyr
Drill Bit - 0.312 inch diameter with a 0.125 inch pilot	ZT108-2	Zephyr
Teflon Washer - 7/16 inch inside diameter, 0.25 inch thick	-	An available source
Steel Washer, 3/16 stud	-	An available source

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

NOTE: An equivalent tool is a satisfactory alternative.



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REAR REMOVAL OF A BACS53B OR MILT-83454/4 THAT HAS FRONT AND REAR ACCESS
Figure 9

(1) Remove the locknut and the terminal lugs from the front of the ground stud. Refer to Figure 1.

(2) Drill a 0.125 inch pilot hole in the rear center head of the ground stud. Refer to Figure 9.

WARNING: MAKE SURE THAT YOU OBEY ALL THE RECOMMENDED SAFETY PRECAUTIONS FOR THE USE OF METAL CUTTING TOOLS ON AIRPLANES THAT ARE IN SERVICE. IF THE SAFETY PRECAUTIONS ARE NOT OBEYED, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR. REFER TO SUBJECT 20-00-10.

CAUTION: BE CAREFUL AND DO NOT CAUSE DAMAGE TO THE SURFACE WITH THE DRILL BIT. DAMAGE TO THE SURFACE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE REPLACEMENT GROUND STUD.

Make sure that you protect adjacent equipment from debri contamination. Refer to Subject 20-00-08.

(3) Drill through the rear of the ground stud using a piloted drill with a 0.312 inch diameter and a 0.125 inch diameter pilot.

Make sure that you protect adjacent equipment from debri contamination. Refer to Subject 20-00-08.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

WARNING: MAKE SURE THAT YOU OBEY ALL THE RECOMMENDED SAFETY PRECAUTIONS FOR THE USE OF METAL CUTTING TOOLS ON AIRPLANES THAT ARE IN SERVICE. IF THE SAFETY PRECAUTIONS ARE NOT OBEYED, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR. REFER TO SUBJECT 20-00-10.

CAUTION: DO NOT REMOVE MATERIAL ON THE SURFACE OF THE STRUCTURE OR ON THE INSIDE OF THE HOLE. DAMAGE TO THE STRUCTURE AND UNSATISFACTIRY PERFORMANCE OF THE REPLACEMENT GROUND STUD CAN OCCUR.

(4) Put the following parts on the front of the ground stud in this order:

- A teflon non-marring washer
- A steel washer for a 3/16 inch stud
- The nut.

Refer to Figure 9.

(5) Tighten the nut until the ground stud comes out of the panel.

(6) If there is collar material that remains in the hole, remove it with a 0.312 inch drill bit with a 0.260 inch pilot.

(7) Measure and record the diameter of the ground stud hole.

F. Removal of a BACS53B or MIL-T-83454/4 Pre-Installed Ground Stud Using ST2336A Tools

NOTE: The ST2336A-1 tools is used as:

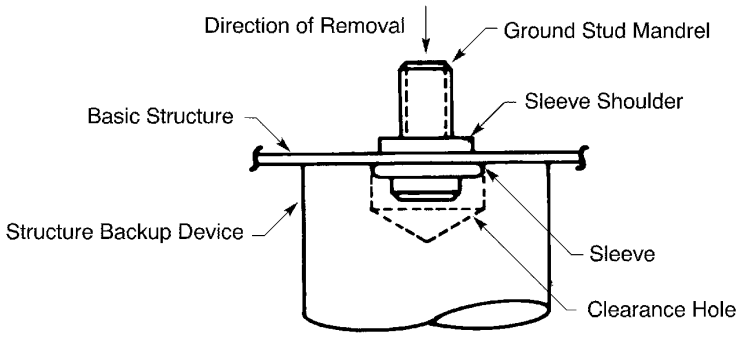
- A structure backup device
- A reamer clamp assembly.

Table 12
GROUND STUD REMOVAL TOOLS

Tool	Part Number	Supplier
C-clamp Assembly	ST2336A-11	Boeing
Drill Bushing	ST2336A-3	Boeing
Handle	ST2336A-9	Boeing
Reamer Clamp Assembly	ST2336A-1	Boeing
Structure Backup Device	ST2336A-1	Boeing

(1) Remove the ground stud mandrel.

Refer to Figure 10.



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REMOVAL OF THE GROUND STUD MANDREL
Figure 10

(a) Make a selection of a structure backup device from Table 12.

NOTE: As an alternative, a special C-clamp assembly can be used. Refer to Table 12.

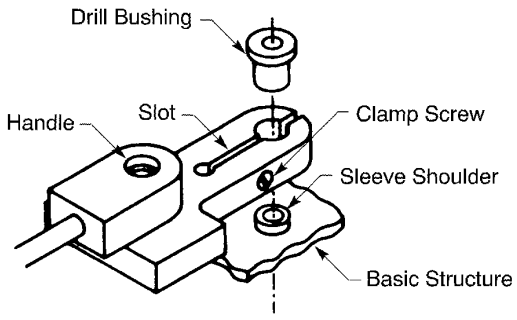
(b) Put the device against the basic structure so that it is over the end of the ground stud that is opposite the long part of the mandrel.

(c) Carefully hit the end of the mandrel with a hammer until it becomes loose.

Make sure that the force is applied in the direction that is parallel to the longitudinal axis of the mandrel.

(2) Remove the ground stud sleeve.

Refer to Figure 11.



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REMOVAL OF THE GROUND STUD SLEEVE
Figure 11

(a) Make a selection of these tools from Table 12:

- A reamer clamp assembly
- A handle.

(b) Put the reamer clamp over the sleeve shoulder of the ground stud so that the hole of the clamp is aligned with the hole of the sleeve.

(c) Put the drill bushing in the hole of the reamer clamp.

(d) Tighten the clamp screw until the sleeve should is tightly held.

(e) Put the handle on the reamer clamp so that the sleeve does not turn when it is drilled.

(f) Drill the sleeve out with a 0.260 inch x 0.309 inch diameter, 2 step drill.

Make sure that you protect adjacent equipment from debri contamination. Refer to Subject 20-00-08

(g) Remove the reamer clamp.

(h) Remove the remaining part or parts of the sleeve.

WARNING: MAKE SURE THAT YOU OBEY ALL THE RECOMMENDED SAFETY PRECAUTIONS FOR THE USE OF METAL CUTTING TOOLS ON AIRPLANES THAT ARE IN SERVICE. IF THE SAFETY PRECAUTIONS ARE NOT OBEYED, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR. REFER TO SUBJECT 20-00-10.

(3) If it is necessary, remove the oxide film from the hole with a 5/16 inch diameter expansion reamer or a stainless steel brush.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

WARNING: MAKE SURE THAT YOU OBEY ALL THE RECOMMENDED SAFETY PRECAUTIONS FOR THE USE OF METAL CUTTING TOOLS ON AIRPLANES THAT ARE IN SERVICE. IF THE SAFETY PRECAUTIONS ARE NOT OBEYED, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR. REFER TO SUBJECT 20-00-10.

CAUTION: IF A REAMER IS USED, MAKE SURE THAT THE HOLE DOES NOT BECOME LARGER. IF THE HOLE DIAMETER IS GREATER THAN 0.317 INCH, A NEW GROUND STUD CANNOT BE SATISFACTORILY INSTALLED.

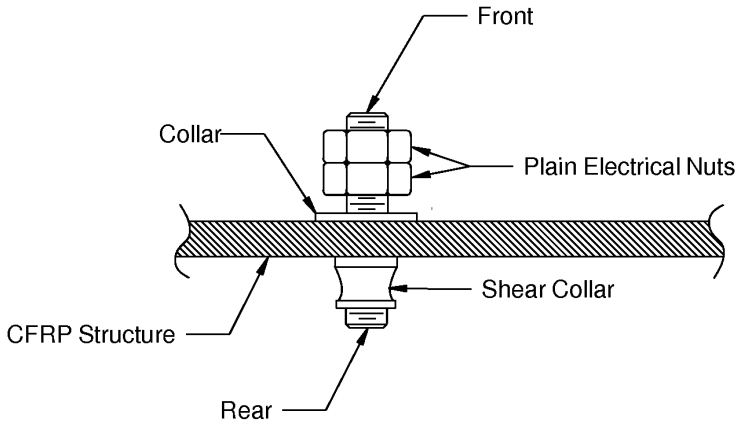
CAUTION: DO NOT PERMIT INSULATION MATERIAL OR OTHER CONTAMINATION TO GO INTO THE HOLE.

(4) Measure and record the hole diameter.

G. Removal of a BACS53F Pre-Installed Ground Stud

Table 13
NECESSARY TOOLS FOR THE REMOVAL OF A BACS53F PRE-INSTALLED GROUND STUD

Name	Part Number	Description	Supplier
Shear Collar Removal Tool	MED50-( )	Offset Handle Wrench	Alcoa Fastening Systems
	MED50-( )S	Straight Handle Wrench	Alcoa Fastening Systems
	MED50-( )CF	Square Drive Wrench	Alcoa Fastening Systems



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REMOVAL OF A BACS53F GROUND STUD
Figure 12

(1) Remove the lock nut, pressure washer, and terminal lugs. Refer to Figure 2.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

CAUTION: BE CAREFUL AND DO NOT CAUSE DAMAGE TO THE METAL STRUCTURE. DAMAGE TO THE SURFACE OF THE METAL STRUCTURE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE REPLACEMENT GROUND STUD.

(2) Make a selection of a shear collar removal tool and two plain electrical nuts. Refer to Table 13.

NOTE: An equivalent tool is a satisfactory alternative.

Make sure that you protect adjacent equipment from metal debri contamination. Refer to Subject 20-00-08.

(3) Remove the shear collar:

(a) Put two plain electrical nuts on the front of the ground stud. Refer to Figure 12.

(b) Hold the top nut with a wrench.

Make sure that the ground stud does not turn in the hole when the shear collar is removed.

(c) Turn the shear collar counter clockwise with the shear collar removal tool until it disengages from the ground stud threads.

(d) Remove the plain electrical nuts and discard the shear collar.

Make sure that you protect adjacent equipment from metal debri contamination. Refer to Subject 20-00-08.

(4) Carefully tap the rear of the ground stud with a hammer until it come out of the hole. Refer to Figure 12.

(5) Measure and record the diameter of the ground stud hole.

H. Removal of a Standard Pre-Installed Ground Stud

(1) Remove the lock nut, pressure washer, terminal lugs, electrical nut, and the corrosion protection washer. Refer to Figure 3.

CAUTION: BE CAREFUL AND DO NOT CAUSE DAMAGE TO THE METAL STRUCTURE. DAMAGE TO THE SURFACE OF THE METAL STRUCTURE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE REPLACEMENT GROUND STUD.

(2) Remove the ground stud.

Make sure that you protect adjacent equipment from metal debri contamination. Refer to Subject 20-00-08.

I. Removal of a Direct Standard Ground Stud

(1) Remove the lock nut, pressure washer, terminal lugs, and the corrosion protection washer. Refer to Figure 4.

Make sure that you protect adjacent equipment from metal debri contamination. Refer to Subject 20-00-08.

CAUTION: DO NOT LET THE GROUND STUD FALL OUT OF THE REAR OF THE PANEL. DEBRI CONTAMINATION OF ADJACENT EQUIPMENT CAN OCCUR.

(2) Remove the ground stud from the rear. Refer to Figure 5.

Make sure that you protect adjacent equipment from metal debri contamination. Refer to Subject 20-00-08.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

J. Removal of a Nut Plate Direct Ground Stud

(1) Remove the ground stud, pressure washer, terminal lugs, and the corrosion protection washer. Refer to Figure 5.

Make sure that you protect adjacent equipment from metal debri contamination. Refer to Subject 20-00-08.

CAUTION: BE CAREFUL AND DO NOT CAUSE DAMAGE TO THE METAL STRUCTURE. DAMAGE TO THE SURFACE OF THE METAL STRUCTURE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE REPLACEMENT GROUND STUD.

K. Removal of a Dual Hole Terminal Direct Ground Stud

Table 14
NECESSARY TOOLS FOR THE REMOVAL OF A DUAL HOLE TERMINAL DIRECT GROUND STUD

Name	Part Number	Description	Supplier
Wrench	Allen	-	An available source
	Open End	-	An available source
	Box End	-	An available source
	Socket	-	An available source
Shear Collar Removal Tool	MED50-()	Offset Wrench	Alcoa Fastening Systems
	MED50-()S	Straight Handle Wrench	Alcoa Fastening Systems
	MED50-()CF	Square Drive Wrench	Alcoa Fastening Systems

NOTE: An equivalent tool is a satisfactory alternative.

(1) If the dual hole ground stud assembly has non-permanent fasteners:

(a) Make a selection of a wrench to hold the bolt. Refer to Table 14.

(b) Make a selection of a wrench to turn the lock nut. Refer to Table 14.

(c) Remove the lock nut, pressure washer, terminal lugs, and the corrosion protective washer. Refer to Figure 6.

Make sure that you protect adjacent equipment from metal debri contamination. Refer to Subject 20-00-08.

CAUTION: DO NOT LET THE GROUND STUD FALL OUT OF THE REAR OF THE PANEL. DEBRI CONTAMINATION OF ADJACENT EQUIPMENT CAN OCCUR.

(2) If the dual hole ground stud assembly has permanent fasteners:

(a) Make a selection of allen wrench to hold the bolt. Refer to Table 14.

(b) Make a selection of a shear collar removal tool. Refer to Table 14.

NOTE: An equivalent tool is a satisfactory alternative.

(c) Hold the bolt with the allen wrench and remove the shear collar with the shear collar removal tool.

(d) Discard the shear collar.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

Make sure that you protect adjacent equipment from metal debri contamination. Refer to Subject 20-00-08.

CAUTION: DO NOT LET THE GROUND STUD FALL OUT OF THE REAR OF THE PANEL. DEBRI CONTAMINATION OF ADJACENT EQUIPMENT CAN OCCUR.

3. PRE-INSTALLED GROUND STUD INSTALLATION

A. Category 1 Unsealed BACS53B and MIL-T-83454/4 Pre-Installed Ground Stud Installation

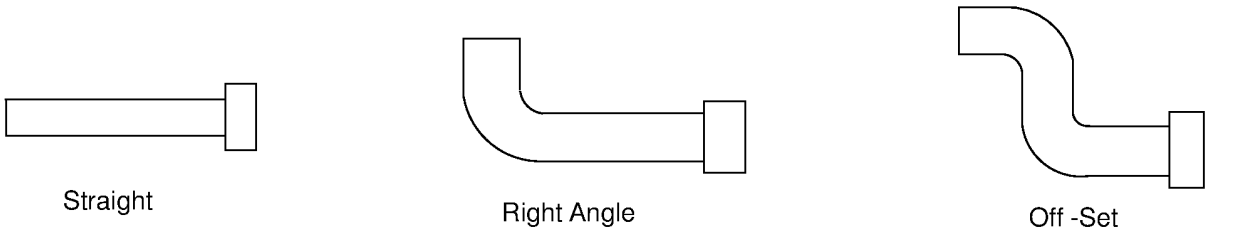
Table 15
BACS53B() GROUND STUDS

Boeing Standard	Installation Dimensions (inch)	
	Structure Thickness T	Head Clearance H
BACS53B1EA1	0.03	0.157
	0.04	0.157
	0.05	0.157
	0.06	0.157
	0.07	0.152
	0.08	0.142
	0.09	0.132
BACS53B1EA2	0.08	0.185
	0.09	0.185
	0.10	0.185
	0.12	0.175
	0.14	0.155

Table 16
BACS53B GROUND STUD INSTALLATION TOOLS

Power Unit		Puller Head		
Part Number	Supplier	Configuration	Part Number	Supplier
G-747	Textron Aerospace Fasteners (Cherry)	Straight	H747-10GS	Textron Aerospace Fasteners (Cherry)
RV30( )	Allfast (Olympic)	Straight	RV911-10	Allfast (Olympic)
		Right Angle	RV981-10	Allfast (Olympic)
		Off-Set	RV971-10	Allfast (Olympic)

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION



GROUND STUD PULLER HEAD CONFIGURATIONS
Figure 13

(1) Clean the hole and the surface around the hole with solvent. Refer to Subject 20-20-00.

Make sure that the inside of the hole is bare metal.

CAUTION: MAKE SURE THAT THE CLEANING SOLVENT IS PERMITTED FOR THE SURFACES THAT ARE CLEANED. A SOLVENT THAT IS NOT PERMITTED CAN CAUSE DAMAGE TO THE MATERIALS.

(2) Make a selection of a ground stud:

(a) Measure the thickness of the structure the ground stud is installed in.

(b) Make a selection of an applicable ground stud for the thickness of the structure. Refer to Table 15.

(3) Make a selection an installation tool from Table 16. Refer to Figure 13.

(4) Make an inspection of the ground stud hole to make sure that there is not any insulation material or other contamination in the hole.

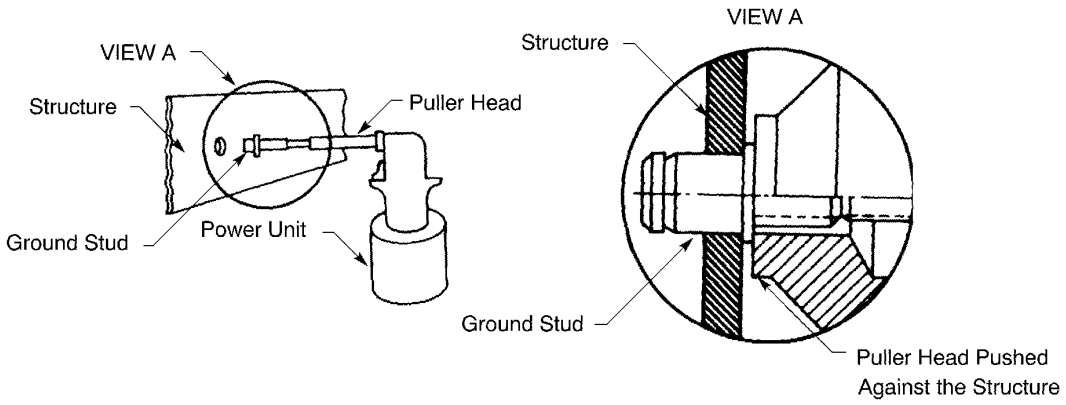
(5) Put the ground stud in the puller head of the tool.

CAUTION: DO NOT MOVE THE TRIGGER UNTIL THE GROUND STUD IS IN THE CORRECT POSITION IN RELATION TO THE HOLE AND THE STRUCTURE.

(6) Put the ground stud into the hole with the puller head so that:

- The puller head of the tool is against the structure
- The longitudinal axis of the ground stud is perpendicular to the structure.

Refer to Figure 14.



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POSITION OF THE GROUND STUD AND THE INSTALLATION TOOL
Figure 14

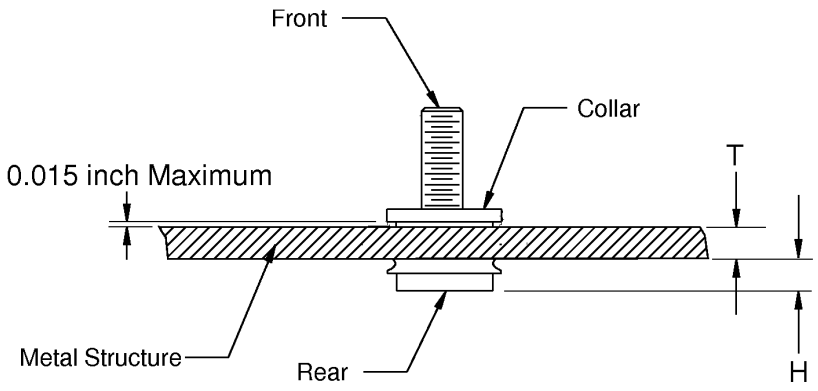
(7) Pull the trigger of the power unit of the installation tool.

(8) Make an inspection of the ground stud head in relation to the structure. Refer to Figure 15.

NOTE: A Boeing ST8711T tool can be used for to measure the distance from the top of the head of the ground stud to the structure.

Make sure that Dimension H is not greater than the specified value in Table 15.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION



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BACS53B AND MIL-T-83454/4 GROUND STUD INSTALLATION DIMENSIONS
Figure 15

(9) Put a nut on the ground stud.

(10) Torque the nut 28 to 35 inch-pounds.

(11) If the ground stud does not turn when it is torqued, remove the nut.

(12) If the ground stud turns when it is torqued:

(a) Remove the ground stud. Refer to Paragraph 2..

(b) Replace the ground stud with a 1/4-28 ground stud assembly.

(13) Do a test of the electrical resistance.

Refer to Paragraph 5. for the maximum permitted resistance and the test procedure.

NOTE: It is permitted to carefully pierce the surface finish of the structure with the test probes to make electrical contact with the structure.

(14) If the meaured resistance is more than the maximum permitted resistance:

(a) Remove the ground stud. Refer to Paragraph 2..

(b) Repeat Step 3.A.(11) through Step 3.A.(13) again.

(15) If part of the structure surface finish was removed to make electrical contact, the finish must be applied again.

Refer to Subject 20-20-00.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

B. Category 1 Unsealed BACS53F Pre-Installed Ground Stud Installation

(1) Clean the holes, ground stud, and adjacent surfaces with solvent before installation. Refer to Subject 20-20-00.

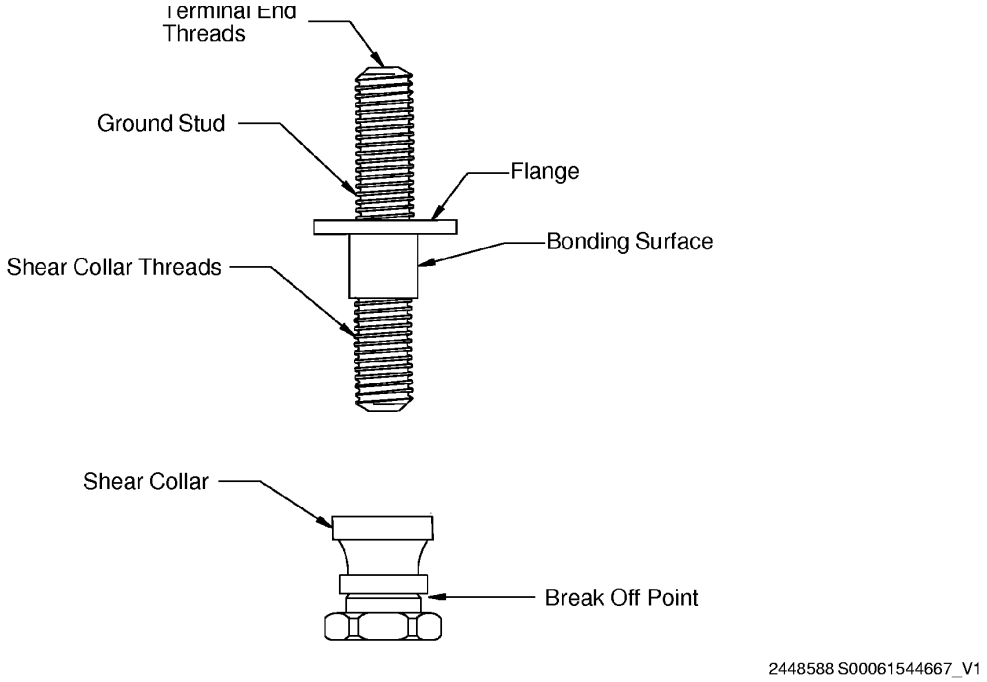
CAUTION: MAKE SURE THAT THE SOLVENT THAT IS USED TO CLEAN IS PERMITTED FOR THE SURFACES TO CLEAN. THE SOLVENT THAT IS NOT PERMITTED CAN CAUSE DAMAGE TO THE MATERIALS.

Table 17
PARTS FOR GROUND STUD INSTALLATION ON COMPOSITE STRUCTURE

Hardware	Part Number	Supplier
Ground Stud	BACS53F6-( )	Boeing
Shear Collar	BACC30AB6S	Boeing

Table 18
NECESSARY TOOLS FOR THE INSTALLATION OF BACS53F GROUND STUD

Name	Part Number	Description	Supplier
Ground Stud Installation Tool	ST2336C-1	Ground Stud Installation Tool	Boeing
Shear Collar Installation Tool	TP931( )	Socket Wrench	U.S. Tool & Supply



BACS53F( )GROUND STUD AND BACC30AB6S SHEAR COLLAR
Figure 16

(2) Put the ground stud through only one panel of the composite structure.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

(3) Install the ground stud:.

(a) Make a selection of a ground stud installation tool. Refer to Table 18.

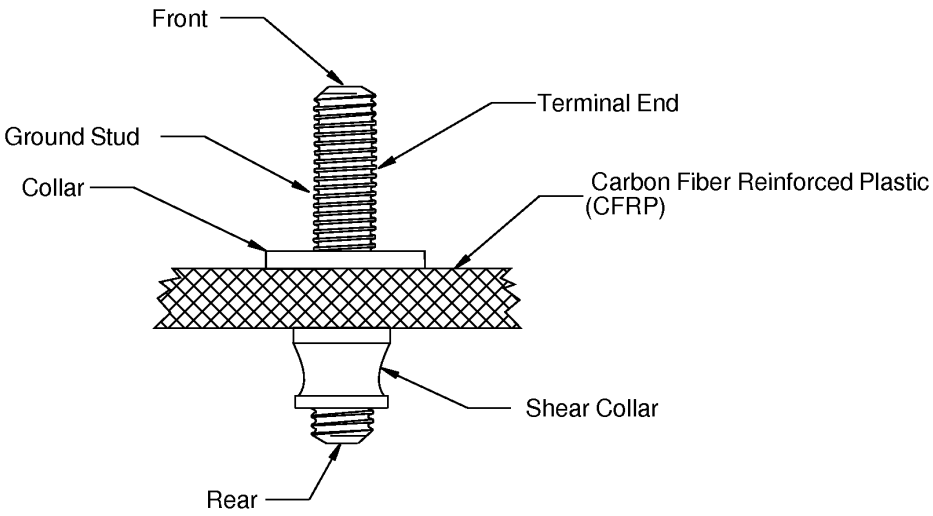
(b) Put the terminal end of the ground stud into the installation tool. Refer to Figure 16.

(c) Put support around the area of the hole before the ground stud is installed.

(d) Put the bonding surface end of the ground stud in the hole of the composite structure. Refer to Figure 16. Push or lightly tap on the end of the installation tool until the flange of the ground stud is tightly to the surface of the composite structure.

(e) Remove the installation tool after the ground stud is in the hole.

CAUTION: THE GROUND STUD MUST NOT TURN IN THE HOLE DURING INSTALLATION. UNSATISFACTORY PERFORMANCE OF THE GROUND STUD ELECTRICAL BOND CAN OCCUR.



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INSTALLED BACS53F GROUND STUD
Figure 17

(4) Install the shear collar. Refer to Figure 17.

(a) Put the shear collar on the ground stud.

Make sure the ground stud does not turn in the hole.

(b) Hold the ground stud with a hex wrench.

(c) Make a selection of a shear collar installation tool from Table 18 to tighten the hex head of the shear collar until it breaks off.

NOTE: An equivalent tool is a satisfactory alternative.

(d) Discard the broken off hex head.

NOTE: It is not necessary to test the electrical resistance of a BACS53F ground stud.

C. Category 1 Unsealed Standard Pre-Installed Ground Stud Installation

Table 19
PARTS FOR GROUND STUD INSTALLATION ON ALUMINUM STRUCTURE

Stud Size	Hardware	Part Number	Supplier
10-32 (3/16)	Fastener	BACS12GU3K( )	Boeing
		BACS12HN3-( )	Boeing
	Nut, Plain Electrical	MS35650-305T	QPL
	Washer, Corrosion Protective	NAS1149D0316H	Boeing
	Washer, Lock	MS35338-43	QPL
1/4-28	Fastener	BACS12HN4U( )	Boeing
	Nut, Plain Electrical	MS35650-3254	QPL
	Washer, Corrosion Protective	BACW10BP4APU	Boeing
	Washer, Lock	MS35338-44	QPL
5/16-24	Fastener	BACS12HN5U( )	Boeing
	Nut, Plain Electrical	MS35650-3314	QPL
	Washer, Corrosion Protective	BACW10BP5APU	Boeing
	Washer, Lock	MS35338-45	QPL
3/8-24	Fastener	BACS12HN6U( )	Boeing
	Nut, Plain Electrical	MS35650-3384	QPL
	Washer, Corrosion Protective	BACW10BP6APU	Boeing
	Washer, Lock	MS35338-46	QPL
1/2-20	Fastener	BACS12HP8U( )	Boeing
	Nut, Plain Electrical	MS35650-3394	QPL
	Washer, Corrosion Protective	BACW10BP8APU	Boeing
	Washer, Lock	MS35338-48	QPL

Table 20
PARTS FOR GROUND STUD INSTALLATION ON STAINLESS STEEL OR TITANIUM STRUCTURE

Stud Size	Hardware	Part Number	Supplier
10-32 (3/16)	Fastener	BACS12HN3U( )	Boeing
	Nut, Plain Electrical	MS35650-304	QPL
	Washer, Corrosion Protective	BACW10BP3APU	Boeing
	Washer, Lock	MS35338-138	QPL

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

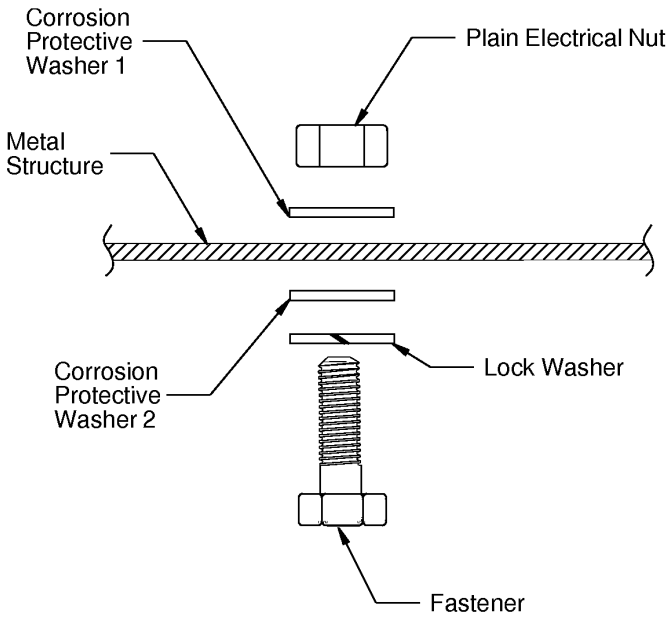
Table 20 PARTS FOR GROUND STUD INSTALLATION ON STAINLESS STEEL OR TITANIUM STRUCTURE (Continued)

Stud Size	Hardware	Part Number	Supplier
1/4-28	Fastener	BACS12HN4U( )	Boeing
	Nut, Plain Electrical	MS35650-3254	QPL
	Washer, Corrosion Protective	BACW10BP4APU	Boeing
	Washer, Lock	MS35338-139	QPL
5/16-24	Fastener	BACS12HN5U( )	Boeing
	Nut, Plain Electrical	MS35650-3314	QPL
	Washer, Corrosion Protective	BACW10BP5APU	Boeing
	Washer, Lock	MS35338-140	QPL
3/8-24	Fastener	BACS12HN6U( )	Boeing
	Nut, Plain Electrical	MS35650-3384	QPL
	Washer, Corrosion Protective	BACW10BP6APU	Boeing
	Washer, Lock	MS35338-141	QPL
1/2-20	Fastener	BACS12HP8U( )	Boeing
	Nut, Plain Electrical	MS35650-3394	QPL
	Washer, Corrosion Protective	BACW10BP8APU	Boeing
	Washer, Lock	MS35338-143	QPL

Table 21
TORQUE VALUES FOR THE PLAIN ELECTRICAL NUT

Nut Size	Torque (inch-pounds)	
	Minimum	Maximum
10-32 (3/16)	35	40
1/4-28	85	105
5/16	150	180
3/8-24	230	280
1/2-20	500	720

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION



CATEGORY 1 UNSEALED STANDARD PRE-INSTALLED GROUND STUD INSTALLATION
Figure 18

(1) Make a selection of the parts needed for the ground stud installation:

- Refer to Table 19 for ground studs that are installed on aluminum structure
- Refer to Table 20 for ground studs that are installed on stainless steel or titanium structure.

(2) Make a selection of a surface cleaning method. Refer to Table 7.

(3) Clean the area of the structure that touches Corrision Protective Washer 1.

If the ground stud installation does not occur in less than 24 hours, the area of the structure that touches Corrision Protective Washer 1 must be cleaned again.

(4) Clean the faying surface of the structure, Corrosion Protective Washer 1, and the Plain Electrical Nut with solvent before installation. Refer to Subject 20-20-00.

Make sure that the area of the structure that touches corrosion protective washer 1 is clean.

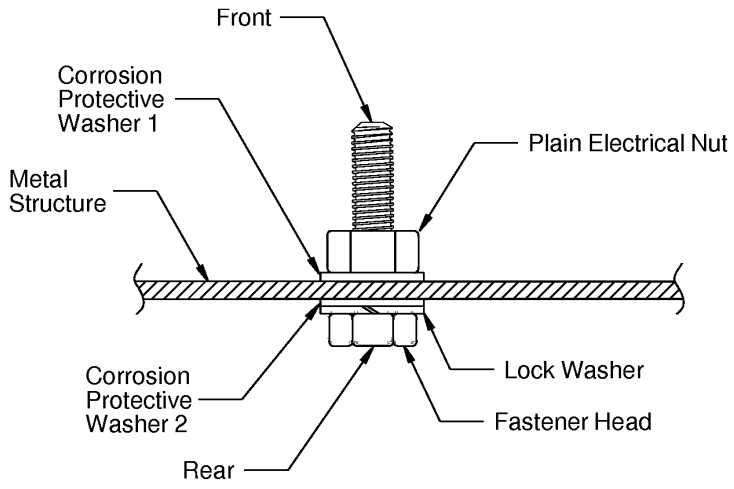
If the ground stud installation does not occur in less than 24 hours, faying surface of the structure, Corrosion Protective Washer 1, and the Plain Electrical Nut must be cleaned again.

(5) Put a lock washer and a corrosion protective washer on the ground stud.

(6) Put the gound stud in the hole with the threads on the side of the structure where the electrical connection is made.

(7) Engage the threads of the plain electrical nut and the ground stud.

(8) Torque the plain electrical nut to the value specified in Table 21.



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COMPLETED CATEGORY 1 UNSEALED STANDARD PRE-INSTALLED GROUND STUD INSTALLATION
Figure 19

(9) Do a test of the electrical resistance.

Refer to Paragraph 5. for the maximum permitted resistance and the test procedure.

NOTE: It is permitted to carefully pierce the surface finish of the structure with the test probes to make electrical contact with the structure.

(10) If the resistance is more than the maximum permitted resistance:

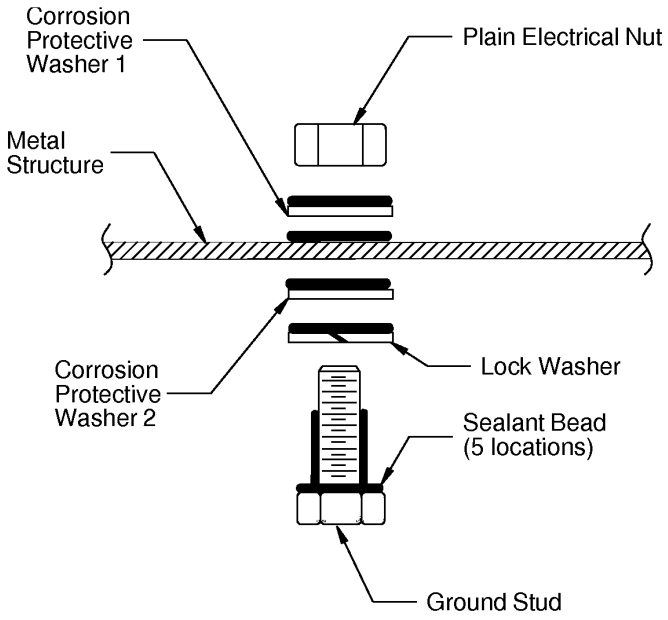
(a) Disassemble the ground stud.

(b) Repeat Step 3.C.(4) through Step 3.C.(9) again.

(11) If part of the structure surface finish was removed to make electrical contact, the finish must be applied again.

Refer to Subject 20-20-00.

D. Category 2 Fay Sealed Standard Pre-Installed Ground Stud Installation



CATEGORY 2 FAY SEALED STANDARD PRE-INSTALLED GROUND STUD INSTALLATION
Figure 20

(1) Make a selection of the parts needed for the ground stud installation:

- Refer to Table 19 for ground studs that are installed on aluminum structure
- Refer to Table 20 for ground studs that are installed on stainless steel or titanium structure.

(2) Clean the hole, ground stud, lock washer, corrosion protective washers, and the plain electrical nut with solvent before installation. Refer to Subject 20-20-00.

Make sure that the area of the structure that touches corrosion protective washers is clean.

CAUTION: MAKE SURE THAT THE SOLVENT THAT IS USED TO CLEAN IS PERMITTED FOR THE SURFACES TO CLEAN. THE SOLVENT THAT IS NOT PERMITTED CAN CAUSE DAMAGE TO THE MATERIALS.

(3) Make a selection of a sealant that is applicable for the area the ground stud is located in. Refer to Table 3.

(4) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth, continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

(5) Apply a continuous layer of sealant to the ground stud threads, ground stud head, and the ground stud shank. Refer to Figure 20.

(6) Apply a sealant bead to the following components:

- Corrosion Protective Washer 2
- The cleaned surface of the structure
- Corrosion Protective Washer 1
- Terminal or Terminals
- Pressure Washer

NOTE: It is necessary to apply the sealant on the surface of one component of two adjacent components.

NOTE: It is satisfactory to apply the sealant to the parts with a brush. Make sure that a uniform coat of sealant covers the mating surface.

(7) Put the threads of the ground stud through these parts in this order:

- The lock washer
- Corrosion protective washer 2
- The hole in the structure
- Corrosion protective washer 1

(8) Engage the threads of the ground stud with the threads of the plain electrical nut.

(9) Torque the plain electrical nut. Refer to Table 21.

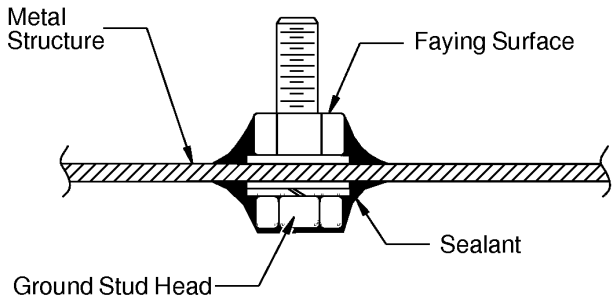
Make sure that there is continuous sealant squeez-out around each component.

CAUTION: IF THE SQUEEZE-OUT AROUND EACH COMPONENT IS NOT SUFFICIENT THE GROUND STUD CAN CORRODE AND CAUSE UNSATISFACTORY PERFORMANCE OF THE GROUND STUD ELECTRICAL BOND.

(10) Smooth out the sealant with a clean wiper or a brush.

CAUTION: DO NOT GET SEALANT ON THE FAYING SURFACE. SEALANT ON THE FAYING SURFACE CAN CAUSE UNSATISFACTORY PERFORMANCE OF THE GROUND STUD ELECTRICAL BOND.

NOTE: It is satisfactory to encapsulate the ground stud head



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COMPLETED CATEGORY 2 FAY SEALED STANDARD PRE-INSTALLED GROUND STUD INSTALLATION
Figure 21

(11) Do a test of the electrical resistance.

Refer to Paragraph 5..

NOTE: It is permitted to carefully pierce the surface finish of the structure with the test probes to make electrical contact with the structure.

(12) If the measured resistance is more than the maximum permitted resistance:

(a) Disassemble the ground stud installation.

(b) Repeat Step 3.D.(2) through Step 3.D.(11) again.

(13) If part of the structure surface finish was removed to make electrical contact, the finish must be applied again.

Refer to Subject 20-20-00.

E. Category 6 Fillet Sealed Pre-Installed Ground Studs

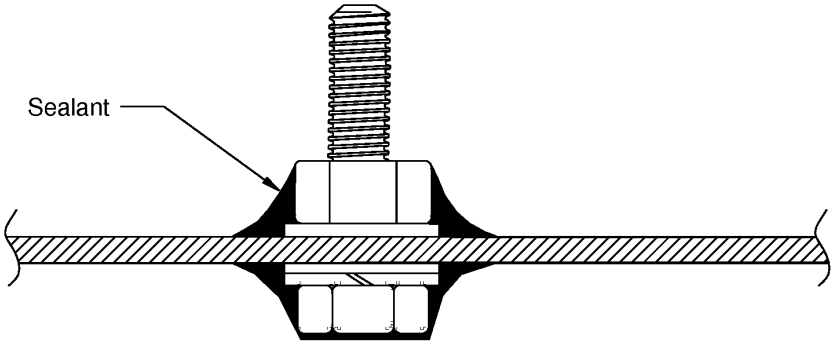
This paragraph gives the procedure to fillet seal these ground stud assemblies before the terminal lugs or the bond jumper terminals are installed:

- A standard pre-installed ground stud
- A BACS53B ground stud
- A MIL-T-83454/4 ground stud.

For the procedure to install a pre-installed ground stud, refer to:

- Paragraph 3.A. for the procedure to install a BACS53B and MIL-T-83454/4 pre-installed ground stud
- Paragraph 3.B. for the procedure to install a BACS53F pre-installed ground stud

• Paragraph 3.C. for the procedure to install a standard pre-installed ground stud.



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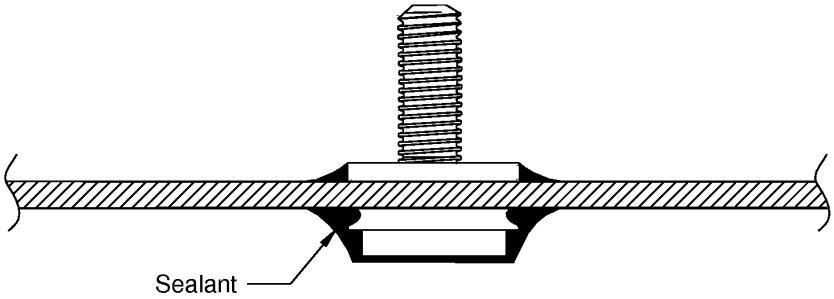
CATEGORY 6 FILLET SEAL OF A STANDARD PRE-INSTALLED GROUND STUD
Figure 22



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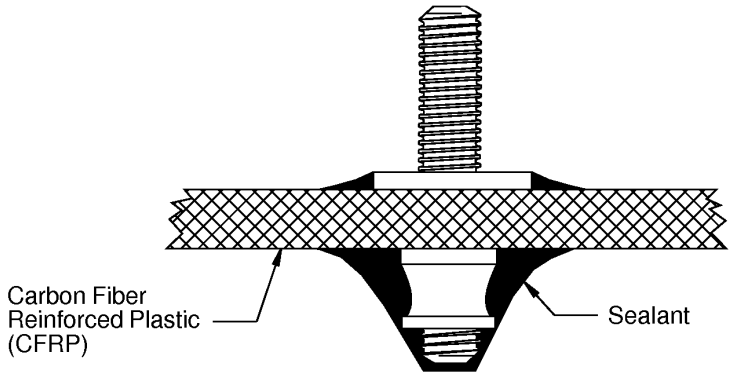
CATEGORY 6 FILLET SEAL OF A BACS53B OR A MIL-T-83454/4 GROUND STUD
Figure 23



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CATEGORY 6 FILLET SEAL OF A BACS53F PRE-INSTALLED GROUND STUD
Figure 24

(1) Make a selection of a sealant from Table 4.

(2) Make a selection of a solvent from Table 6.

(3) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth, continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

(4) Remove the contamination with a clean cloth and solvent from these surfaces:

- The outer surfaces of the ground stud assembly on each side of the structure
- A 1 inch minimum area around the ground assembly on each side of the structure.

CAUTION: THE SURFACES THAT THE SEALANT IS APPLIED ON MUST BE CLEAN. A CONTAMINATION ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

(5) Let the area dry.

(6) Apply a continuous layer of sealant on the ground stud assembly on each side of the structure.

For the seal of:

- A pre-installed ground stud assembly, refer to Figure 22
- A BACS53B or a MIL-T-83454/4 ground stud assembly, refer to Figure 23.

Make sure that the sealant:

- Is a small fillet
- Is smooth and continuous
- Does not have air bubbles or voids
- Does not have contamination in it
- Does not touch the faying surfaces of the ground stud components or the terminal lug.

CAUTION: SEALANT ON THE FAYING SURFACES CAN CAUSE UNSATISFACTORY RESISTANCE OF THE GROUND ASSEMBLY.

(7) If sealant touches a faying surface:

(a) Remove all contamination from the faying surface with a clean cloth and naptha or an equivalent solvent.

(b) Let the surface dry.

(c) If the sealant must be applied again, do Step 3.E.(6) again.

(8) Let the sealant cure.

NOTE: The full cure of a sealant is recommended, but the sealant is serviceable when:

- It is tack free
- It is in an area where wind shear does not occur.

4. GROUND STUD ASSEMBLY WITH TERMINAL LUGS OR BONDING JUMPERS

A. General Conditions for Terminal Lug or Bonding Jumper Installation

These conditions are applicable:

- The selection of a bonding jumper installation procedure is made by the identification of the type of ground stud that the bonding jumper is attached to.
- Tin plated copper terminal lugs must be used on aluminum structure
- Nickel plated terminal lugs must be used on steel and titanium structure
- When a clamp is used to attach a terminal lug to a metallic tube, the clamp must be tightened carefully to make sure that damage to the tube does not occur
- Do not bend flag, spring blade, hook, or faston terminal lugs
- A terminal lug can be bent one time only
- A terminal lug can have only one bend
- A terminal lug must be bent before it is installed on the ground stud
- A tool must be used to form a bend in a terminal lug
- There can be no bends in the wire barrel to tongue transition area or in the hole area. Refer to Figure 25 and Figure 26
- The terminal lug can not have any twist in the wire barrel. Refer to Figure 27
- The terminal lug can not have any twist in the ring tongue. Refer to Figure 28
- A standard terminal lug can have a maximum bend of 30 degrees in the up direction and a maximum bend of 90 degrees in the down direction. Refer to Figure 29
- A BACT12M( ) terminal lug can have a maximum bend of 30 degrees in the up direction and 30 degrees in the down direction. Refer to Figure 30
- A solid nickel terminal lug can have a maximum bend of 45 degrees in the up direction and 45 degrees in the down direction. Refer to Figure 31

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

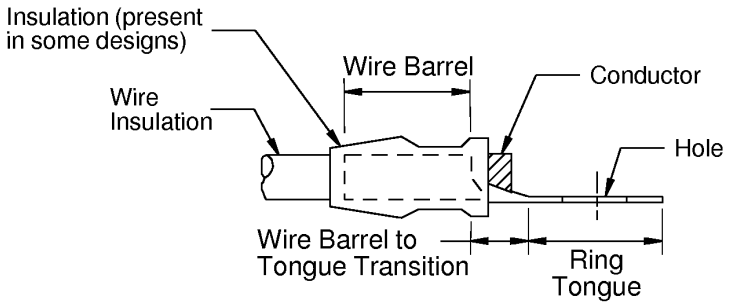
- Crazing of the plating material is permitted if there is no exposed copper
- Flaking of the plating material is not permitted.

A terminal lug of a ground wire must not make an interference with the operation of:

- A control surface that moves
- A shock mount that moves
- Other equipment that is attached to a fixed point that moves.

When more than one terminal lug is attached with one fastener to the basic structure, these conditions are applicable:

- The largest terminal lug must be adjacent to the structure
- The remaining terminal lugs must be in the sequence of the next largest size to the smallest size
- The terminal lugs must be even and symmetrical around the stud
- The terminal lugs must not make an interference with another part or a structure
- No more than 4 terminal lugs are permitted on one fastener with threads
- A terminal lug can be turned over to help installation.



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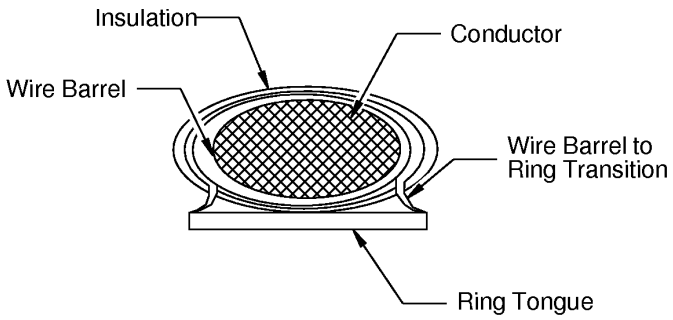
ELEMENTS OF A TERMINAL LUG
Figure 25



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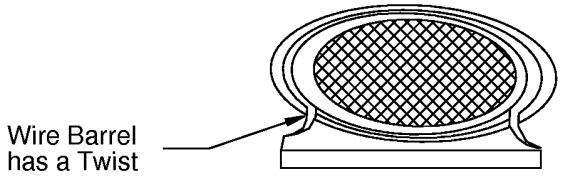
TERMINAL LUG THAT IS SATISFACTORY
Figure 26



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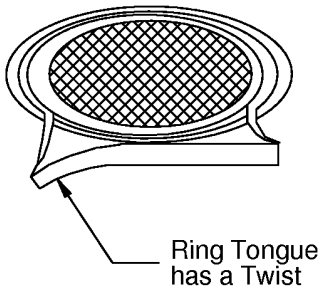
TERMINAL LUG THAT IS NOT SATISFACTORY - WIRE BARREL HAS A TWIST
Figure 27



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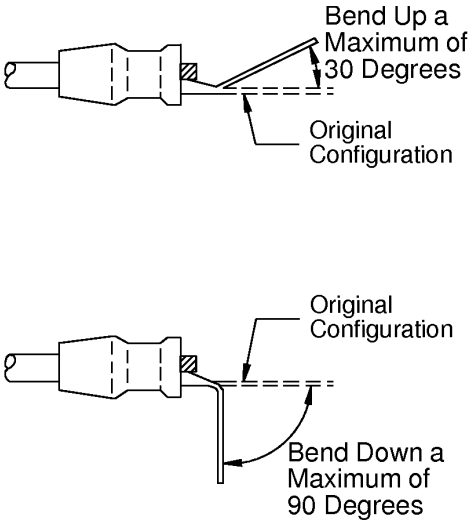
TERMINAL LUG THAT IS NOT SATISFACTORY - RING TONGUE HAS A TWIST
Figure 28



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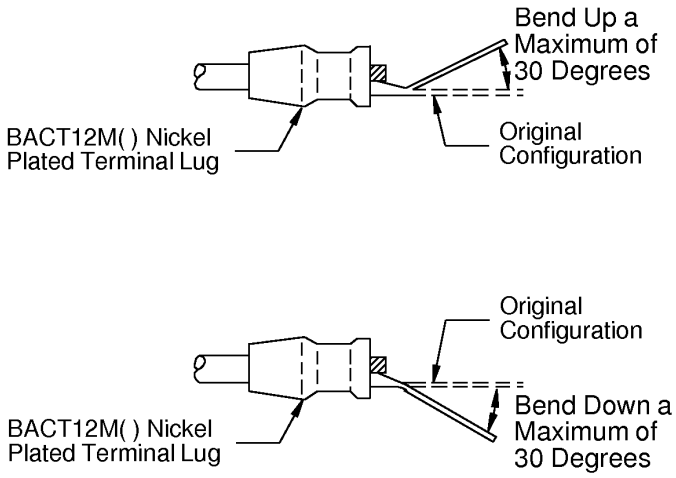
BACT12AC( ) TIN PLATED COPPER TERMINAL LUG BEND LIMITS
Figure 29



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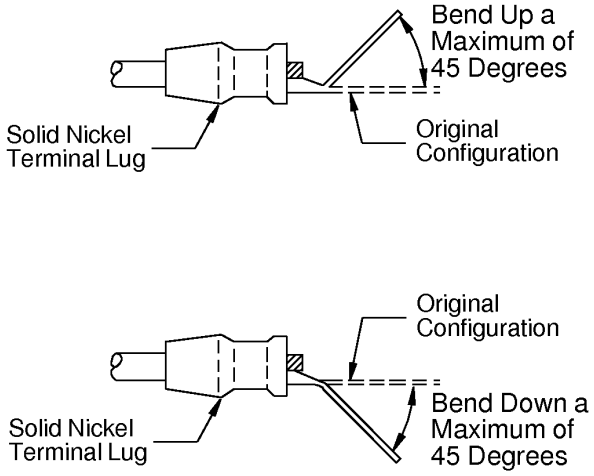
BACT12M( ) NICKEL PLATED COPPER TERMINAL LUG WIRE SIZE AWG 3/0 THROUGH AWG 10 BEND LIMITS

Figure 30



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SOLID NICKEL TERMINAL LUG WIRE SIZE AWG 10 THROUGH AWG 24 BEND LIMITS

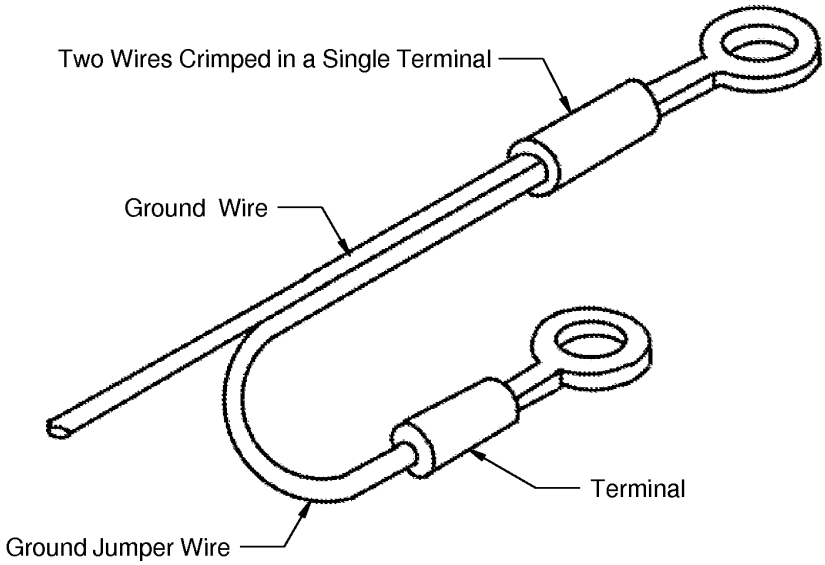
Figure 31

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

B. Dual Terminated Grounds

It is satisfactory to install these wires in one terminal to achieve a dual terminated ground:

- One ground wire.
- A second ground wire with the terminal at the other end that gives the second bond to ground. Refer to Figure 32.



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DUAL TERMINATED GROUND WITH ONE GROUND WIRE
Figure 32

When one or more ground wires terminate at one ground stud, make the CAU of the jumper wire to the second ground stud the same as, or more than, the sum of the CAUs of the individual wire that terminate at the first ground stud.

When the shield and conductor of a shielded wire are terminated into a single lug, do not include the CAU of the shield, when calculating the CAU of the jumper wire.

If the ground jumper wire length is not specified, make the length of the dual ground jumper wire, from terminal hole to terminal hole, equal to 4.50 inches ± 0.25 inch. Refer to Figure 32.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

Select the dual ground termination jumper wire. Refer to Table 22.

Table 22
JUMPER WIRE FOR DUAL GROUND TERMINATIONS

Temperature Grade	Wire Type	Wire Type Code
A & B	BMS13-48, Type 10	PA
A & B	BMS13-60, Type 1	GA
C & D	BMS13-60, Type 7	HA
A, B, C & D	Same as primary wire	---

When the engineering drawing makes it necessary to install a sleeve on the dual ground wire, it is not necessary to install the sleeve on the jumper wire.

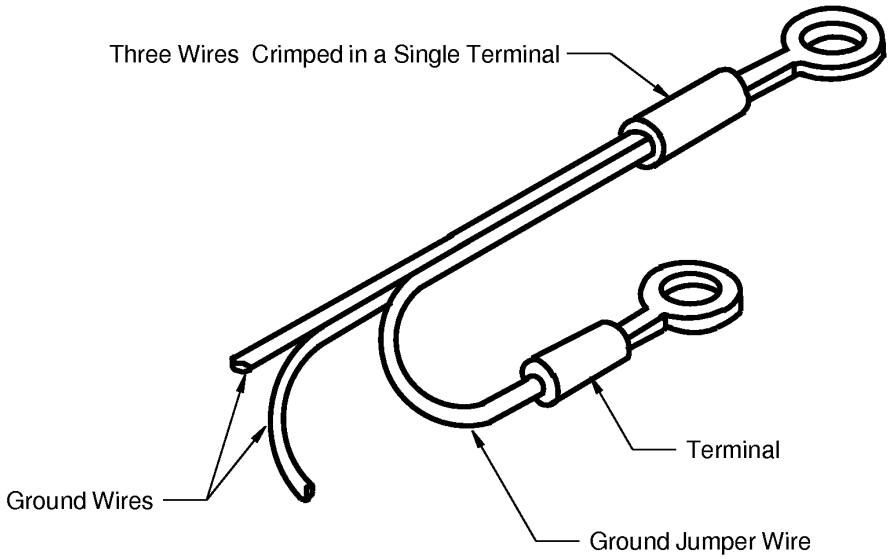
When shielded ground wires terminate at dual terminated grounds, the unshielded distance between the shield termination and the end of the ground wire terminal shall be no greater than 3.5 inches and no less than 3.0 inches, except where the shield and the wire terminate in the same terminal.

Use the same GD equipment number to identify the two ground locations.

It is not necessary to tie together dual ground wires, except engine and strut bundles.

It is satisfactory to install these wires in one terminal to achieve a dual terminated ground:

- Two ground wires.
- A third ground wire with the terminal at the other end that gives the second bond to ground. Refer to Figure 33.



DUAL TERMINATED GROUND WITH TWO GROUND WIRES
Figure 33

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

When one or more ground wires terminate at one ground stud, make the CAU of the jumper wire to the second ground stud the same as, or more than, the sum of the CAUs of the individual wire that terminate at the first ground stud.

When the shield and conductor of a shielded wire are terminated into a single lug, do not include the CAU of the shield, when calculating the CAU of the jumper wire.

If the ground jumper wire length is not specified, make the length of the dual ground jumper wire, from terminal hole to terminal hole, equal to 4.50 inches ± 0.25 inch. Refer to Figure 33.

Select the dual ground termination jumper wire. Refer to Table 22.

When the engineering drawing makes it necessary to install a sleeve on the dual ground wire, it is not necessary to install the sleeve on the jumper wire.

When shielded ground wires terminate at dual terminated grounds, the unshielded distance between the shield termination and the end of the ground wire terminal shall be no greater than 3.5 inches and no less than 3.0 inches, except where the shield and the wire terminate in the same terminal.

Use the same GD equipment number to identify the two ground locations.

It is not necessary to tie together dual ground wires, except engine and strut bundles.

C. Category 1 Unsealed and Category 6 Fillet Sealed Pre-Installed Ground Stud Assembly

Table 23
NECESSARY PARTS FOR PRE-INSTALLED GROUND STUD ASSEMBLY ON ALUMINUM STRUCTURE

Stud Size	Description	Part Number	Supplier
10-32 (3/16)	Nut, Self Locking	BACN10YR3CD	Boeing
	Washer, Pressure	NAS1149D0316H	QPL
1/4-28	Nut, Self Locking	BACN10YR4CD	Boeing
	Washer, Pressure	NAS1149D0416H	QPL
5/16-24	Nut, Self Locking	BACN10YR5CD	Boeing
	Washer, Pressure	NAS1149D0516H	QPL
3/8-24	Nut, Self Locking	BACN10YR6CD	Boeing
	Washer, Pressure	NAS1149D0616H	QPL
1/2-20	Nut, Self Locking	BACN10YR8CD	Boeing
	Washer, Pressure	NAS1149D0816H	QPL

Table 24
NECESSARY PARTS FOR PRE-INSTALLED GROUND STUD ASSEMBLY ON STEEL OR TITANIUM STRUCTURE

Stud Size	Description	Part Number	Supplier
10-32 (3/16)	Nut, Self Locking	BACN10JC3CM	Boeing
	Washer, Pressure	BACW10BP3APU	Boeing
1/4-28	Nut, Self Locking	BACN10JC4CM	Boeing
	Washer, Pressure	BACW10BP4APU	QPL

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

Table 24 NECESSARY PARTS FOR PRE-INSTALLED GROUND STUD ASSEMBLY ON STEEL OR TITANIUM STRUCTURE (Continued)

Stud Size	Description	Part Number	Supplier
5/16-24	Nut, Self Locking	BACN10JC5CM	Boeing
	Washer, Pressure	BACW10BP5APU	QPL
3/8-24	Nut, Self Locking	BACN10JC6CM	Boeing
	Washer, Pressure	BACW10BP6APU	QPL
1/2-20	Nut, Self Locking	BACN10JC8CM	Boeing
	Washer, Pressure	BACW10BP8APU	QPL

Table 25
NECESSARY PARTS FOR PRE-INSTALLED GROUND STUDS ON CFRP STRUCTURE

Stud Size	Description	Part Number	Supplier
10-32 (3/16)	Nut, Self Locking	BACN10JC3M	Boeing
	Washer, Pressure	BACW10BP3APU	Boeing

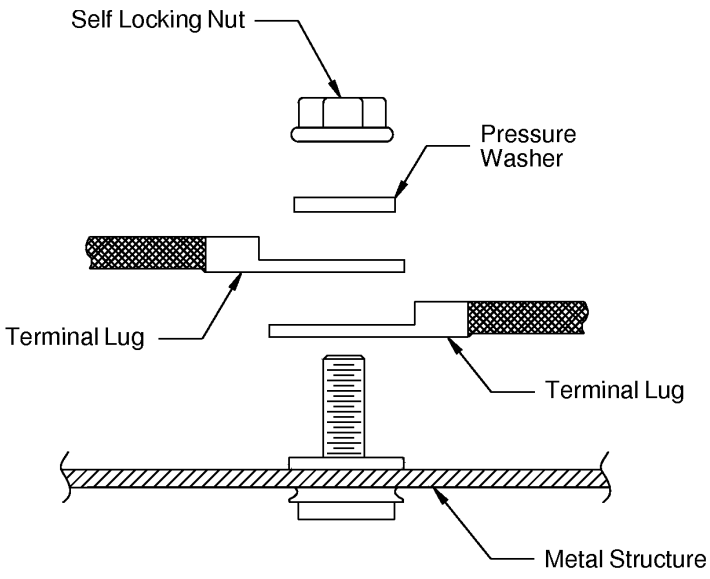
Table 26
TORQUE VALUES FOR PRE-INSTALLED GROUND STUD ASSEMBLIES

Stud Type	Stud Size	Structure Material	Torque (inch-pounds)	
			Minimum	Maximum
BACS53F	10-32 (3/16)	CFRP	33	40
BACS53B	10-32 (3/16)	Aluminum	28	35
		Steel	33	40
		Titanium	33	40
MIL-T-83454/4	10-32 (3/16)	Aluminum	28	35
		Steel	33	40
		Titanium	33	40

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

Table 26 TORQUE VALUES FOR PRE-INSTALLED GROUND STUD ASSEMBLIES (Continued)

Stud Type	Stud Size	Structure Material	Torque (inch-pounds)	
			Minimum	Maximum
Standard Pre-Installed Ground Stud	10-32 (3/16)	Aluminum	28	35
		Steel	33	40
		Titanium	33	40
	1/4-28	Aluminum	65	70
		Steel	90	105
		Titanium	90	105
	5/16-24	Aluminum	135	145
		Steel	170	200
		Titanium	170	200
	3/8-24	Aluminum	180	200
		Steel	300	350
		Titanium	300	350
	1/2-20	Aluminum	480	520
		Steel	730	840
		Titanium	730	840



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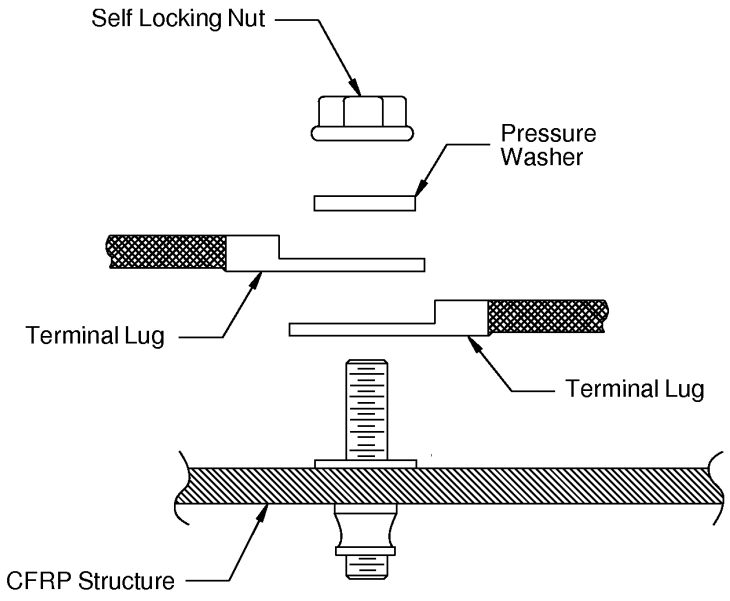
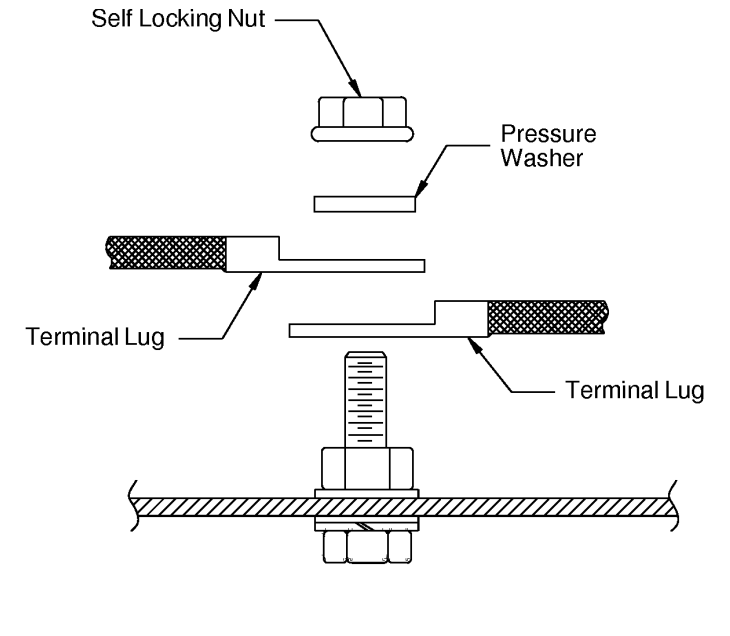
TERMINAL INSTALLATION ON BACS53B AND MIL-T-83454/4 GROUND STUDS
Figure 34



TERMINAL INSTALLATION ON BACS53F GROUND STUDS
Figure 35



TERMINAL INSTALLATION ON STANDARD PRE-INSTALLED GROUND STUDS
Figure 36

(1) Make a selection of a self locking nut and a pressure washer.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

Refer to:

- Table 23 for ground studs installed on aluminum structure
- Table 24 for ground studs installed on steel or titanium structure
- Table 25 for ground studs installed on CFRP structure.

(2) Clean the ground stud faying surface area and the terminal lugs with solvent before installation. Refer to Subject 20-20-00.

Make sure that the area of the pre-installed ground stud that touches the terminal lug is clean.

CAUTION: MAKE SURE THAT THE SOLVENT THAT IS USED TO CLEAN IS PERMITTED FOR THE SURFACES TO CLEAN. THE SOLVENT THAT IS NOT PERMITTED CAN CAUSE DAMAGE TO THE MATERIALS.

(3) Put the terminal lugs on the ground stud.

Refer to:

- Figure 34 for the BACS53B pre-installed ground stud
- Figure 35 for the BACS53F pre-installed ground stud
- Figure 36 for the standard pre-installed ground stud

(4) Put the self locking nut on the ground stud:

(a) Engage the threads of the self locking nut with the threads of the grond stud.

(b) Torque the nut to the specified value in Table 26.

(5) Do a test of the electrical resistance of the terminals for these ground studs:

- BACS53B
- MIL-T-83454/4
- Standard Pre-Installed.

Refer to Paragraph 5. for the maximum permitted resistance and the procedure to perform the test.

NOTE: It is not necessary to test the terminals on BACS53F ground studs.

(6) If the measured electrical resistance is more than the maximum permitted:

(a) Disassemble the ground stud assembly.

(b) Repeat Step 4.C.(2) through Step 4.C.(5).

(7) If part of the structure surface finish was removed to make electrical contact, the finish must be applied again within 7 days of removal of the original the finish.

Refer to Subject 20-20-00.

(8) If the ground stud is a Category 1 unsealed ground stud, the installation and assembly of the ground stud is complete.

(9) If the ground stud is a Category 6 fillet sealed ground stud:

(a) Make a selection of a sealant from Table 3.

Make sure that the sealant is applicable for the area the ground stud is located in.

(b) Make a selection of a solvent from Table 5.

(c) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth, continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

(d) Remove the contamination with a clean cloth and solvent from these surfaces:

- The outer surfaces of the ground stud assembly on each side of the structure
- A 1 inch minimum area around the ground assembly on each side of the structure.

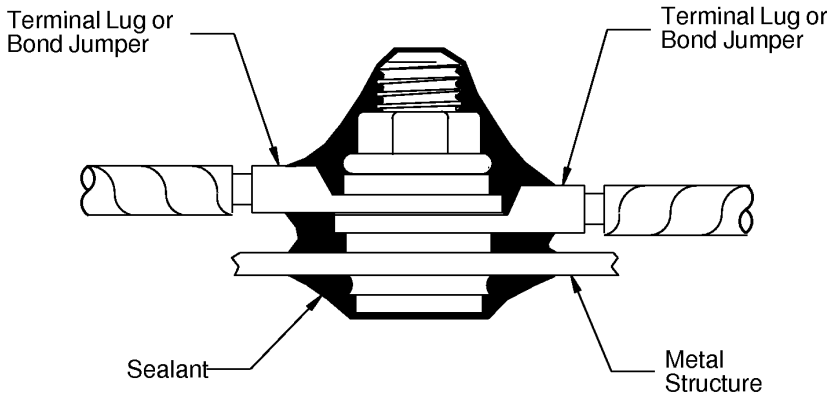
CAUTION: THE SURFACES THAT THE SEALANT IS APPLIED ON MUST BE CLEAN. A CONTAMINATION ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

(e) Let the area dry.

(f) Apply a continuous layer of sealant on the ground stud assembly on each side of the structure.

For the seal of:

- A BACS53B or a MIL-T-83454/4 ground stud assembly, refer to Figure 37
- A BACS53F ground stud assembly, refer to refer to Figure 38
- A standard pre-installed ground stud assembly, refer to Figure 39



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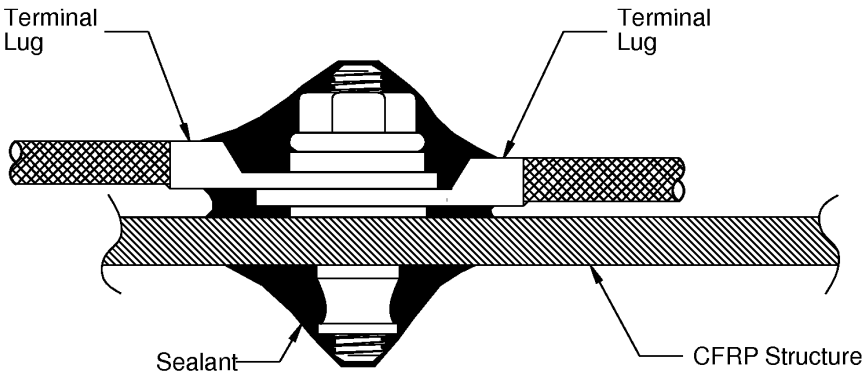
COMPLETED CATEGORY 6 FILLET SEALED BACS53B OR MIL-T-83454/4 GROUND STUD ASSEMBLY
Figure 37



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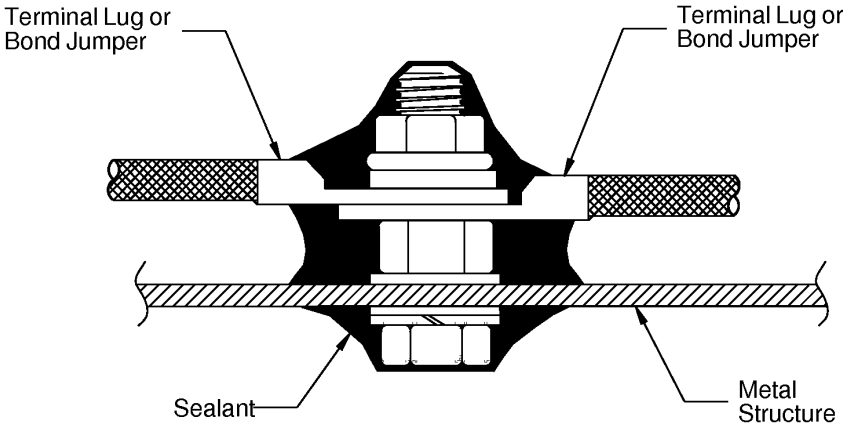
COMPLETED CATEGORY 6 FILLET SEALED BACS53F GROUND STUD ASSEMBLY
Figure 38



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COMPLETED CATEGORY 6 FILLET SEALED STANDARD PRE-INSTALLED GROUND STUD ASSEMBLY
Figure 39

Make sure that the sealant:

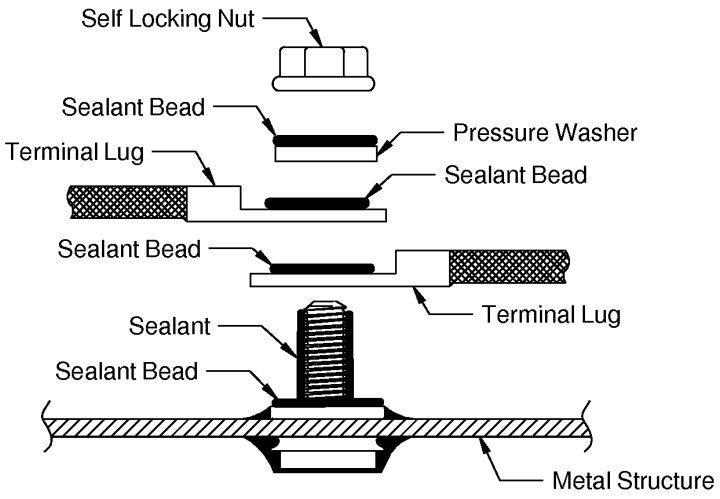
- Is a small fillet
- Is smooth and continuous
- Does not have air bubbles or voids
- Does not have contamination in it
- Does not touch the faying surfaces of the ground stud components or the terminal lug.

(g) Let the sealant cure. Refer to Table 4 for the application time, the tack free time, and the cure time.

NOTE: The full cure of a sealant is recommended, but the sealant is serviceable when:

- It is tack free
- It is in an area where wind shear does not occur.

D. Category 2 Fay Sealed Pre-Installed Ground Stud Assembly



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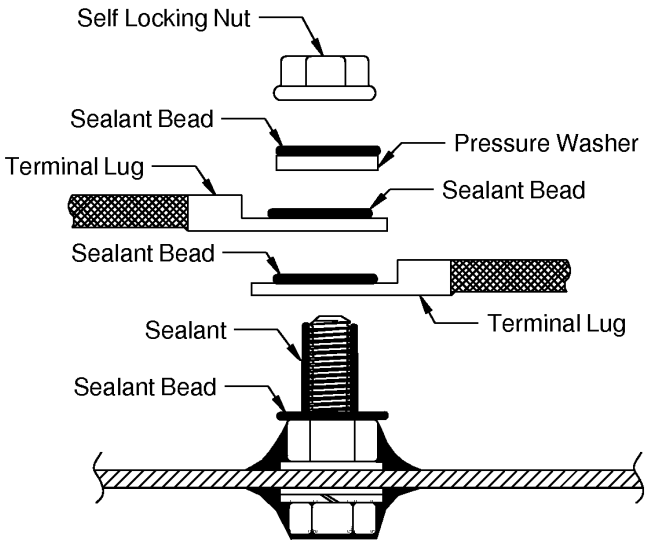
CATEGORY 2 FAY SEALED BACS53B AND MIL-T-83454/4 PRE-INSTALLED GROUND STUD ASSEMBLY
Figure 40

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION



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CATEGORY 2 FAY SEALED STANDARD PRE-INSTALLED GROUND STUD ASSEMBLY
Figure 41

(1) Make a selection of a self locking nut and a pressure washer.

Refer to:

- Table 23 for ground studs installed on aluminum structure
- Table 24 for ground studs installed on steel or titanium structure

(2) Clean the ground stud area that touches the terminal lug, the terminal lugs, the pressure washer, and the self locking nut with solvent before installation. Refer to Subject 20-20-00.

Make sure that the areas that touch and make the electrical bond are clean.

CAUTION: MAKE SURE THAT THE SOLVENT THAT IS USED TO CLEAN IS PERMITTED FOR THE SURFACES TO CLEAN. THE SOLVENT THAT IS NOT PERMITTED CAN CAUSE DAMAGE TO THE MATERIALS.

CAUTION: THE GROUND STUD ASSEMBLY AND RESISTANCE MEASUREMENT MUST BE DONE WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE BOND ASSEMBLY AND RESISTANCE MEASUREMENT ARE NOT DONE WITHIN 24 HOURS, THE FAYING SURFACES MUST BE CLEANED AGAIN.

(3) Make a selection of a sealant that is applicable for the area the ground stud is located in. Refer to Table 3.

(4) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth, continuous layer of sealant

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

- Does not cause damage to the structure or the finish when the sealant is applied.

(5) Apply a continuous layer of sealant to these surfaces:ground stud faying surface, ground stud threads, terminal lugs, and the pressure washer.

- Ground stud faying surface
- Ground stud threads
- Terminal Lugs
- Pressure Washer

Refer to:

- Figure 40 for the seal of a BACS53B or MIL-T-83454/4 pre-installed ground stud assembly
- Figure 41 for the seal of a standard pre-installed ground stud assembly.

NOTE: It is necessary to apply the sealant on the surface of one component of two adjacent components.

NOTE: It is satisfactory to apply the sealant to the parts with a brush. Make sure that a uniform coat of sealant covers the mating surface.

(6) Engage the threads of the ground stud with the threads of the self locking nut.

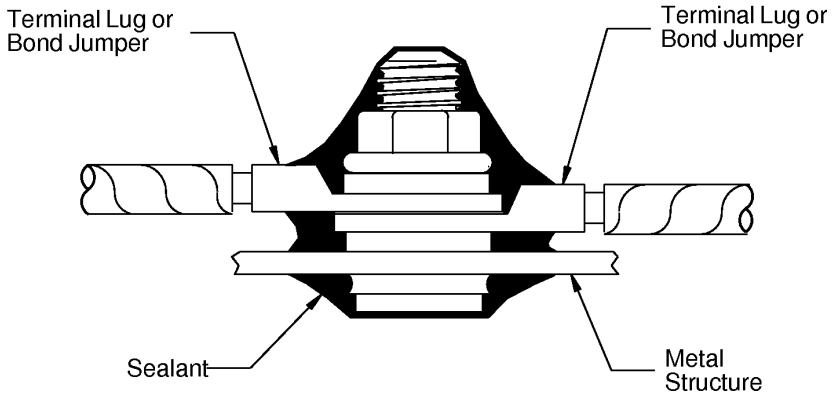
(7) Torque the self locking nut. Refer to Table 26.

Make sure that there is continuous sealant squeez-out around each component.

CAUTION: IF THE SQUEEZE-OUT AROUND EACH COMPONENT IS NOT SUFFICIENT THE GROUND STUD CAN CORRODE AND CAUSE UNSATISFACTORY PERFORMANCE OF THE GROUND STUD ELECTRICAL BOND.

For the Category 2 fay seal of:

- A BACS53B or a MIL-T-83454/4 ground stud assembly, refer to Figure 42
- A standard pre-installed ground stud assembly, refer to Figure 43



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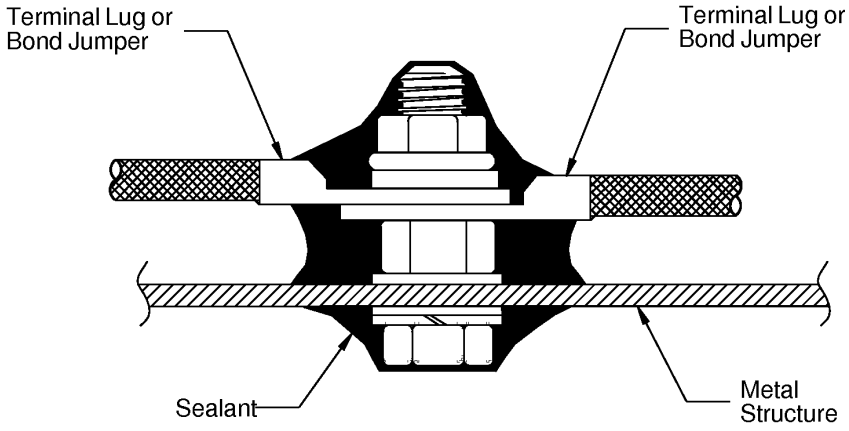
COMPLETED CATEGORY 2 FAY SEALED BACS53B OR MIL-T-83454/4 GROUND STUD ASSEMBLY
Figure 42



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COMPLETED CATEGORY 2 FAY SEALED STANDARD PRE-INSTALLED GROUND STUD ASSEMBLY
Figure 43

(8) Smooth out the sealant with a clean wiper or a brush.

NOTE: It is satisfactory to encapsulate the ground stud head.

(9) Do a test of the electrical resistance.

Refer to Paragraph 5. for the maximum permitted resistance and the procedure to perform the test.

NOTE: It is permitted to carefully pierce the surface finish of the structure with the test probes to make electrical contact with the structure.

(10) If the measured electrical resistance is more than the maximum permitted:

(a) Disassemble the ground stud assembly.

(b) Repeat Step 4.D.(2) through Step 4.D.(9).

(11) If part of the structure surface finish was removed to make electrical contact, the finish must be applied again within 7 days of removal of the original the finish.

Refer to Subject 20-20-00.

E. Category 1 Unsealed and Category 6 Fillet Sealed Direct Ground Stud Assembly

Table 27
NECESSARY PARTS FOR DIRECT GROUND STUD ASSEMBLY ON ALUMINUM STRUCTURE

Stud Size	Description	Part Number	Supplier
10-32 (3/16)	Fastener	BACS12GU3K( )	Boeing
		BACS12HN3-( )	Boeing
	Nut, Self Locking	BACN10YR3CD	Boeing
	Washer, Corrosion Protective	NAS1149D0316H	QPL
	Washer, Pressure	NAS1149D0316H	QPL
1/4-28	Fastener	BACS12GU4K( )	Boeing
		BACS12HN4-( )	Boeing
	Nut, Self Locking	BACN10YR4CD	Boeing
	Washer, Corrosion Protective	NAS1149D0416H	QPL
	Washer, Pressure	NAS1149D0416H	QPL
5/16-24	Fastener	BACS12GU5K( )	Boeing
		BACS12HN5-( )	Boeing
	Nut, Self Locking	BACN10YR5CD	Boeing
	Washer, Corrosion Protective	NAS1149D0516H	QPL
	Washer, Pressure	NAS1149D0516H	QPL
3/8-24	Fastener	BACS12GU6K( )	Boeing
		BACS12HN6-( )	Boeing
	Nut, Self Locking	BACN10YR6CD	Boeing
	Washer, Corrosion Protective	NAS1149D0616H	QPL
	Washer, Pressure	NAS1149D0616H	QPL

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

Table 27 NECESSARY PARTS FOR DIRECT GROUND STUD ASSEMBLY ON ALUMINUM STRUCTURE (Continued)

Stud Size	Description	Part Number	Supplier
1/2-20	Fastener	BACS12GU8K( )	Boeing
		BACS12HN8-( )	Boeing
	Nut, Self Locking	BACN10YR5CD	Boeing
	Washer, Corrosion Protective	NAS1149D0816H	QPL
	Washer, Pressure	NAS1149D0816H	QPL

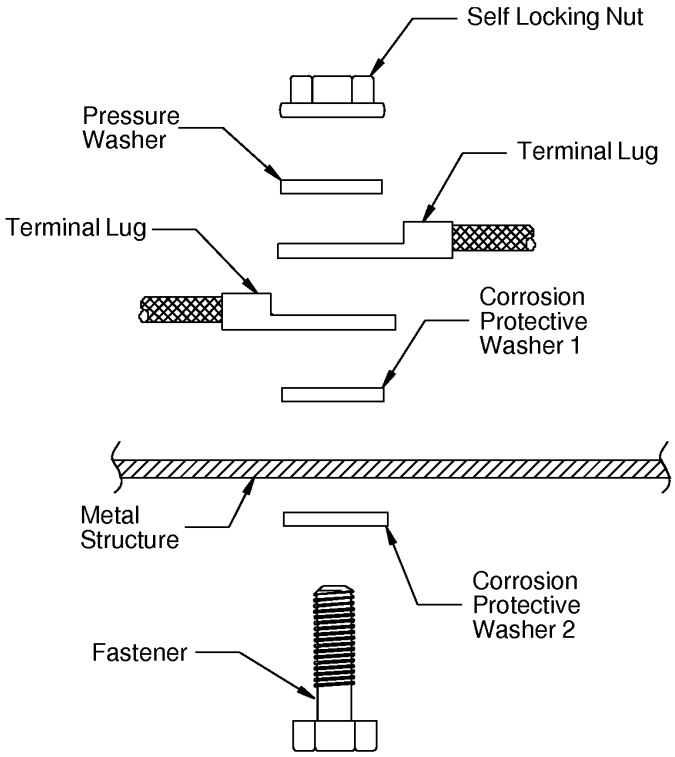
Table 28
NECESSARY PARTS FOR DIRECT GROUND STUD ASSEMBLY ON STEEL OR TITANIUM STRUCTURE

Stud Size	Description	Part Number	Supplier
10-32 (3/16)	Fastener	BACS12GU3K( )	Boeing
		BACS12HN3U( )	Boeing
	Nut, Self Locking	BACN10JC3CM	Boeing
	Washer, Corrosion Protective	BACW10BP3APU	Boeing
	Washer, Pressure	BACW10BP3APU	Boeing
1/4-28	Fastener	BACS12GU4K( )	Boeing
		BACS12HN4U( )	Boeing
	Nut, Self Locking	BACN10JC4CM	Boeing
	Washer, Corrosion Protective	BACW10BP4APU	Boeing
	Washer, Pressure	BACW10BP4APU	Boeing
5/16-24	Fastener	BACS12GU5K( )	Boeing
		BACS12HN5U( )	Boeing
	Nut, Self Locking	BACN10JC5CM	Boeing
	Washer, Corrosion Protective	BACW10BP5APU	Boeing
	Washer, Pressure	BACW10BP5APU	Boeing
3/8-24	Fastener	BACS12GU6K( )	Boeing
		BACS12HN6U( )	Boeing
	Nut, Self Locking	BACN10JC6CM	Boeing
	Washer, Corrosion Protective	BACW10BP6APU	Boeing
	Washer, Pressure	BACW10BP6APU	Boeing
1/2-20	Fastener	BACS12GU8K( )	Boeing
		BACS12HN8U( )	Boeing
	Nut, Self Locking	BACN10JC8CM	Boeing
	Washer, Corrosion Protective	BACW10BP8APU	Boeing
	Washer, Pressure	BACW10BP8APU	Boeing

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

Table 29
TORQUE VALUES DIRECT GROUND STUD ASSEMBLIES

Stud Size	Structure Material	Torque (inch-pounds)	
		Minimum	Maximum
10-32 (3/16)	Aluminum	28	35
	Steel	33	40
	Titanium	33	40
1/4-28	Aluminum	65	70
	Steel	90	105
	Titanium	90	105
5/16-24	Aluminum	135	145
	Steel	170	200
	Titanium	170	200
3/8-24	Aluminum	180	200
	Steel	300	350
	Titanium	300	350
1/2-20	Aluminum	480	520
	Steel	730	840
	Titanium	730	840



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CATEGORY 1 UNSEALED AND CATEGORY 6 FILLET SEALED DIRECT GROUND STUD ASSEMBLY
Figure 44

(1) Make a selection of:

- A fastener
- A self locking nut
- Two corrosion protective washers
- A pressure washer.

Refer to:

- Table 28 for ground studs installed on aluminum structure
- Table 28 for ground studs installed on steel or titanium structure

(2) Make a selection of a surface cleaning method. Refer to Table 7.

(3) Clean the faying surface of the structure that touches Corrosion Protective Washer 1.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

(4) Clean these components using solvent.

- The faying surface of the structure
- Corrosion Protective Washer 1
- Terminal Lugs.

Refer to Subject 20-20-00 for the procedure to clean with solvent.

Make sure that the parts for the ground stud assembly are clean.

CAUTION: REMOVAL OF PLATING ON THE TERMINALS CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

CAUTION: USING THE WRONG PARTS CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

(5) Put the corrosion protective washer 2 on the fastener. Refer to Figure 44.

(6) Put the fastener through the hole in the structure.

Make sure that the threads of the fastener are on the side of the structure where the electrical connection is made.

(7) Put the following parts on the threads of the fastener in this order:

- Corrosion protective washer 1
- Terminal lugs
- Pressure washer

Make sure that the parts for the ground stud assembly are clean.

(8) Put the self locking nut on the ground stud:

(a) Engage the threads of the self locking nut with the threads of the fastener.

(b) Torque the nut to the specified value in Table 29.

(9) Do a test of the electrical resistance of the terminals.

Refer to Paragraph 5. for the maximum permitted resistance and the procedure to perform the test.

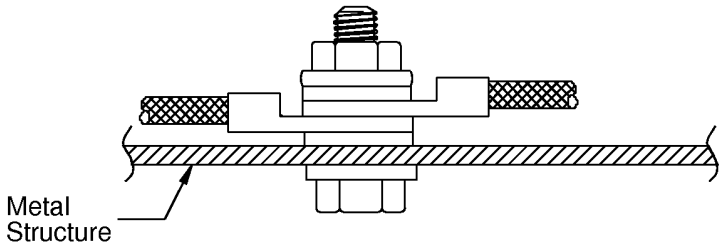
NOTE: It is permitted to carefully pierce the surface finish of the structure with the test probes to make electrical contact with the structure.

(10) If the measured electrical resistance is more than the maximum permitted:

(a) Disassemble the ground stud assembly.

(b) Repeat Step 4.E.(4) through Step 4.E.(9).

(11) If the ground stud is a Category 1 unsealed ground stud the assembly of the ground stud is complete.



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COMPLETED CATEGORY 1 UNSEALED DIRECT GROUND STUD ASSEMBLY
Figure 45

(12) If the ground stud is a Category 6 fillet sealed ground stud:

(a) Make a selection of a sealant from Table 3.

Make sure that the sealant is applicable for the area the ground stud is located in.

(b) Make a selection of a solvent from Table 5.

(c) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth, continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

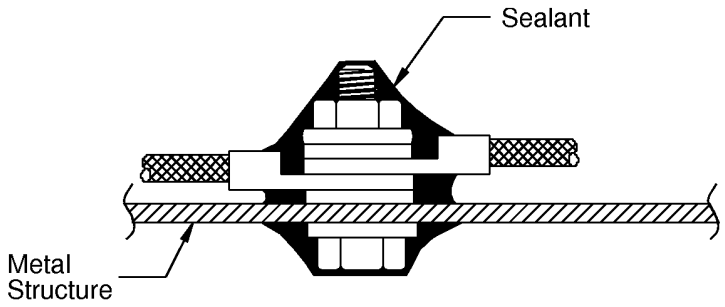
(d) Remove the contamination with a clean cloth and solvent from these surfaces:

- The outer surfaces of the ground stud assembly on each side of the structure
- A 1 inch minimum area around the ground assembly on each side of the structure.

CAUTION: THE SURFACES THAT THE SEALANT IS APPLIED ON MUST BE CLEAN. A CONTAMINATION ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

(e) Let the area dry.

(f) Apply a continuous layer of sealant on the ground stud assembly on each side of the structure. Refer to Figure 46



CATEGORY 6 FILLET SEALED DIRECT GROUND STUD ASSEMBLY
Figure 46

Make sure that the sealant:

- Is a small fillet
- Is smooth and continuous
- Does not have air bubbles or voids
- Does not have contamination in it
- Does not touch the faying surfaces of the ground stud components or the terminal lug.

(g) Let the sealant cure. Refer to Table 4 for the application time, the tack free time, and the cure time.

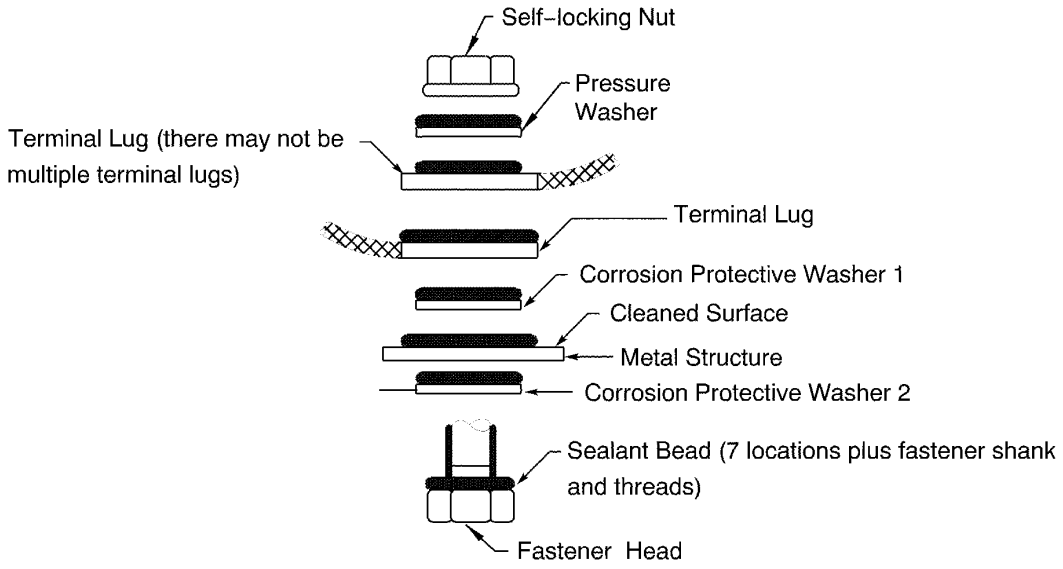
NOTE: The full cure of a sealant is recommended, but the sealant is serviceable when:

- It is tack free
- It is in an area where wind shear does not occur.

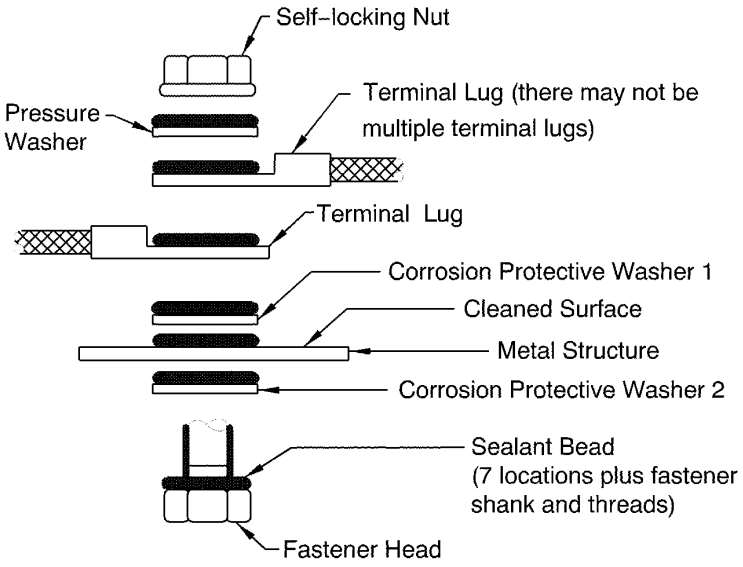
REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

F. Category 2 Fay Sealed Direct Ground Stud Installation

This paragraph gives the procedure to fay seal a direct standard ground stud assembly while the terminal lugs are being installed.



BACJ40C,D,E JUMPER ASSEMBLY CATEGORY 2 FAY SEALED DIRECT STANDARD GROUND STUD INSTALLATION
Figure 47



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BACJ40A,AB,AC,AD,K JUMPER ASSEMBLY CATEGORY 2 FAY SEALED DIRECT STANDARD GROUND STUD INSTALLATION
Figure 48

(1) Make a selection of a surface cleaning method. Refer to Table 7.

(2) Clean the faying surface of the structure that touches Corrosion Protective Washer 1. Refer to Figure 47, and Figure 48.

If the ground stud installation does not occur in less than 24 hours, the area of the structure that touches Corrision Protective Washer 1 must be cleaned again.

(3) Clean these components using solvent. Refer to Figure 47 and Figure 48:

- The faying surface of the structure
- Corrosion Protective Washer 1
- Terminal Lug or Terminal Lugs.

CAUTION: REMOVAL OF PLATING ON THE TERMINALS CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

CAUTION: USING THE WRONG PARTS CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

If the ground stud installation does not occur in less than 24 hours, the components must be cleaned again.

(4) Make a selection of a sealant that is applicable for the area the Ground Stud is located in. Refer to Table 3.

(5) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth, continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

(6) Apply a continuous layer of sealant to the fastener threads, fastener head, and the fastener shank. Refer to Figure 47 and Figure 48.

(7) Apply a sealant bead to the following components:

- Corrosion Protective Washer 2
- The cleaned surface of the structure
- Corrosion Protective Washer 1
- Terminal or Terminals
- Pressure Washer

Refer to Figure 47 and Figure 48.

NOTE: It is necessary to apply the sealant on the surface of one component of two adjacent components.

NOTE: It is satisfactory to apply the sealant to the parts with a brush. Make sure that a uniform coat of sealant covers the mating surface.

CAUTION: THE SEALANT MUST HAVE SUFFICIENT THICKNESS TO FILL THE SPACE BETWEEN THE TERMINAL LUG AND THE STRUCTURE. EMPTY SPACES BETWEEN THE TERMINAL LUG AND THE STRUCTURE THAT ARE NOT FILLED WITH SEALANT CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

(8) Put the threads of the Fastener through the Corrosion Protective Washer 2.

(9) Put the threads of the Fastener through the hole in the structure.

(10) Put the remaining parts on the assembly in this order:

- Corrosion Protective Washer 1
- Terminal or Terminals
- Pressure Washer
- Self Locking Nut

Refer to Figure 47 and Figure 48.

(11) Torque the self locking nut with a manual torque wrench. Refer to Table 30.

Make sure that:

- The torque is applied before the end of the squeeze-out life of the sealant. Refer to Table 3
- You see the sealant come out from between each component of the assembly when the self-locking nut is tightened
- There are no empty spaces between the terminal lug and the structure
- The sealant is continuous around each component.

CAUTION: FAILURE TO APPLY THE TORQUE BEFORE THE END OF THE SQUEEZE-OUT LIFE OF THE SEALANT CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

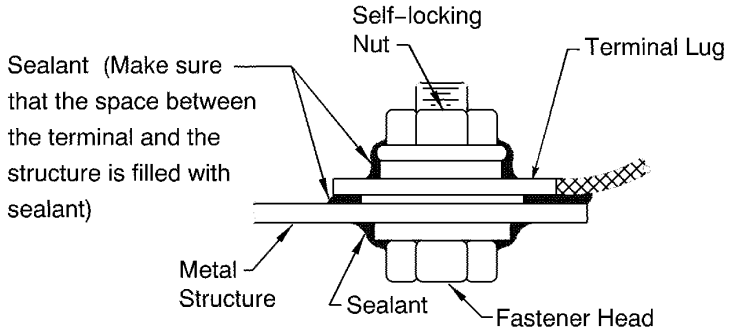
CAUTION: FAILURE TO SEE THE SEALANT COME OUT FROM BETWEEN EACH COMPONENT CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

NOTE: It is satisfactory to use a power tool to apply 75[pct] of the torque value followed by the use of a manual torque tool to apply the final torque value.

NOTE: If the terminal or jumper rotates when applying torque to the self-locking nut, hold the self-locking nut with a wrench and apply torque to the fastener head. Refer to Table 30.

Table 30
TORQUE VALUES FOR DIRECT GROUND STUD ASSEMBLIES

Stud Size	Structure Material	Torque (inch pounds)	
		Minimum	Maximum
10-32 (3/16)	Aluminum	28	35
	Steel	33	40
	Titanium	33	40
1/4-28	Aluminum	65	70
	Steel	90	105
	Titanium	90	105
5/16-24	Aluminum	135	145
	Steel	170	200
	Titanium	170	200
3/8-24	Aluminum	180	200
	Stainless	300	350
	Titanium	300	350
1/2-20	Aluminum	480	520
	Steel	730	840
	Titanium	730	840



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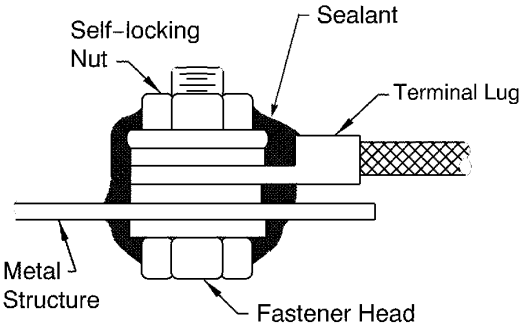
COMPLETED BACJ40C,D,E JUMPER ASSEMBLY CATEGORY 2 FAY SEALED DIRECT STANDARD GROUND STUD INSTALLATION
Figure 49



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COMPLETED BACJ40A,AB,AC,AD,K JUMPER ASSEMBLY CATEGORY 2 FAY SEALED DIRECT STANDARD GROUND STUD INSTALLATION
Figure 50

(12) Smooth out the sealant using a brush or clean wiper. Refer to Figure 49 and Figure 50.

Make sure that:

- The sealant is continuous around each component
- There are no empty spaces between the terminal lug and the structure
- The sealant makes a seal around each component.

(13) Do a test of the electrical resistance between the terminal lug and the structure. Refer to Paragraph 5..

It is permitted to carefully pierce the surface finish of the structure with the test probes to make an electrical connection.

(14) If the measured electrical resistance is more than the specified maximum resistance.

(a) Disassemble the components and do Step (b) and Step (d) or Step (c) and Step (d).

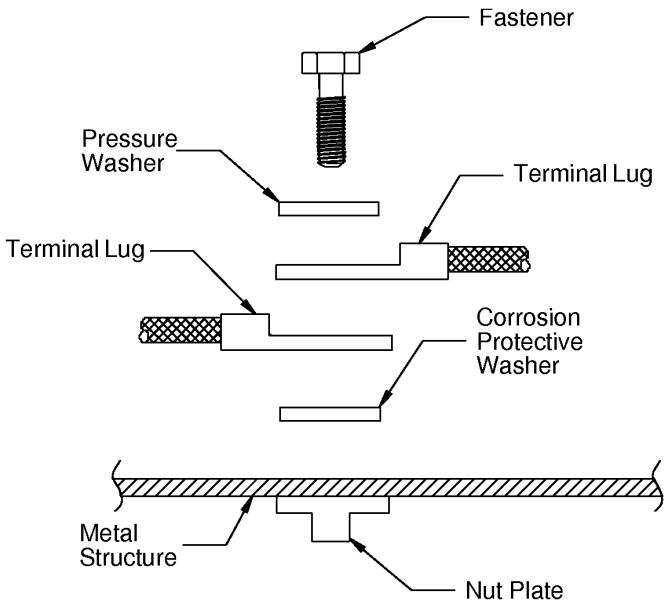
(b) Clean the components with solvent. Refer to Subject 20-20-00.

(c) Discard the components and get new components.

(d) Do Step 4.F.(1) through Step 4.F.(13) again.

(15) If the area adjacent to the ground stud has bare metal, replace the surface finish on the bare metal. Refer to Subject 20-20-00.

G. Category 1 Unsealed and Category 6 Fillet Sealed Nut Plate Direct Ground Stud Assembly



CATEGORY 1 UNSEALED AND CATEGORY 6 FILLET SEALED NUT PLATE DIRECT GROUND STUD ASSEMBLY
Figure 51

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

Table 31
TORQUE VALUES DIRECT NUT PLATE GROUND STUD ASSEMBLIES

Stud Size	Structure Material	Torque (inch-pounds)	
		Minimum	Maximum
10-32 (3/16)	Aluminum	32	38
	Steel	35	45
	Titanium	35	45
1/4-28	Aluminum	63	77
	Steel	95	115
	Titanium	95	115
5/16-24	Aluminum	130	160
	Steel	180	220
	Titanium	180	220
3/8-24	Aluminum	180	200
	Steel	315	385
	Titanium	315	385
1/2-20	Aluminum	470	570
	Steel	755	925
	Titanium	755	925

(1) Make a selection of:

- A fastener
- A corrosion protective washer
- A pressure washer.

Refer to:

- Table 27 for ground studs installed on aluminum structure
- Table 28 for ground studs installed on steel or titanium structure

(2) Clean the fastener, the corrosion protective washer, the pressure washer, the nut plate, and the terminal lugs with solvent. Refer to Subject 20-20-00.

Make sure that the parts for the ground stud assembly are clean.

CAUTION: MAKE SURE THAT THE SOLVENT THAT IS USED TO CLEAN IS PERMITTED FOR THE SURFACES TO CLEAN. THE SOLVENT THAT IS NOT PERMITTED CAN CAUSE DAMAGE TO THE MATERIALS.

(3) Put the presure washer on the fastener.

Refer to Figure 51.

(4) Put the fastener through the holes in the terminal lugs.

(5) Put the corrosion protective washer on the fastener.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

(6) Put the fastener through the hole in the structure and engage the threads of the fastener with the threads of the nut plate.

(7) Torque the fastener to the applicable value specified in Table 31.

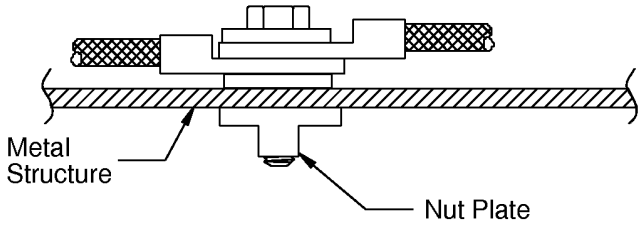
(8) Do a test of the electrical resistance of the terminals. Refer to Paragraph 5. for the maximum permitted resistance and the procedure to perform the test.

(9) If the measured electrical resistance is more than the maximum permitted:

(a) Disassemble the ground stud assembly.

(b) Repeat Step 4.G.(2) through Step 4.G.(8).

(10) If the ground stud is a Category 1 unsealed ground stud the assembly of the ground stud is complete.



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COMPLETED CATEGORY 1 UNSEALED NUT PLATE DIRECT GROUND STUD ASSEMBLY
Figure 52

(11) If the ground stud is a Category 6 fillet sealed ground stud:

(a) Make a selection of a sealant from Table 3.

Make sure that the sealant is applicable for the area the ground stud is located in.

(b) Make a selection of a solvent from Table 5.

(c) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth, continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

(d) Remove the contamination with a clean cloth and solvent from these surfaces:

- The outer surfaces of the ground stud assembly on each side of the structure
- A 1 inch minimum area around the ground assembly on each side of the structure.

CAUTION: THE SURFACES THAT THE SEALANT IS APPLIED ON MUST BE CLEAN. A CONTAMINATION ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

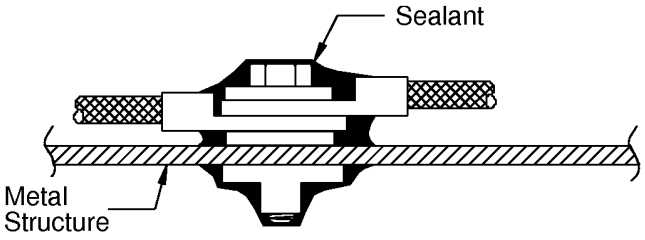
(e) Let the area dry.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

(f) Apply a continuous layer of sealant on the ground stud assembly on each side of the structure.

For the seal of:

- A BACS53B or a MIL-T-83454/4 ground stud assembly, refer to Figure 52
- A BACS53F ground stud assembly, refer to refer to Figure 53
- A standard pre-installed ground stud assembly, refer to Figure 51



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COMPLETED CATEGORY 6 FILLET SEALED DIRECT NUT PLATE GROUND STUD ASSEMBLY
Figure 53

Make sure that the sealant:

- Is a small fillet
- Is smooth and continuous
- Does not have air bubbles or voids
- Does not have contamination in it
- Does not touch the faying surfaces of the ground stud components or the terminal lug.

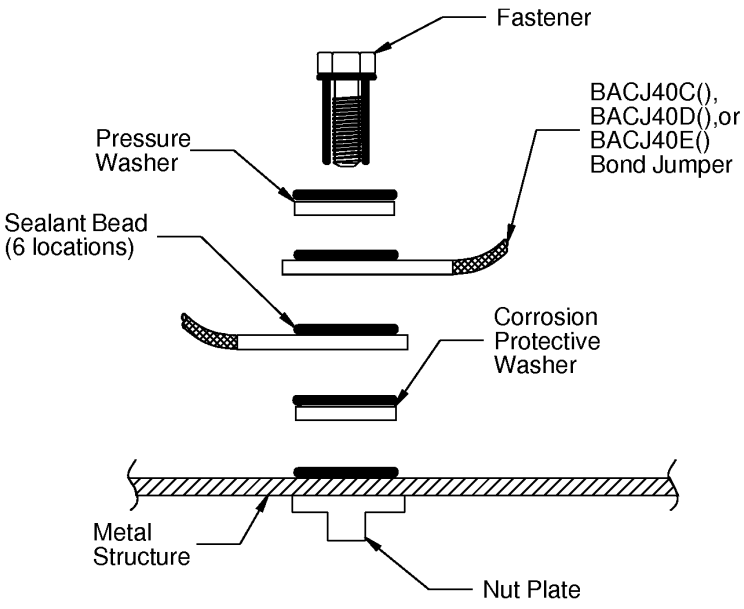
(g) Let the sealant cure.

NOTE: The full cure of a sealant is recommended, but the sealant is serviceable when:

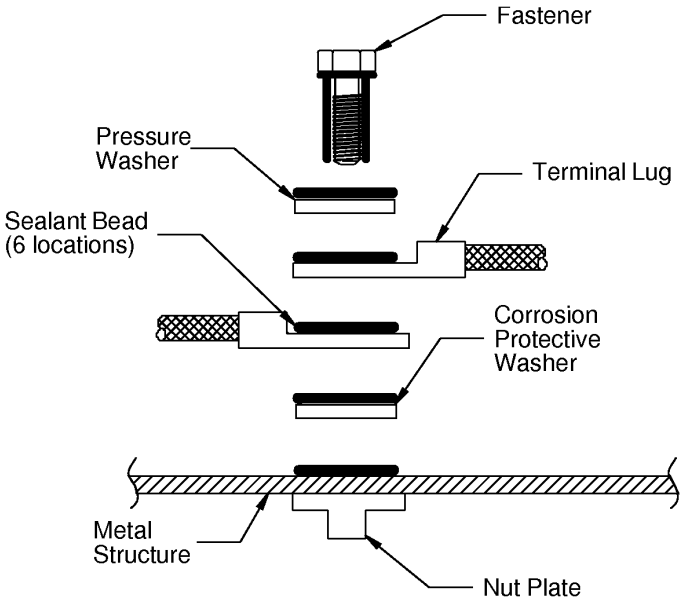
- It is tack free
- It is in an area where wind shear does not occur.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

H. Category 2 Fay Sealed Nut Plate Direct Ground Stud Installation



CATEGORY 2 FAY SEALED NUT PLATE DIRECT GROUND STUD ASSEMBLY WITH BOND JUMPERS
Figure 54



CATEGORY 2 FAY SEALED NUT PLATE DIRECT GROUND STUD ASSEMBLY WITH TERMINAL LUGS
Figure 55

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

(1) Make a selection of a surface cleaning method. Refer to Table 7.

(2) Clean the faying surface of the structure that touches Corrosion Protective Washer 1. Refer to Figure 54, Figure 55.

(3) Clean these components using solvent. Refer to Figure 54 and Figure 55:

- The faying surface of the structure
- Corrosion Protective Washer 1
- Terminal Lugs or bond jumpers.

CAUTION: REMOVAL OF PLATING ON THE TERMINALS CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

CAUTION: USING THE WRONG PARTS CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

(4) Make a selection of a sealant that is applicable for the area the Ground Stud is located in. Refer to Table 3.

(5) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth, continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

(6) Apply a continuous layer of sealant to the fastener threads, fastener head, and the fastener shank. Refer to Figure 54 and Figure 55.

(7) Apply a sealant bead to the following components:

- Corrosion Protective Washer 2
- The cleaned surface of the structure
- Corrosion Protective Washer 1
- Terminal or Terminals
- Pressure Washer

Refer to Figure 54 and Figure 55.

NOTE: It is necessary to apply the sealant on the surface of one component of two adjacent components.

NOTE: It is satisfactory to apply the sealant to the parts with a brush. Make sure that a uniform coat of sealant covers the mating surface.

CAUTION: THE SEALANT MUST HAVE SUFFICIENT THICKNESS TO FILL THE SPACE BETWEEN THE TERMINAL LUG AND THE STRUCTURE. EMPTY SPACES BETWEEN THE TERMINAL LUG AND THE STRUCTURE THAT ARE NOT FILLED WITH SEALANT CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

(8) Put the threads of the Fastener through the Corrosion Protective Washer 2.

(9) Put the threads of the Fastener through the hole in the structure.

(10) Put the remaining parts on the assembly in this order:

- Corrosion Protective Washer 1
- Terminal or Terminals
- Pressure Washer
- Self Locking Nut

Refer to Figure 54 and Figure 55.

(11) Torque the self locking nut with a manual torque wrench. Refer to Table 31.

Make sure that:

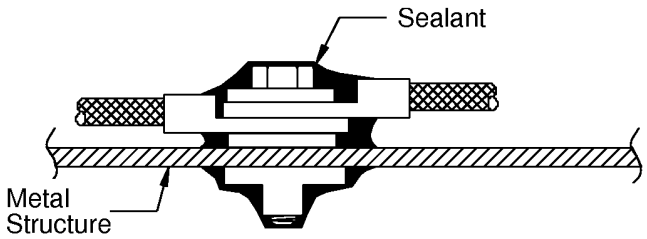
- The torque is applied before the end of the squeeze-out life of the sealant. Refer to Table 3
- You see the sealant come out from between each component of the assembly when the self-locking nut is tightened
- There are no empty spaces between the terminal lug and the structure
- The sealant is continuous around each component.

CAUTION: FAILURE TO APPLY THE TORQUE BEFORE THE END OF THE SQUEEZE-OUT LIFE OF THE SEALANT CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

CAUTION: FAILURE TO SEE THE SEALANT COME OUT FROM BETWEEN EACH COMPONENT CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

NOTE: It is satisfactory to use a power tool to apply 75 per-cent of the torque value followed by the use of a manual torque tool to apply the final torque value.

NOTE: If the terminal or jumper rotates when applying torque to the self-locking nut, hold the self-locking nut with a wrench and apply torque to the fastener head.



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COMPLETED CATEGORY 2 FAY SEALED DIRECT NUT PLATE GROUND STUD ASSEMBLY
Figure 56

(12) Smooth out the sealant using a brush or clean wiper.

Make sure that:

- The sealant is continuous around each component
- There are no empty spaces between the terminal lug and the structure
- The sealant makes a seal around each component.

(13) Do a test of the electrical resistance between the terminal lug and the structure. Refer to Paragraph 5..

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

(14) If the measured electrical resistance is more than the specified maximum resistance in Subject 20-20-00:

(a) Disassemble the components and do Step (b) and Step (d) or Step (c) and Step (d).

(b) Clean the components with solvent. Refer to Subject 20-20-00.

(c) Discard the components and get new components.

(d) Do Step 4.H.(1) through Step 4.H.(13) again.

(15) If the area adjacent to the ground stud has bare metal, replace the surface finish on the bare metal. Refer to Subject 20-20-00.

I. Category 1 Non-Permanent Unsealed Dual Hole Terminal Direct Ground Stud Installation

Table 32
PARTS FOR NON-PERMANENT DUAL HOLE TERMINAL GROUND STUD INSTALLATION ON ALUMINUM STRUCTURE

Stud Size	Hardware	Part Number	Supplier
1/4-28	Bolt	BACS12HN4-( )	Boeing
	Nut, Lock	BACN10YR4CD	Boeing
	Washer Corrosion Protective	NAS1149D0416H	QPL
	Washer, Pressure	NAS1149D0416H	Boeing
3/8-24	Bolt	BACS12HN6-( )	Boeing
	Nut, Lock	BACN10YR6CD	QPL
	Washer, Corrosion Protective	NAS1149D0616H	QPL
	Washer, Pressure	NAS1149D0416H	Boeing

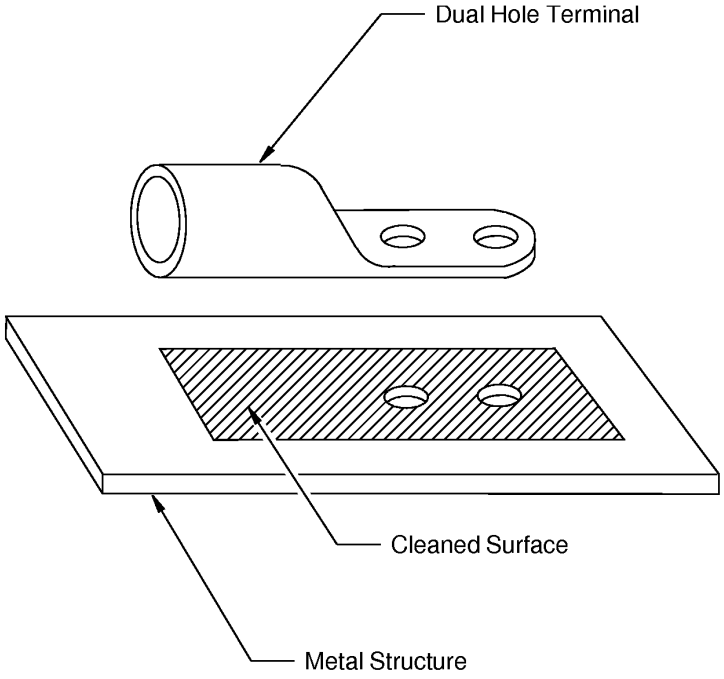
Table 33
PARTS FOR GROUND STUD INSTALLATION ON STAINLESS STEEL OR TITANIUM STRUCTURE

Stud Size	Hardware	Part Number	Supplier
1/4-28	Bolt	BACS12HN4U( )	Boeing
	Nut, Lock	BACN120JC4CM	Boeing
	Washer, Corrosion Protective	BACW10BP4APU	Boeing
	Washer, Pressure	BACW10BP4APU	Boeing
3/8-24	Fastener	BACS12HN6U( )	Boeing
	Nut, Lock	BACN10JC6CM	Boeing
	Washer, Corrosion Protective	BACW10BP6APU	Boeing
	Washer, Lock	BACW10BP6APU	Boeing

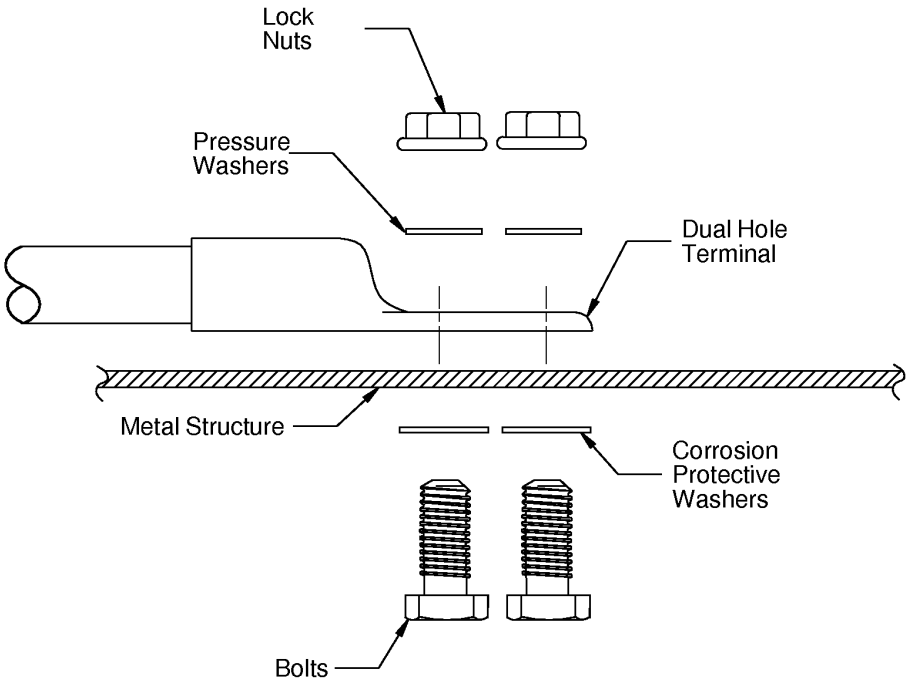
REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

Table 34
TORQUE VALUES FOR THE LOCK NUT

Nut Size	Structure Material	Torque (inch-pounds)	
		Minimum	Maximum
1/4-28	Aluminum	65	70
	Steel	90	105
	Titanium	90	105
3/8-24	Aluminum	180	200
	Steel	300	350
	Titanium	300	350



AREA TO CLEAN FOR A DUAL HOLE TERMINAL LUG
Figure 57



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NON-PERMANENT UNSEALED DUAL HOLE TERMINAL DIRECT GROUND STUD INSTALLATION
Figure 58

(1) Make a selection of the parts needed for the ground stud installation:
- Refer to Table 32 for ground studs that are installed on aluminum structure
- Refer to Table 33 for ground studs that are installed on stainless steel or titanium structure.

(2) Make a selection of a surface cleaning method. Refer to Table 7.

(3) Clean the area of the structure that touches the Dual Hole Terminal Lug. Refer to Figure 57.

CAUTION: THE GROUND STUD ASSEMBLY AND RESISTANCE MEASUREMENT MUST BE DONE WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE BOND ASSEMBLY AND RESISTANCE MEASUREMENT ARE NOT DONE WITHIN 24 HOURS, THE FAYING SURFACES MUST BE CLEANED AGAIN.

(4) Clean the Dual Hole Terminal Lug, Bolts, Corrosion Protective Washers, Pressure Washers, and the Lock Nuts with solvent before installation. Refer to Subject 20-23-00.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

Make sure that the area of the structure that touches the Terminal Lug is clean.

(5) Put a corrosion protective washer on each bolt.

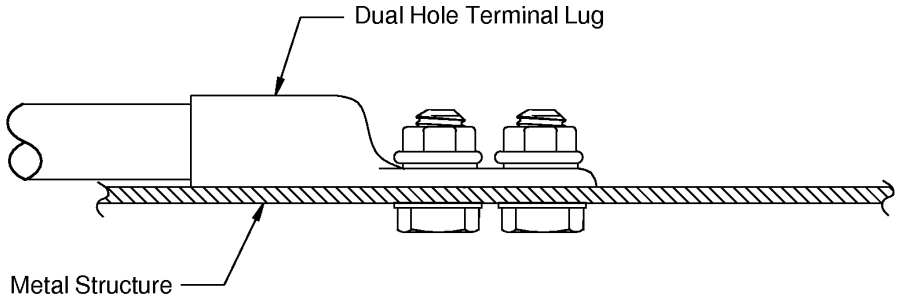
(6) Put the bolts in the holes with the threads on the side of the structure where the electrical connection is made.

(7) Put the threads of the bolts through the 2 holes in the Dual Hole Terminal Lug.

(8) Put a Pressure Washer on each bolt.

(9) Engage the threads of the lock nuts and the bolts.

(10) Torque the lock nut to the value specified in Table 34.



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COMPLETED CATEGORY 1 NON-PERMANENT UNSEALED DUAL HOLE TERMINAL DIRECT GROUND STUD INSTALLATION
Figure 59

(11) Do a test of the electrical resistance.

Refer to Paragraph 5. for the maximum permitted resistance and the test procedure.

NOTE: It is permitted to carefully pierce the surface finish of the structure with the test probes to make electrical contact with the structure.

(12) If the resistance is more than the maximum permitted resistance:

(a) Disassemble the ground stud installation.

(b) Repeat Step 4.I.(2) through Step 4.I.(11) again.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

CAUTION: THE GROUND STUD ASSEMBLY AND RESISTANCE MEASUREMENT MUST BE DONE WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE BOND ASSEMBLY AND RESISTANCE MEASUREMENT ARE NOT DONE WITHIN 24 HOURS, THE FAYING SURFACES MUST BE CLEANED AGAIN.

(13) If part of the structure surface finish was removed to make electrical contact, the finish must be applied again.

Refer to Subject 20-20-00.

J. Category 2 Permanent Fay Sealed Dual Hole Terminal Direct Ground Stud Installation

This paragraph gives the procedure to install a fay sealed dual hole terminal direct standard ground stud assembly.

Table 35
PARTS FOR DUAL HOLE TERMINAL GROUND STUD INSTALLATION

Hardware	Part Number	Supplier
Bolt	BACB30NX12K()	Boeing
Washer, Countersunk	BACW10EG12CK	Boeing
Washer, Pressure	BACW10BP6PK	Boeing
Shear Collar	BACC30BH12K	Boeing

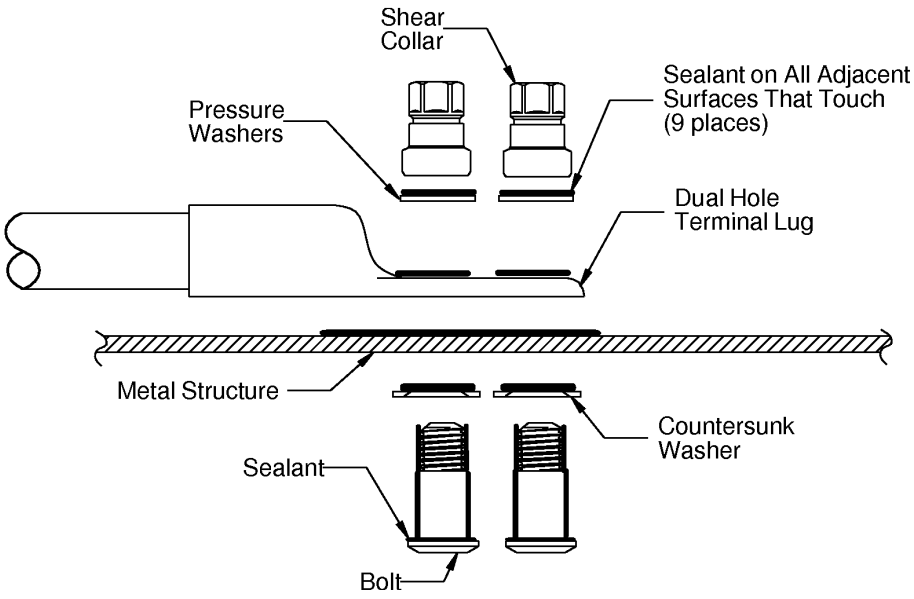
Table 36
ALTERNATIVE BOLT PART NUMBERS FOR A PERMANENT DUAL HOLE TERMINAL GROUND STUD INSTALLATION

Specified Bolt		Alternative Bolt	
Part Number	Supplier	Part Number	Supplier
BACB30NX12K()	Boeing	BACB30NT6()()	Boeing
		BACB30NR6K()()	Boeing
		BACB30LT6()()	Boeing
		BACB30UU6()()	Boeing
		BACB30LE6()()	Boeing
		BACB30MR6()()	Boeing
		BACB30LJ6()()	Boeing

Table 37
NECESSARY TOOLS

Tool	Description	Supplier
Wrench	Allen	An available source
Wrench	Open End	An available source
Wrench	Box End	An available source
Wrench	Socket	An available source

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION



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CATEGORY 2 PERMANENT FAY SEALED DUAL HOLE TERMINAL DIRECT GROUND STUD INSTALLATION
Figure 60

(1) Make a selection of 2 each of these items:

- Bolt
- Countersunk Washer
- Pressure Washer
- Shear Collar.

Refer to Table 35.

(2) Clean the surface of the structure that the terminal lug touches. Refer to:

- Table 7 for the procedure to clean the surface
- Figure 57 for the area to clean.

CAUTION: THE GROUND STUD ASSEMBLY AND RESISTANCE MEASUREMENT MUST BE DONE WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE BOND ASSEMBLY AND RESISTANCE MEASUREMENT ARE NOT DONE WITHIN 24 HOURS, THE FAYING SURFACES MUST BE CLEANED AGAIN.

(3) Clean these components using solvent.

- The bolts
- The countersunk washers
- The pressure washers
- The shear collars
- The terminal lug.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

CAUTION: REMOVAL OF PLATING ON THE TERMINALS CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

CAUTION: USING THE WRONG PARTS CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

CAUTION: THE GROUND STUD ASSEMBLY AND RESISTANCE MEASUREMENT MUST BE DONE WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE BOND ASSEMBLY AND RESISTANCE MEASUREMENT ARE NOT DONE WITHIN 24 HOURS, THE FAYING SURFACES MUST BE CLEANED AGAIN.

(4) Make a selection of a sealant that is applicable for the area the Ground Stud is located in. Refer to Table 3.

(5) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth, continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

(6) Apply a continuous layer of sealant to the bolt threads, bolt head, and the bolt shank. Refer to Figure 60 and Figure 61.

(7) Apply a sealant bead to the following components:

- Countersunk Washers
- The cleaned surface of the structure
- Terminal Lug
- Pressure Washer.

Refer to Figure 60 and Figure 61.

NOTE: It is necessary to apply the sealant on the surface of one component of two adjacent components.

NOTE: It is satisfactory to apply the sealant to the parts with a brush. Make sure that a uniform coat of sealant covers the mating surface.

CAUTION: THE SEALANT MUST HAVE SUFFICIENT THICKNESS TO FILL THE SPACE BETWEEN THE TERMINAL LUG AND THE STRUCTURE. EMPTY SPACES BETWEEN THE TERMINAL LUG AND THE STRUCTURE THAT ARE NOT FILLED WITH SEALANT CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

(8) Put the threads of the bolts through the countersunk washers.

(9) Put the threads of the bolts through the holes in the structure.

(10) Put the remaining parts on the assembly in this order:

- Terminal Lug
- Pressure Washer
- Shear Collar.

Refer to Figure 60.

(11) Install the 2 shear collars:

CAUTION: FAILURE TO APPLY THE TORQUE BEFORE THE END OF THE SQUEEZE-OUT LIFE OF THE SEALANT CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

CAUTION: FAILURE TO SEE THE SEALANT COME OUT FROM BETWEEN EACH COMPONENT CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

NOTE: It is satisfactory to use a power tool to apply 75 per-cent of the torque value followed by the use of a manual torque tool to apply the final torque value.

NOTE: If the terminal or jumper rotates when applying torque to the self-locking nut, hold the self-locking nut with a wrench and apply torque to the fastener head. Refer to Table 37.

(a) Engage the threads of the shear collars and the bolts.

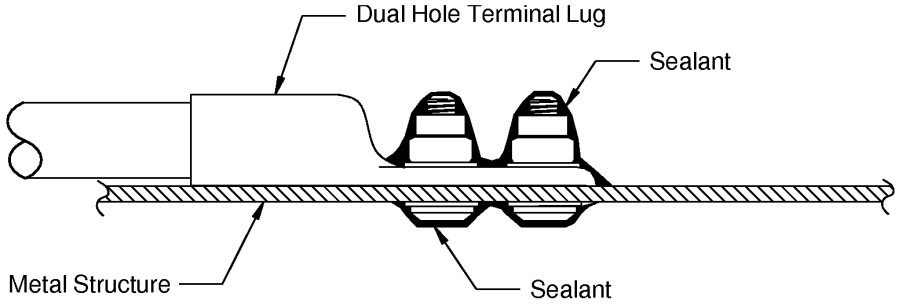
(b) Hold the bolt with an allen wrench.

Make sure that the bolt does not turn in the hole during installation.

(c) Turn the hex head of the shear collar clockwise until the hex head breaks off.

(d) Discard the hex head.

(12) Smooth out the sealant using a brush or clean wiper. Refer to Figure 61.



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COMPLETED CATEGORY 2 PERMANENT FAY SEALED DUAL HOLE TERMINAL DIRECT GROUND STUD INSTALLATION

Figure 61

Make sure that:

- The sealant is continuous around each component
- There are no empty spaces between the terminal lug and the structure

- The sealant makes a seal around each component.

(13) Do a test of the electrical resistance between the terminal lug and the structure. Refer to Paragraph 5..

It is permitted to carefully pierce the surface finish of the structure with the test probes to make an electrical connection.

(14) If the measured electrical resistance is more than the specified maximum resistance.

(a) Disassemble the components.

(b) Clean the components with solvent. Refer to Subject 20-20-00.

(c) Do Step 4.J.(2) through Step 4.J.(13) again.

CAUTION: THE GROUND STUD ASSEMBLY AND RESISTANCE MEASUREMENT MUST BE DONE WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE BOND ASSEMBLY AND RESISTANCE MEASUREMENT ARE NOT DONE WITHIN 24 HOURS, THE FAYING SURFACES MUST BE CLEANED AGAIN.

(15) If part of the structure surface finish was removed to make electrical contact, the finish must be applied again.

Refer to Subject 20-20-00.

(16) Let the sealant cure. Refer to Table 4.

NOTE: The full cure of the sealant is recommended, but the sealant is serviceable when:

- It is tack free
- It is in an area where wind shear does not occur.

K. Category 2 Non Permanent Fay Sealed Dual Hole Terminal Direct Ground Stud Installation

This paragraph gives the procedure to install a fay sealed dual hole terminal direct standard ground stud assembly using non-permanent fasteners.

Table 38
NECESSARY TOOLS

Tool	Description	Supplier
Wrench	Open End	An available source
Wrench	Box End	An available source
Wrench	Socket	An available source

(1) Make a selection of the parts needed for the ground stud installation:

- Refer to Table 32 for ground studs that are installed on aluminum structure
- Refer to Table 33 for ground studs that are installed on stainless steel or titanium structure.

(2) Make a selection of a surface cleaning method. Refer to Table 7.

(3) Clean the area of the structure that touches the Dual Hole Terminal Lug. Refer to Figure 57.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

CAUTION: THE GROUND STUD ASSEMBLY AND RESISTANCE MEASUREMENT MUST BE DONE WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE BOND ASSEMBLY AND RESISTANCE MEASUREMENT ARE NOT DONE WITHIN 24 HOURS, THE FAYING SURFACES MUST BE CLEANED AGAIN.

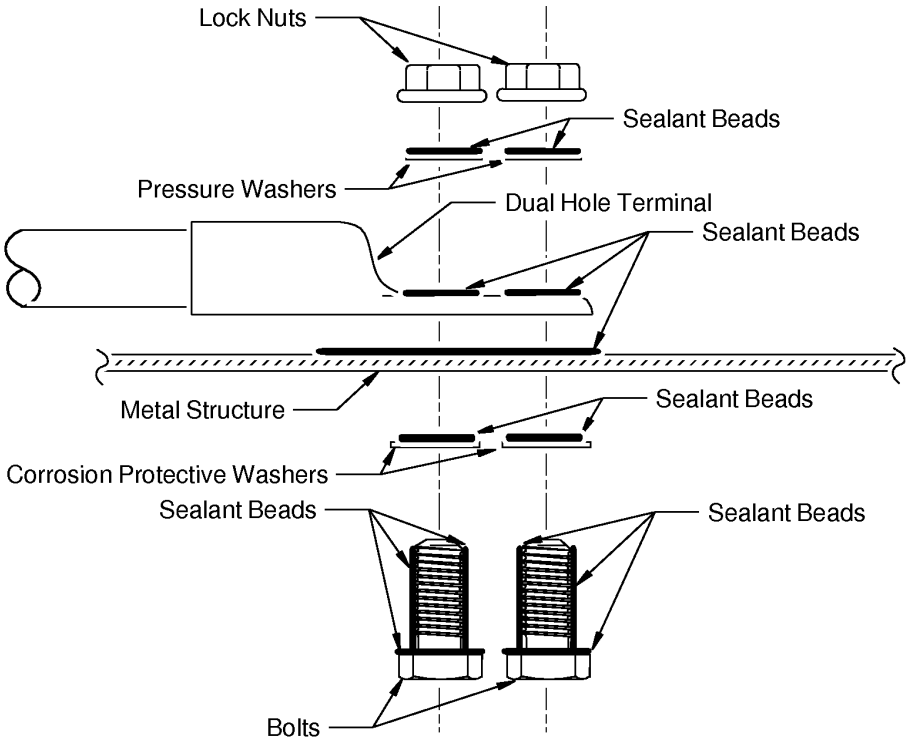
(4) Make a selection of a sealant that is applicable for the area the Ground Stud is located in. Refer to Table 3.

(5) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth, continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

(6) Apply a continuous layer of sealant to the bolt head, bolt threads, and the bolt shank.



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CATEGORY 2 NON-PERMANENT FAY SEALED DUAL HOLE TERMINAL DIRECT GROUND STUD INSTALLATION
Figure 62

(7) Apply a sealant bead to the following components:

- Corrosion Protective Washers
- The cleaned surface of the structure
- Terminal Lug
- Pressure Washer.

Refer to Figure 62.

NOTE: It is necessary to apply the sealant on the surface of one component of two adjacent components.

NOTE: It is satisfactory to apply the sealant to the parts with a brush. Make sure that a uniform coat of sealant covers the mating surface.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

CAUTION: THE SEALANT MUST HAVE SUFFICIENT THICKNESS TO FILL THE SPACE BETWEEN THE TERMINAL LUG AND THE STRUCTURE. EMPTY SPACES BETWEEN THE TERMINAL LUG AND THE STRUCTURE THAT ARE NOT FILLED WITH SEALANT CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

(8) Put the threads of the bolts through the corrosion protective washers.

(9) Put the threads of the bolts through the holes in the structure.

(10) Put the remaining parts on the assembly in this order:

- Terminal Lug
- Pressure Washer
- Lock Nuts.

Refer to Figure 62.

(11) Install the 2 lock nuts:

CAUTION: FAILURE TO APPLY THE TORQUE BEFORE THE END OF THE SQUEEZE-OUT LIFE OF THE SEALANT CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

CAUTION: FAILURE TO SEE THE SEALANT COME OUT FROM BETWEEN EACH COMPONENT CAN CAUSE AN UNSATISFACTORY ELECTRICAL BOND.

NOTE: It is satisfactory to use a power tool to apply 75 per-cent of the torque value followed by the use of a manual torque tool to apply the final torque value.

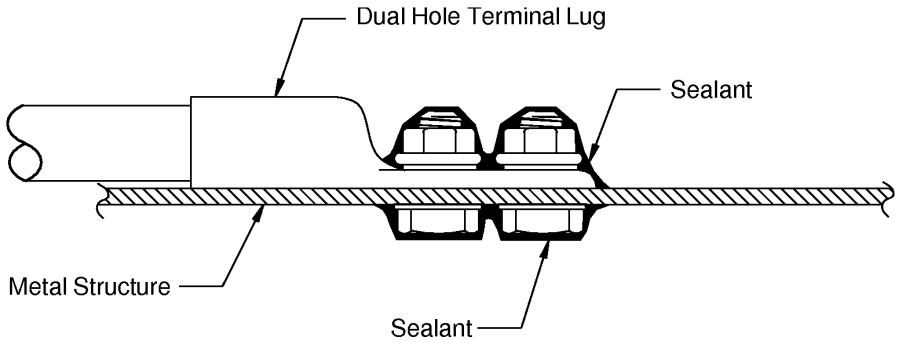
(a) Engage the threads of the lock nuts and the bolts.

(b) Hold the bolt with a wrench.

Make sure that the bolt does not turn in the hole during installation.

(c) Torque the lock nuts. Refer to Table 34.

(12) Smooth out the sealant using a brush or clean wiper. Refer to Figure 63.



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COMPLETED CATEGORY 2 NON-PERMANENT FAY SEALED DUAL HOLE TERMINAL DIRECT GROUND STUD INSTALLATION
Figure 63

Make sure that:

- The sealant is continuous around each component
- There are no empty spaces between the terminal lug and the structure
- The sealant makes a seal around each component.

(13) Do a test of the electrical resistance between the terminal lug and the structure. Refer to Paragraph 5..

It is permitted to carefully pierce the surface finish of the structure with the test probes to make an electrical connection.

(14) If the measured electrical resistance is more than the specified maximum resistance.

(a) Disassemble the components.

(b) Clean the components with solvent. Refer to Subject 20-20-00.

(c) Do Step 4.K.(2) through Step 4.K.(13) again.

CAUTION: THE GROUND STUD ASSEMBLY AND RESISTANCE MEASUREMENT MUST BE DONE WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE BOND ASSEMBLY AND RESISTANCE MEASUREMENT ARE NOT DONE WITHIN 24 HOURS, THE FAYING SURFACES MUST BE CLEANED AGAIN.

(15) If part of the structure surface finish was removed to make electrical contact, the finish must be applied again.

Refer to Subject 20-20-00.

(16) Let the sealant cure. Refer to Table 4.

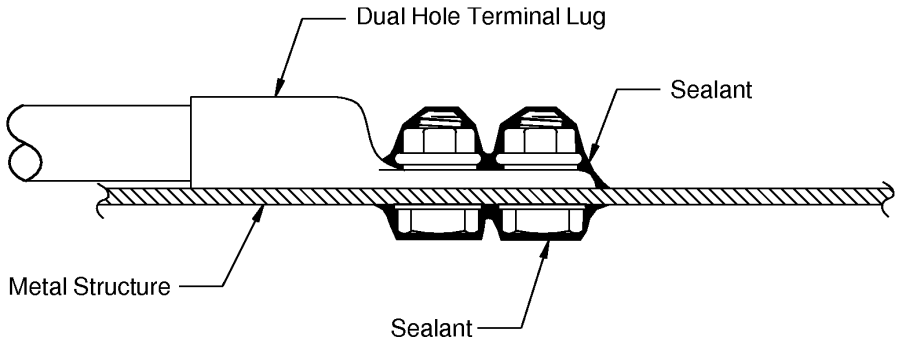
NOTE: The full cure of the sealant is recommended, but the sealant is serviceable when:

- It is tack free
- It is in an area where wind shear does not occur.

L. Category 6 Non Permanent Fillet Sealed Dual Hole Terminal Direct Ground Stud Installation

This paragraph gives the procedure to fillet seal a Non Permanent Dual Hole Terminal Direct Ground Stud Installation.

For the procedure to install the Non-Permanent Dual Hole Terminal, refer to Paragraph 4.I..



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COMPLETED CATEGORY 6 NON PERMANENT FILLET SEALED DUAL HOLE TERMINAL DIRECT GROUND STUD INSTALLATION
Figure 64

(1) Make a selection of a sealant from Table 4.

(2) Make a selection of a solvent from Table 6.

(3) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth, continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

(4) Remove the contamination with a clean cloth and solvent from these surfaces:

- The outer surfaces of the ground stud assembly on each side of the structure
- A 1 inch minimum area around the ground assembly on each side of the structure.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

CAUTION: THE SURFACES THAT THE SEALANT IS APPLIED ON MUST BE CLEAN. A CONTAMINATION ON A SURFACE CAN CAUSE AN UNSATISFACTORY BOND BETWEEN THE SEALANT AND THE SURFACE.

CAUTION: THE GROUND STUD ASSEMBLY AND RESISTANCE MEASUREMENT MUST BE DONE WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE BOND ASSEMBLY AND RESISTANCE MEASUREMENT ARE NOT DONE WITHIN 24 HOURS, THE FAYING SURFACES MUST BE CLEANED AGAIN.

(5) Let the area dry.

(6) Apply a continuous layer of sealant on the ground stud assembly on each side of the structure.

Make sure that the sealant:

- Is a small fillet
- Is smooth and continuous
- Does not have air bubbles or voids
- Does not have contamination in it
- Does not touch the faying surfaces of the ground stud components or the terminal lug.

CAUTION: SEALANT ON THE FAYING SURFACES CAN CAUSE UNSATISFACTORY RESISTANCE OF THE GROUND ASSEMBLY.

(7) If part of the structure surface finish was removed to make electrical contact, the finish must be applied again.

Refer to Subject 20-20-00.

(8) Let the sealant cure. Refer to Table 5.

NOTE: The full cure of a sealant is recommended, but the sealant is serviceable when:

- It is tack free
- It is in an area where wind shear does not occur.

5. MAXIMUM PERMITTED RESISTANCE AND TEST PROCEDURES FOR GROUND STUDS

A. General Conditions for Bond Resistance Tests

For any bond that has a jumper or a designated ground wire, a control point that is used to measure the resistance must be:

- In the cleaned area for the terminal
- 0.25 inch maximum from the terminal.

Two points must be used to calibrate the meter to zero ohms:

- One point is on one side of the cleaned area
- The other point is on the opposite side of the same cleaned area.

NOTE: Either of the two points can be used as the control point.

REPLACEMENT OF GROUND STUDS AND BONDING JUMPER INSTALLATION

B. Conditions for Bond Resistance Tests - Not Explosion Hazard Areas

Refer to Table 39 for the recommended bond resistance meters.

Other bond resistance meters are acceptable if all of these conditions occur:

- The meter is calibrated
- The meter has an accuracy of ±5 percent of the reading in the range specified by the manufacturer of the equipment
- The meter has a four probe design
- The meter has different probes for current and potential.

NOTE: The satisfactory alternatives to measure resistances that are greater than 1 ohm are:

- An ohmmeter
- A multimeter.

NOTE: To measure AC and DC current return grounds:

- With Model M1 bond resistance meter, it is not necessary to disconnect each plug from the equipment
- With other bond resistance meters, it is necessary to disconnect each plug from the equipment.

Table 39
RECOMMENDED BOND RESISTANCE METERS

Part Number	Supplier
DLRO 247000-47	Biddle
DLRO 247000-7	Biddle
Model M1	BCD Electronics
Model T207 Type W	Avtron
Model T477W	Avtron

C. Conditions for Bond Resistance Tests - Explosion Hazard Areas

WARNING: BEFORE A METER IS USED IN AN EXPLOSION HAZARD AREA, MAKE SURE THAT DANGEROUS VAPORS ARE NOT IN THE AREA. INJURY CAN OCCUR.

WARNING: THE PROBES OF THE METER MUST NOT BE PUT DIRECTLY ON:

- THE TERMINAL OF AN EXPLOSIVE SQUIB
- A PART OF THE CIRCUIT THAT IS CONNECTED TO AN EXPLOSIVE SQUIB.

Refer to Table 40 for the permitted bond resistance meters.

NOTE: To measure AC and DC current return grounds:

- With Model M1 bond resistance meter, it is not necessary to disconnect each plug from the equipment
- With other bond resistance meters, it is necessary to disconnect each plug from the equipment.

Table 40
PERMITTED BOND RESISTANCE METERS

Part Number	Supplier
Model M1	BCD Electronics
Model T477W	Avtron

D. Maximum Resistance of Ground Stud Bonds

Table 41 specifies the maximum bond resistance of a pre-installed ground stud, a direct standard ground stud, and a nut plate direct standard ground stud and the structure for a new installation or a repair where the faying surfaces are prepared for a bond again.

Table 42 specifies the maximum bond resistance of a dual hole terminal direct ground stud and the structure for a new installation where the faying surfaces are prepared for a bond again.

Table 43 specifies the maximum bond resistance of a dual hole terminal direct ground stud installation that is in service.

Table 41
MAXIMUM RESISTANCE OF BONDS FOR PRE-INSTALLED, DIRECT STANDARD, AND NUT PLATE DIRECT STANDARD GROUND STUDS

Ground Stud Size	Maximum Resistance (ohm)
10-32	0.001
1/4-28	0.001
5/16-24	0.0007
3/8-24	0.0001
1/2-20	0.0001

Table 42
MAXIMUM RESISTANCE OF BONDS FOR NEW INSTALLATIONS OF DUAL HOLE TERMINAL DIRECT GROUND STUDS

Type of Fasteners	Stud Size	Structure Material	Maximum Resistance	
			(Miliohms)	(Ohms)
Permanent	3/8-24	Aluminum	0.025	0.000025
		Steel	0.4	0.0004
		Titanium	0.8	0.0008
Non-Permanent	1/4-28	Aluminum	0.5	0.0005
		Steel	0.4	0.0004
		Titanium	0.8	0.0008
	3/8-24	Aluminum	0.1	0.0001
		Steel	0.4	0.0004
		Titanium	0.8	0.0008

Table 43
MAXIMUM RESISTANCE OF BONDS FOR IN-SERVICE DUAL HOLE TERMINAL DIRECT GROUND STUDS

Type of Fasteners	Stud Size	Structure Material	Maximum Resistance	
			(Miliohms)	(Ohms)
Permanent	3/8-24	Aluminum	0.07	0.00007
		Steel	0.4	0.0004
		Titanium	0.8	0.0008
Non-Permanent	1/4-28	Aluminum	1.0	0.0001
		Steel	0.4	0.0004
		Titanium	0.8	0.0008
	3/8-24	Aluminum	0.1	0.0001
		Steel	0.4	0.0004
		Titanium	0.8	0.0008

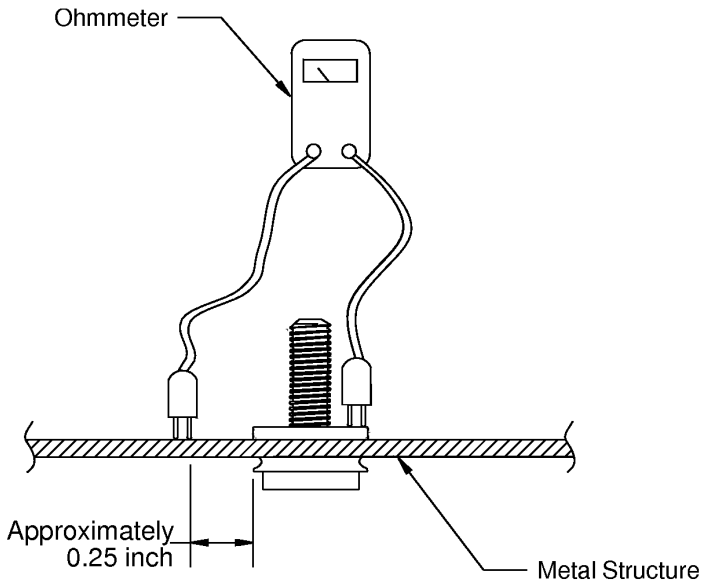
E. Bond Test of a Ground Stud

Refer to:

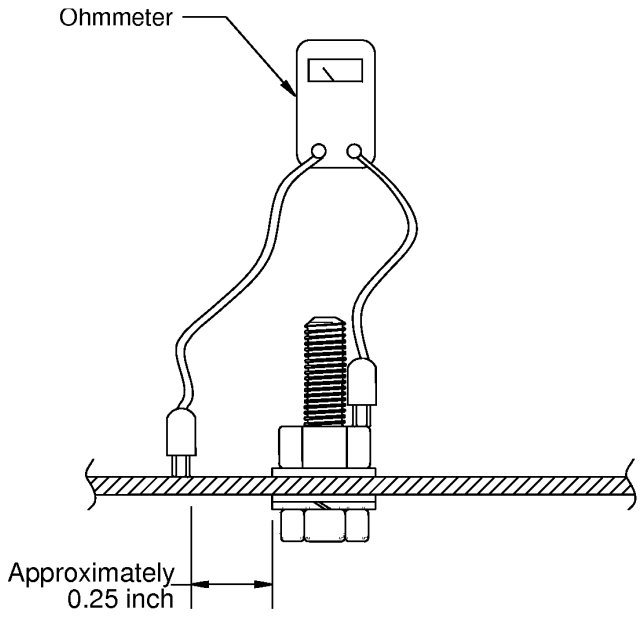
- Paragraph 5.A. for the general conditions for a bond test
- Paragraph 5.B. for the conditions and bond meters for a bond test in a not explosion hazard area
- Paragraph 5.C. for the conditions and bond meters for a bond test in an explosion hazard area.
- Paragraph 5.D. for the maximum resistance values.

The location of the test points for the bond test of a ground stud is shown in:

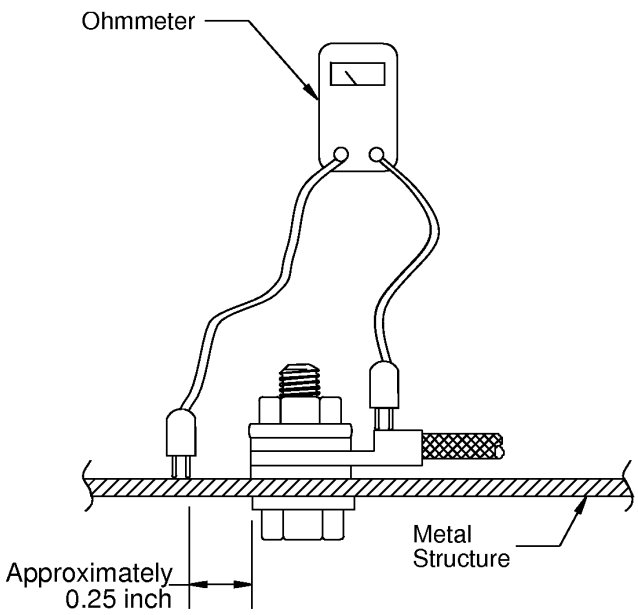
- Figure 65 for a BACS53B or MIL-T-83454/4 pre-installed ground stud
- Figure 66 for a standard pre-installed ground stud
- Figure 67 for a direct ground stud assembly with terminal lugs
- Figure 68 for a nut plate direct ground stud assembly with terminal lugs
- Figure 69 for a BACS53B or MIL-T-83454/4 pre-installed ground stud assembly with terminal lugs
- Figure 70 for a standard pre-installed ground stud assembly with terminal lugs
- Figure 71 for a dual hole terminal direct ground stud.



TEST POINTS FOR A BACS53B OR MIL-T-83454/4 PRE-INSTALLED GROUND STUD
Figure 65



TEST POINTS FOR A STANDARD PRE-INSTALLED GROUND STUD
Figure 66



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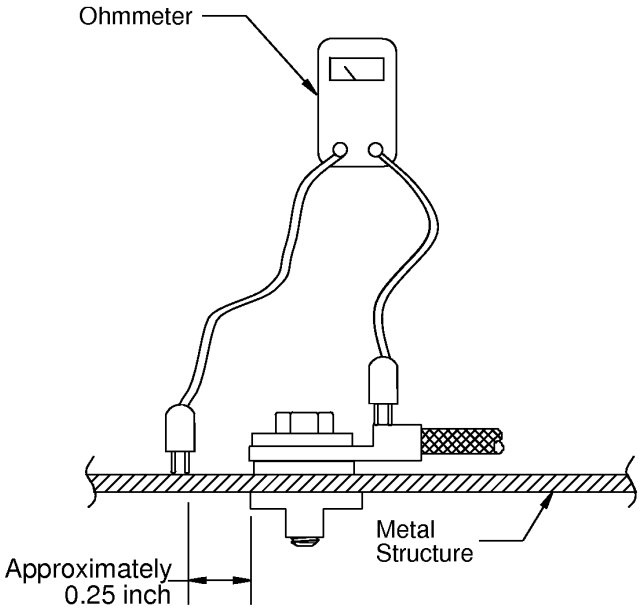
TEST POINTS FOR A DIRECT GROUND STUD ASSEMBLY WITH TERMINAL LUGS
Figure 67



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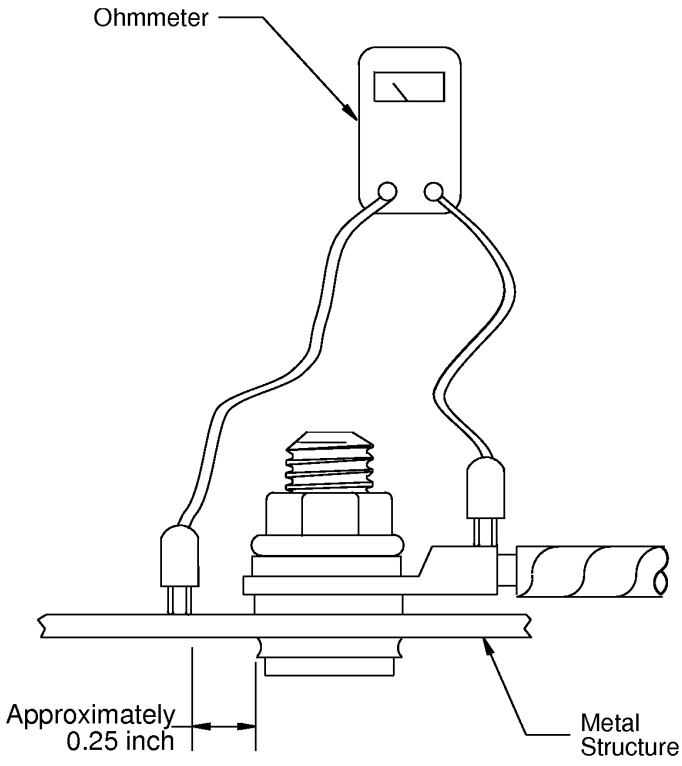
TEST POINTS FOR A NUT PLATE DIRECT GROUND STUD ASSEMBLY WITH TERMINAL LUGS
Figure 68



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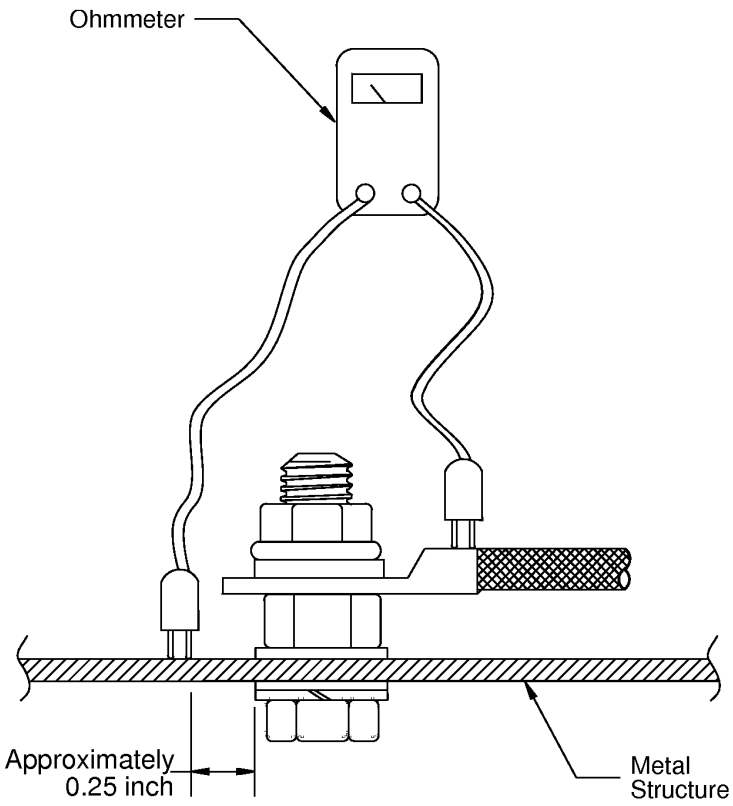
TEST POINTS FOR A BACS53B OR MIL-T-83454/4 PRE-INSTALLED GROUND STUD ASSEMBLY
Figure 69



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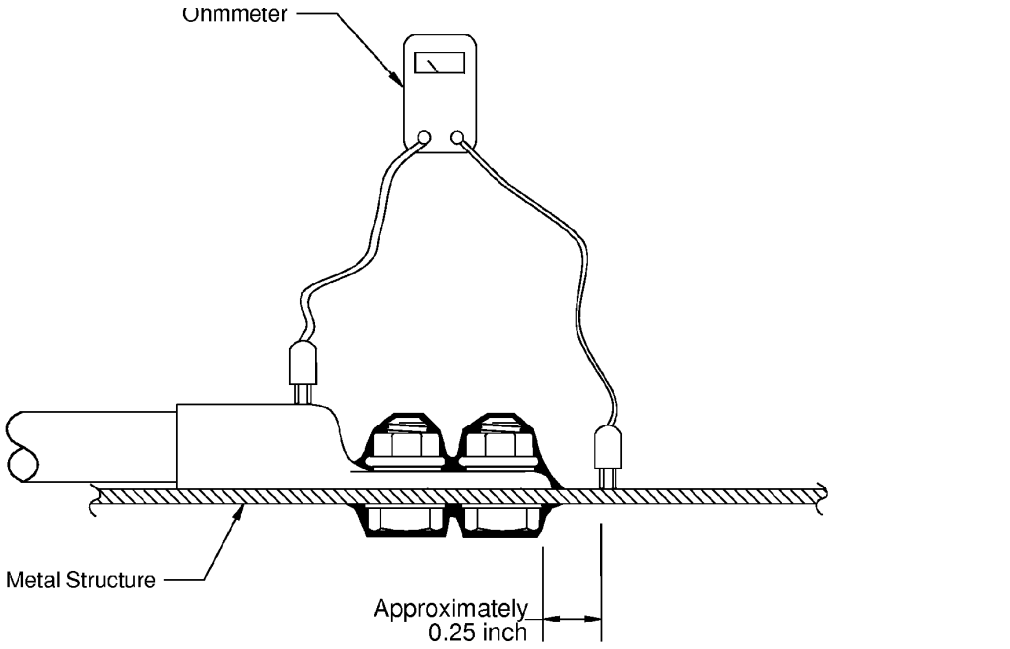
TEST POINTS FOR A STANDARD PRE-INSTALLED GROUND STUD WITH TERMINAL LUGS
Figure 70



TEST POINTS FOR A DUAL HOLE TERMINAL DIRECT GROUND STUD
Figure 71

ASSEMBLY OF BURNDY YHLZG GROUND BLOCK MODULES

TABLE OF CONTENTS

ASSEMBLY OF BURNDY YHLZG GROUND BLOCK MODULES

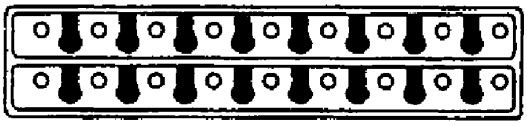
1. PART NUMBERS AND DESCRIPTION

A. Ground Block Part Numbers

Table 1
GROUND BLOCK PART NUMBERS

Part Number	Contact Configuration	Mount	Supplier
YHLZG8-1	8 Socket Common Bus	Right Angle	Souriau/Burndy
YHLZG8-2	8 Socket Common Bus	Straight	Souriau/Burndy
YHLZG16-1	16 Socket Common Bus	Right Angle	Souriau/Burndy
YHLZG16-2	16 Socket Common Bus	Straight	Souriau/Burndy

YHLZG8-( )



YHLZG16-( )

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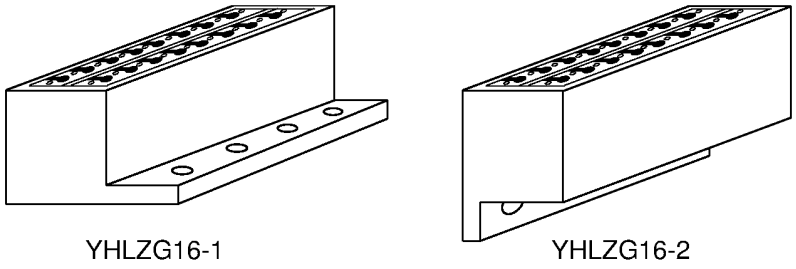
CONTACT CONFIGURATIONS OF THE YHLZG8-() AND YHLZG16-() GROUND BLOCK MODULES
Figure 1

ASSEMBLY OF BURNDY YHLZG GROUND BLOCK MODULES



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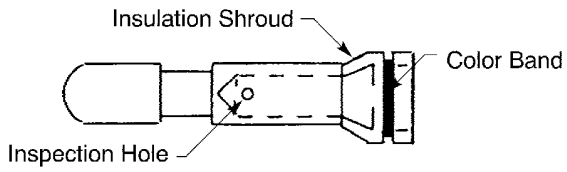
MOUNTING CONFIGURATIONS OF THE YHLZG16-1 AND YHLZG16-2 GROUND BLOCK MODULES
Figure 2

B. Contact Part Numbers

Table 2
CONTACT PART NUMBERS

Boeing Standard	Part Number	Supplier
BACC47DE1	YHMM16-1F50	Burndy
BACC47DE1A	YHMM16-6D28	Burndy
	417-1215-332	Tri-Star
BACC47DE3	YHMM22-1DB8	Burndy
BACC47DE3A	YHMM22-4D28	Burndy
	417-1223-332	Tri-Star
BACC47DE4	YHMM22-2DB8	Burndy
BACC47DE4A	YHMM22-5D28	Burndy
	417-1222-332	Tri-Star
BACC47DE5	YHMM16-4F50	Burndy
BACC47DE5A	YHMM16-7D28	Burndy
	417-1216-332	Tri-Star
BACC47DE6	YHMM18-2F50	Burndy
BACC47DE6A	YHMM18-3D28	Burndy
	417-1218-332	Tri-Star
BACC47DE7	YHMM20-2DB8	Burndy
BACC47DE7A	YHMM20-3D28	Burndy
	417-1220-332	Tri-Star
BACC47DE8	YHMM24-1F50	Burndy
BACC47DE8A	YHMM24-3D28	Burndy
	417-1224-332	Tri-Star



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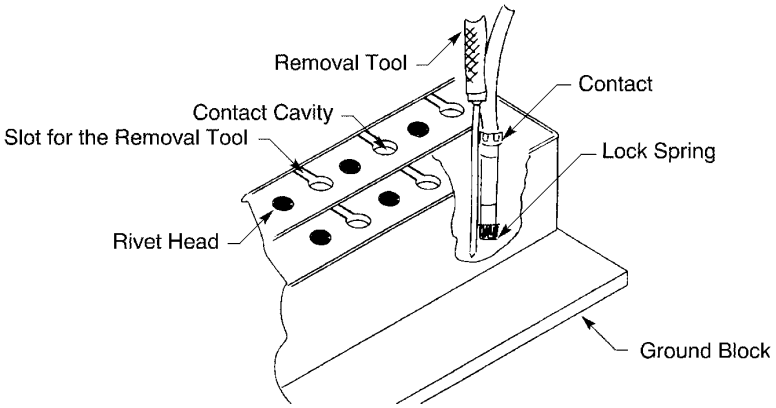
BACC47DE()A CONTACT
Figure 3

2. GROUND BLOCK MODULE DISASSEMBLY

A. Contact Removal

Table 3
CONTACT REMOVAL TOOLS

Removal Tool		Supplier
Handle	**Tip**	
ATB3062-2	-	Astro
DHK21	-	Daniels
J-1276-1	-	Burndy
ST2220-3-34A-1	ST2220-3-34A-3	Boeing
ST2220-3-34A-2	ST2220-3-34A-8	Boeing



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CONTACT REMOVAL
Figure 4

(1) Make a selection of a contact removal tool from Table 3.

CAUTION: ONLY THE REMOVAL TOOLS THAT ARE GIVEN IN TABLE 3 PERMITTED. OTHER REMOVAL TOOLS CAN CAUSE DAMAGE TO THE MODULE.

(2) Put the tip of the removal tool in the slot that is adjacent to the contact cavity. Refer to Figure 4.

(3) Push the tool into the slot and into the module until it stops.
This releases the lock spring that holds the contact in position. Refer to Figure 4.

CAUTION: IF REMOVAL OF THE CONTACT IS TRIED BEFORE THE LOCK SPRING IS RELEASED, DAMAGE TO THE CONTACT, THE MODULE, OR THE WIRE CAN OCCUR.

(4) Carefully pull the wired contact from the contact cavity.

(5) Pull the removal tool out of the slot.

3. GROUND BLOCK MODULE ASSEMBLY

A. Contact Selection

NOTE: The BACC47DE()A contacts are replacements for the BACC47DE() contacts.

ASSEMBLY OF BURNDY YHLZG GROUND BLOCK MODULES

Table 4
CONTACT SELECTION

Wire Size (AWG)	Insulation Diameter (inch)		Contact		
	Minimum	Maximum	Boeing Standard	Finish	Color Band
24	0.032	0.045	BACC47DE8A	Gold	Violet
			BACC47DE8	Silver	Green
	0.041	0.065	BACC47DE4A	Gold	Green
			BACC47DE4	Gold	Green
	0.070	0.080	BACC47DE3A	Gold	None
			BACC47DE3	Gold	None
22	0.047	0.065	BACC47DE7A	Gold	Red
			BACC47DE7	Gold	Red
	0.041	0.065	BACC47DE4A	Gold	Green
			BACC47DE4	Gold	Green
	0.070	0.080	BACC47DE3A	Gold	None
			BACC47DE3	Gold	None
20	0.047	0.065	BACC47DE7A	Gold	Red
			BACC47DE7	Gold	Red
	0.056	0.069	BACC47DE6A	Gold	Black
			BACC47DE6	Silver	Black
	0.063	0.083	BACC47DE5A	Gold	Blue
			BACC47DE5	Silver	Red
	0.080	0.110	BACC47DE1A	Gold	Brown
			BACC47DE1	Silver	None
18	0.056	0.069	BACC47DE6A	Gold	Black
			BACC47DE6	Silver	Black
	0.063	0.083	BACC47DE5A	Gold	Blue
			BACC47DE5	Silver	Red
	0.080	0.110	BACC47DE1A	Gold	Brown
			BACC47DE1	Silver	None
16	0.063	0.083	BACC47DE5A	Gold	Blue
			BACC47DE5	Silver	Red
	0.080	0.110	BACC47DE1A	Gold	Brown
			BACC47DE1	Silver	None

(1) Use BACC47DE4 or BACC47DE4A contacts for these wires:

- BMS 13-51 Type XXVI AWG 22
- BMS 13-48 Type IX AWG 20

- Haveg 51-04570
- Haveg 51-04569.

(2) For BMS 13-48 Type VIII AWG 20 wire, use BACC47DE7 or BACC47DE7A contacts.

(3) For all other wires:

- Find the wire size.
- Measure the outer diameter of the insulation of the wire.
- Make a selection of the contact from Table 4.

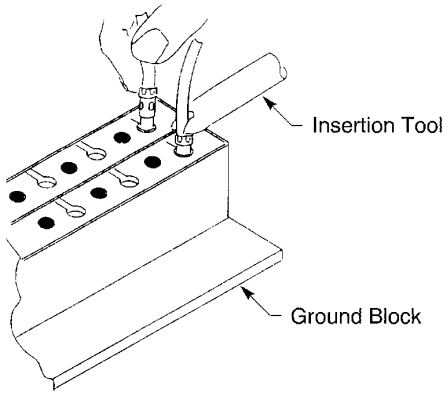
B. Contact Assembly

The procedure to assemble the contacts is given in Subject 20-90-11.

C. Contact Insertion

Table 5
CONTACT INSERTION TOOLS

Insertion Tool	Supplier
ATB3062-2	Astro
DHK21	Daniels
J-1276-1	Burndy
ST2220-3-34A-1	Boeing
ST2220-3-34A-2	Boeing



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CONTACT INSERTION
Figure 5

ASSEMBLY OF BURNDY YHLZG GROUND BLOCK MODULES

Refer to Figure 5.

(1) Make a selection of a contact insertion tool from Table 5.

(2) Put the wired contact into the contact cavity of the module.

(3) Push the tip of the insertion tool onto the end of the contact.

(4) Push the tool and the contact into the contact cavity until it is fully inserted.

(5) Make sure the contact is locked in the contact cavity of the module:

(a) Lightly hold the wire between the thumb and the forefinger.

(b) Pull slowly until the thumb and the forefinger move on the wire.

CAUTION: DO NOT CAUSE DAMAGE TO THE WIRE INSULATION WITH THE FINGERNAILS.

ASSEMBLY OF A DUAL GROUND WITH BACT12G FLAG TERMINALS

TABLE OF CONTENTS

ASSEMBLY OF A DUAL GROUND WITH BACT12G FLAG TERMINALS

1. PART NUMBERS AND DESCRIPTION

A. BACT12G Terminal Part Numbers

Table 1
BACT12G TERMINAL PART NUMBERS

Wire Size (AWG)	Crimp Barrel Size	Ground Stud Size	Boeing Standard	Supplier Part Number	Supplier
8	8	10	BACT12G81	YBM8C	Burndy
					FCI
		1/4	BACT12G82	YBM8C-T2	Burndy
				YBM8CT2	FCI
6	6	1/4	BACT12G62	YBM6C-L	Burndy
				YBM6CL	FCI
		5/16	BACT12G64	YBM6C-L2	Burndy
				YBM6CL2	FCI
4	4	1/4	BACT12G42	YBM4C-L	Burndy
				YBM4CL	FCI
		3/8	BACT12G44	YBM4C-L2	Burndy
				YBM4CL2	FCI
2	2	1/4	BACT12G23	YBM2C-L1	Burndy
				YBM2CL1	FCI
		3/8	BACT12G24	YBM2C-L	Burndy
				YBM2CL	FCI
1/0	1/0	3/8	BACT12G102	YBM25-L	Burndy
				YBM25L	FCI
2/0	2/0	3/8	BACT12G202	YBM26-L	Burndy
				YBM26L	FCI

2. DUAL GROUND ASSEMBLY

A. Wire Preparation

Table 2
INSULATION REMOVAL LENGTH

Wire Size (AWG)	Terminal	Removal Length L (inch)	
		Target	Tolerance
8	BACT12G81	1.88	0.06
	BACT12G82	1.88	0.06

ASSEMBLY OF A DUAL GROUND WITH BACT12G FLAG TERMINALS

Table 2 INSULATION REMOVAL LENGTH (Continued)

Wire Size (AWG)	Terminal	Removal Length L (inch)	
		Target	Tolerance
6	BACT12G62	1.88	0.06
	BACT12G64	1.88	0.06
4	BACT12G42	1.88	0.06
	BACT12G44	1.88	0.06
2	BACT12G23	1.88	0.06
	BACT12G24	1.88	0.06
1/0	BACT12G102	2.00	0.06
2/0	BACT12G202	2.00	0.06

(1) Cut the wire so that the end of the wire is perpendicular to its longitudinal axis.

(2) Make a selection of a Grade B, Class 1 heat shrinkable sleeve from Subject 20-00-11.

(3) Put a 1 inch length of the heat shrinkable sleeve on the wire.

(4) Remove the necessary length of insulation from the end of the wire. Refer to Table 2 and Figure 1.

B. Assembly of Flag Terminals for a Dual Ground

Table 3
CRIMP TOOLS FOR BACT12G AND BURNDY YBM SERIES FLAG TERMINAL LUGS

Crimp Barrel Size	Crimp Tool					
	Basic Unit	Type	Head	Adapter	Nest	Indenter
8	BAT35	Battery Powered	-	Y35P3	UV8B-1	Y29PBL
	MY28	Large Adjustable Hand Tool	-	-	-	-
	Power Pump	-	BDHD1	-	DV8BL-1	Y29PBL-1
			Y29B	-	DV8BL	Y29PBL
					DV8BL-1	Y29PBL-1
			Y35BH	Y35P3	UV8B-1	Y29PBL
	Y29BH	Hydraulic Head	-	-	DV88	Y29PBL
	Y29NC	Pneumatic Head	-	-	DV88	Y29PBL
	Y35	Hydraulic Hand	-	Y35P3	UV8B-1	Y29PBL
	Y6NP-5	-	Y29B	-	DV88	Y29PBL

ASSEMBLY OF A DUAL GROUND WITH BACT12G FLAG TERMINALS

Table 3 CRIMP TOOLS FOR BACT12G AND BURNDY YBM SERIES FLAG TERMINAL LUGS (Continued)

Crimp Barrel Size	Crimp Tool					
	Basic Unit	Type	Head	Adapter	Nest	Indenter
6	BAT35	Battery Powered	-	Y35P3	UV6B-1	Y29PBL
	MY28	Large Adjustable Hand Tool	-	-	-	-
	Power Pump	-	BDHD1	-	DV6BL	Y29PBL-1
			Y29B	-	DV6BL	Y29PBL
						Y29PBL-1
			Y35BH	Y35P3	UV6B-1	Y29PBL
	Y29BH	Hydraulic Head	-	-	DV6L	Y29PBL
	Y29NC	Pneumatic Head	-	-	DV6L	Y29PBL
	Y35	Hydraulic Hand	-	Y35P3	UV6B-1	Y29PBL
	Y6NP-5	-	Y29B	-	DV6L	Y29PBL
4	BAT35	Battery Powered	-	Y35P3	UV4B-1	Y29PL
	MY28	Large Adjustable Hand Tool	-	-	-	-
	Power Pump	-	BDHD1	-	DV4BL	Y29PBL
			Y29B	-	DV4BL	Y29PBL
			Y35BH	Y35P3	UV4B-1	Y29PL
	Y29BH	Hydraulic Head	-	-	DV4BL	Y29PBL
	Y29NC	Pneumatic Head	-	-	DV4BL	Y29PBL
	Y35	Hydraulic Hand	-	Y35P3	UV4B-1	Y29PL
	Y6NP-5	-	Y29B	-	DV4BL	Y29PBL
2	BAT35	Battery Powered	-	Y35P3	UV2B-1	Y29PA
	MY28	Large Adjustable Hand Tool	-	-	-	-
	Power Pump	-	BDHD1	-	DV2BL	Y29PBL
			Y29B	-	DV2BL	Y29PBL
			Y35BH	Y35P3	UV2B-1	Y29PA
	Y29BH	Hydraulic Head	-	-	DV2BL	Y29PL
	Y29NC	Pneumatic Head	-	-	DV2BL	Y29PL
	Y35	Hydraulic Hand	-	Y35P3	UV2B-1	Y29PA
	Y35BH	-	-	Y35P3	UV2B-1	Y29PA
	Y6NP-5	-	Y29B	-	DV2BL	Y29PL

ASSEMBLY OF A DUAL GROUND WITH BACT12G FLAG TERMINALS

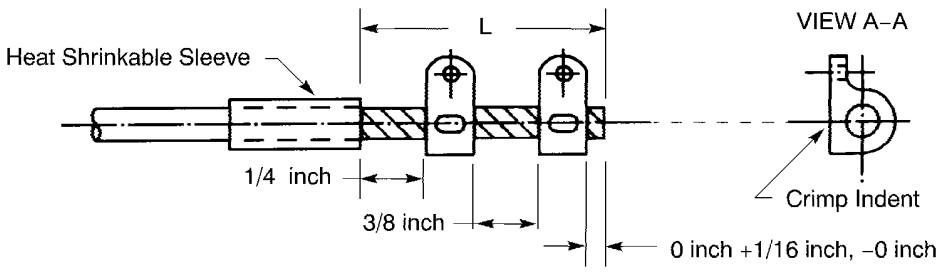
Table 3 CRIMP TOOLS FOR BACT12G AND BURNDY YBM SERIES FLAG TERMINAL LUGS (Continued)

Crimp Barrel Size	Crimp Tool					
	Basic Unit	Type	Head	Adapter	Nest	Indenter
1/0	BAT35	Battery Powered	-	Y35P3	UV25B-1	Y29PA-1
	MY28	Large Adjustable Hand Tool	-	-	-	-
	Power Pump	-	BDHD1	-	DV25BL-1	Y29PR
			Y29B	-	DV25BL	
					DV25BL-1	
			Y35BH	Y35P3	UV25B-1	Y29PA
						Y29PA-1
	Y29BH	Hydraulic Head	-	-	DV25BL	Y29PR
	Y29NC	Pneumatic Head	-	-	DV25BL	Y29PR
	Y35	Hydraulic Hand	-	Y35P3	UV25B-1	Y29PA
						Y29PA-1
	Y6NP-5	-	Y29B	-	DV25BL	Y29PR
2/0	BAT35	Battery Powered	-	Y35P3	UV26B-1	Y29PA-1
	MY28	Large Adjustable Hand Tool	-	-	-	-
	Power Pump	-	BDHD1	-	DV26BL	Y29PR
			Y29B	-	DV26BL	Y29PR
			Y35BH	Y35P3	UV26B-1	Y29PA-1
	Y35	Hydraulic Hand	-	Y35P3	UV26B-1	Y29PA-1

Table 4
GAGE PIN DIAMETERS FOR THECALIBRATION OF THE BURNDY MY28 CRIMP TOOL

Terminal Crimp Barrel Size	Gage Pin Diameter (inch)	
	Target	Tolerance
8	0.1360	0.0005
6	0.1360	0.0005
4	0.1960	0.0005
2	0.2950	0.0005
1/0	0.3906	0.0005
2/0	0.4375	0.0005

ASSEMBLY OF A DUAL GROUND WITH BACT12G FLAG TERMINALS



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FLAG TERMINAL ASSEMBLY FOR A DUAL GROUND
Figure 1

(1) Make a selection of a crimp tool from Table 3.

NOTE: Refer to Paragraph 3. for the operation of the Burndy MY28 crimp tool.

(2) Put both of the flag terminals in the correct position on the wire. Refer to Figure 1.

Make sure that the tongues of the terminals are in the same plane.

(a) Push the inner terminal toward the wire insulation until the rear edge of the terminal is 1/4 inch from the end of the insulation.

(b) Push the outer terminal toward the inner terminal until the rear edge of the terminal is 3/8 inch from the forward edge of the inner terminal.

(3) Crimp the outer terminal so that the conductor strands do not move apart.

(4) Put the inner terminal in the correct position. Refer to Figure 1.

(5) Crimp the inner terminal.

(6) Push the heat shrinkable sleeve forward until the end of the sleeve is aligned with the rear end of the inner terminal.

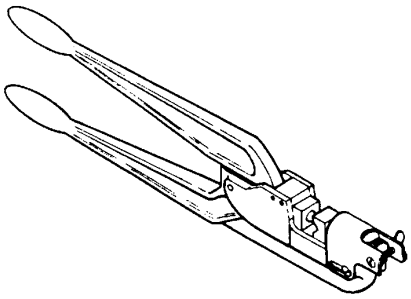
(7) Shrink the sleeve into position. Refer to Subject 20-10-14.

ASSEMBLY OF A DUAL GROUND WITH BACT12G FLAG TERMINALS

3. OPERATION OF THE BURNDY MY28 CRIMP TOOL

A. Tool Description

The MY28 crimp tool is an adjustable hand crimp tool. Refer to Figure 2.



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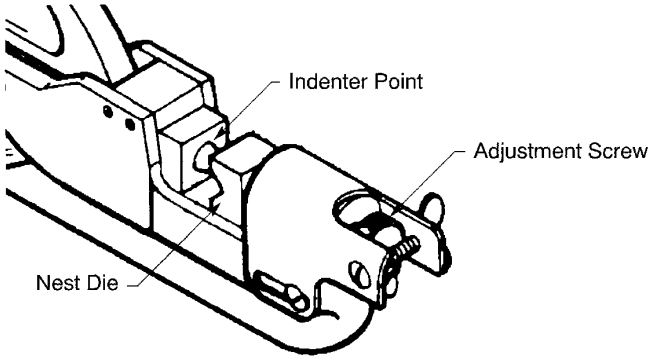
BURNDY MY28 HAND CRIMP TOOL
Figure 2

B. Tool Operation

(1) Adjust the crimp depth. Refer to Figure 3.



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LOCATION OF THE INDENTER POINT ON THE CRIMP TOOL
Figure 3

(a) Move the tool handles to the closed position.

(b) Make a selection of the correct size of gauge pin from Table 3.

(c) Put the gauge pin directly under the indenter point.

(d) Tighten the nest die with the adjustment screw.

(2) Fully open the handles of the tool.

(3) Put the terminal in the tool so that the flat side of the terminal is toward the indenter point.

(4) Put the end of the wire in the crimp barrel of the terminal.

(5) Close the handles fully.

4. APPROVED TOOL SUPPLIERS

A. Crimp Tools

Table 5
CRIMP TOOL SUPPLIERS

Crimp Tool	Supplier
DV25BL	Burndy
DV2BL	Burndy
DV4BL	Burndy
DV6L	Burndy

Table 5 CRIMP TOOL SUPPLIERS (Continued)

Crimp Tool	Supplier
DV88	Burndy
MY28	Burndy
Y29B	Burndy
Y29BH	Burndy
Y29NC	Burndy
Y29PBL	Burndy
Y29PL	Burndy
Y29PR	Burndy
Y6NP-5	Burndy

MAINTENANCE OF THE BACC13AU AND BACC13AW CURRENT RETURN NETWORK CABLES

TABLE OF CONTENTS

MAINTENANCE OF THE BACC13AU AND BACC13AW CURRENT RETURN NETWORK CABLES

1. GENERAL DATA

A. Definitions

Table 1
DEFINITIONS

Term	Definition
Basic Structure	The major, electrically integral, metallic part of an airplane
Bond Jumper	An assembly that has one wire with a terminal lug at each end
Cable Assembly, Ground Path	An assembly that has more than one wire segment with a terminal lug at each end of the assembly and an integral terminal between each wire segment
Carbon Fiber Reinforced Plastic (CFRP)	A strong, lightweight, composite material consisting of a plastic matrix (often an epoxy) embedded with carbon filament thread fibers or fabric.
Cleaned Surface	A bonding surface that has had all the surface finishes and contaminants removed.
CRN	Current Return Network
CRN Component, Flexible	A bond jumper or a ground path cable assembly that has the same installation requirements as a wire harness that has only one wire or cable; refer to Subject 20-10-11.
Designated Bond	An electrical bond that has a specified resistance. A designated bond is always tested to make sure the resistance is satisfactory.
Electrical Bond	A stable connection between two objects that has the result of electrical conductivity between those objects
Explosion Hazard Area	A work area, or the area of an airplane or any other manufactured product that is identified by the responsible organization as a hazard because of the combustible or explosive substances in the area
Faying Surface	A surface that is prepared to have the correct fit against a second surface so that an electrical bond is made between the two surfaces
Ground	An electrically conductive path between a component or an electrical circuit and the basic structure, or a connection between the conductive frame or housing of an object and the earth-ground connection point in a facility
Non-Permanent Dual Hole Terminal Direct Ground Stud	A direct ground stud installation that has a dual hole terminal installed with standard fasteners.
Permanent Dual Hole Terminal Direct Ground Stud	A direct ground stud installation that has a dual hole terminal installed with permanent fasteners.
Surface Finish	A finish that is on a bonding surface and is necessary to be removed before an electrical bond is made.

NOTE: Subject 20-20-10 gives the installation procedures for the terminals of bonding jumpers.

NOTE: Subject 20-20-14 gives the installation procedures for the terminals of the BACC13AU and BACC13AW Current Return Network cables.

MAINTENANCE OF THE BACC13AU AND BACC13AW CURRENT RETURN NETWORK CABLES

B. Airworthiness Limitations

These wiring configurations, installations, and procedures are given in Critical Design Configuration Control Limitations (CDCCL) related to:

- Fuel System Wiring that has Airworthiness Limitations
- Wiring that is installed adjacent to the fuel tank.

CDCCLs identify design configuration features that can decrease fuel tank ignition sources for the operational life of the airplane.

NOTE: The wiring configurations, installations, and procedures given allow the Critical Design Configuration Control Limitation (CDCCL) to decrease possible fuel tank ignition sources. If the CDCCL is not followed, the risk of a fuel tank ignition source can increase.

To find more data about CDCCLs, refer to Table 2 for the document that is applicable for the airplane model.

Table 2
BOEING DOCUMENTS FOR AIRWORTHINESS LIMITATIONS

Airplane Model	Boeing Document
707	D6-7552-AWL Airworthiness Limitations
727	D6-8766-AWL Airworthiness Limitations
737-100, -200, -200C, -300, -400, -500	D6-38278-CMR Airworthiness Limitations and Certification Maintenance Requirements
747-100, -200, -300, -SP	D6-13747-CMR Airworthiness Limitations and Certification Maintenance Requirements
737-600, -700, -700C, -800, -900, -900ER	D626A001-CMR Maintenance Planning Data Document, Section 9
747-400	D621U400-9 Maintenance Planning Data Document, Section 9
757	D622N001-9 Maintenance Planning Data Document, Section 9
767	D622T001-9-04 Special Compliance Items/Airworthiness Limitations
777	D622W001-9 Maintenance Planning Data Document, Section 9
747-8	D011U721-02-04 Special Compliance Items/Airworthiness Limitations
787	D011Z009-03-04 Special Compliance Items/Airworthiness Limitations

C. General Conditions for the BACC13AU and BACC13AW Current Return Network

The following data must be known before you begin these procedures:

- The category of the electrical fay surface bond.
- The part numbers of the parts to be joined
- The material and the finish of the parts to be joined
- The part numbers and quantity of the fasteners used to join the parts
- The procedures used to install the fasteners
- The necessary torque values for the fasteners
- If refinishing is necessary
- If the installation is in a fuel vapor area of the airplane.

MAINTENANCE OF THE BACC13AU AND BACC13AW CURRENT RETURN NETWORK CABLES

Table 3
CATEGORIES FOR ELECTRICAL FAY SURFACE BONDS

Bond Category	Description
1	An unsealed electrical bond made without sealant.
2	A fay sealed electrical bond that is sealed when the electrical bond is made. Sealant is applied to components before they are assembled.
6	A fillet sealed electrical bond that is sealed after the electrical bond is made. Sealant is applied to the assembled components.

These conditions are applicable for the Current Return Network (CRN):

- A Current Return Network that has damage can be replaced with a new CRN of the same configuration. Refer to Figure 1 and Figure 2 for the Part Number Structures of the BACC13AU and BACC13AW.
- A CRN end terminal that is to be replaced, must be replaced with a terminal of the same configuration. Refer to Table 9 for BACC13AU, and Table 10 for BACC13AW.
- An integral terminal of a CRN cable cannot be replaced. A new repair cable that has an integral terminal must be used for the repair. For CRN repair cable part numbers, refer to Table 8 for BACC13AU, and Table 11 for BACC13AW.
- A BACC13AU CRN cable that has more than one integral terminal can be made from two or more repair cables selected from Table 8 that are spliced together. New copper end terminals can be selected from Table 9
- A BACC13AW CRN cable that has more than one integral terminal can be made from two or more repair cables selected from Table 11 that are spliced together. New aluminum end terminals can be selected from Table 10.

These conditions are applicable for the electrical faying surface bond of the terminals:

- The aluminum integral terminals and the aluminum end terminals that are supplied on the BACC13AU and BACC13AW CRN cables must have a monel gasket for an integral terminal installed between the integral terminal lug and the faying surface of the structure
- The installation of the tin plated aluminum terminals: BACT12BC (Straight), BACT12BD (90 Degree Flag), BACT12BE (Flag), BACT12BF (Hammerhead) and BACT12BG (90 Degree Hammerhead) must have a monel gasket for an end terminal
- The installation of the tin plated copper terminals: BACT13L (Straight), BACT12AW (90 Degree), and BACT12AY (Flag) does not use a monel gasket
- After the faying surfaces and terminals are clean, the terminal installation must occur in less than 24 hours
- Clean the faying surface and terminal again with solvent if they become dirty before the installation occurs. Refer to Subject 20-20-00
- Use the applicable cleaning method to clean the faying surface and terminal again if the installation did not occur in less than 24 hours. Refer to Subject 20-20-00.

CAUTION: DO NOT LET THE FAYING SURFACE OR THE TERMINAL BECOME DIRTY BEFORE INSTALLATION. UNSATISFACTORY PERFORMANCE OF THE TERMINAL ELECTRICAL CONNECTION CAN OCCUR.

MAINTENANCE OF THE BACC13AU AND BACC13AW CURRENT RETURN NETWORK CABLES

D. Applicable Conditions for the Seal of a Current Return Network Terminal Lug

For the conditions that are applicable for a Current Return Network in a flammable leakage zone, refer to 20-30-00.

For a location that is not a flammable leakage zone, the terminal lug must be sealed if the initial configuration of the terminal lug is sealed.

E. Necessary Materials

NOTE: The cure times and the tack free times that are specified in Table 4 are applicable for 77 degrees F ±5 degrees F and 50 percent relative humidity.

NOTE: The cure time and tack free time of ground stud sealants:

- Increase at lower temperature and lower humidity
- Decrease at higher temperature and higher humidity.

Table 4
SEALANTS FOR CURRENT RETURN NETWORK TERMINAL LUGS

Part Number	Application Time (hours)	Squeeze Out Life (hours)	Cure Time (hours)	Tack Free Time (hours)
BMS5-45, Class B-1/2	1/2	-	12	10
BMS5-45, Class B-2	2	6	24	12
BMS5-45, Class C-24	8	24	168 (7 days)	-
BMS5-45, Class C-48	12	48	336 (14 days)	-
BMS5-45, Class C-168	48	168 (7 days)	1344 (56 days)	-

Table 5
APPROVED SUPPLIERS OF SEALANTS

Sealant	Supplier
BMS5-45	QPL

Table 6
SOLVENTS

Material	Specification	Supplier
Acetone	0-A-51	An available source
	ASTM D 329	An available source
Ethyl Alcohol, Denatured	AMS 3002	An available source
	ASTM E 1145, Type II	An available source
Alcohol, Isopropyl	TT-I-735, Grade A	An available source
	TT-I-735, Grade B	An available source

Table 6 SOLVENTS (Continued)

Material	Specification	Supplier
Naptha, Aliphatic	TT-N-95, Type II	An available source
Methyl Ethyl Ketone	ASTM D 740, Type I	An available source

F. Surface Cleaning Methods

Table 7
SURFACE CLEANING METHODS FOR CURRENT RETURN NETWORK TERMINAL INSTALLATION

Bond Category	Surface Material	Surface Finish	Cleaning Method Refer to Subject 20-20-00.	
			Description	Reference
1,2, and 6	Aluminum Alloy	Anodized	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc
1, 2, and 6	Aluminum Alloy	Bare with or without grease, oil, CIC, oxide film contamination or other contaminants	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc
1,2, and 6	Aluminum Alloy	Chemical Conversion Coating	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc

Table 7 SURFACE CLEANING METHODS FOR CURRENT RETURN NETWORK TERMINAL INSTALLATION (Continued)

Bond Category	Surface Material	Surface Finish	Cleaning Method Refer to Subject 20-20-00.	
			Description	Reference
1,2, and 6	Aluminum Alloy	Paint, Primer, or Enamel	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc
1 and 6	Aluminum	Chemical conversion coating with or without grease, oil, CIC, or other contaminants	Solvent Cleaning	Solvent Cleaning
2	Aluminum	Chemical conversion coating with or without grease, oil, CIC, or other contaminants	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc
1,2, and 6	Clad Aluminum	Bare metal with or without grease, oil, CIC, or other contaminants	Solvent Cleaning	Solvent Cleaning
1,2, and 6	Steel	Bare metal with or without grease, oil, CIC, or other contaminants	Solvent Cleaning	Solvent Cleaning
		Paint, Primer, or Enamel	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc
		Cadmium plating with or without grease, oil, CIC, or other contaminants	Solvent Cleaning	Solvent Cleaning

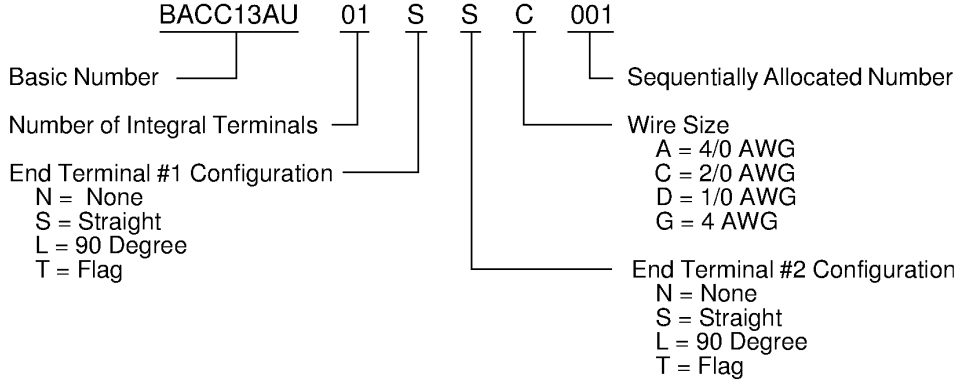
MAINTENANCE OF THE BACC13AU AND BACC13AW CURRENT RETURN NETWORK CABLES

Table 7 SURFACE CLEANING METHODS FOR CURRENT RETURN NETWORK TERMINAL INSTALLATION (Continued)

Bond Category	Surface Material	Surface Finish	Cleaning Method Refer to Subject 20-20-00.	
			Description	Reference
1,2, and 6	Titanium	Bare with or without grease, oil, CIC, or other contaminants	Solvent Cleaning	Solvent Cleaning
		Paint, Primer, or Enamel	Abrasive Cleaning	Abrasives Applied Manually
				Stainless Steel Rotary Brush
				Rotary Abrasive Disc

2. PART NUMBERS AND DESCRIPTION

A. Cable Assembly Part Numbers and Description



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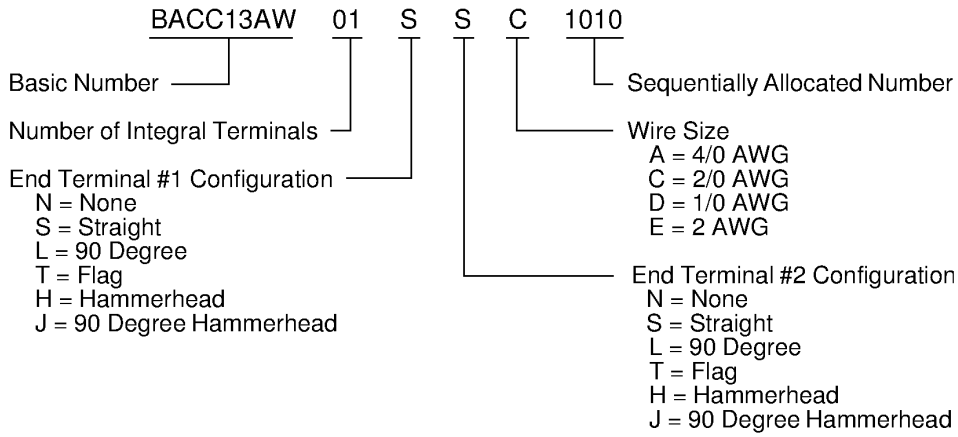
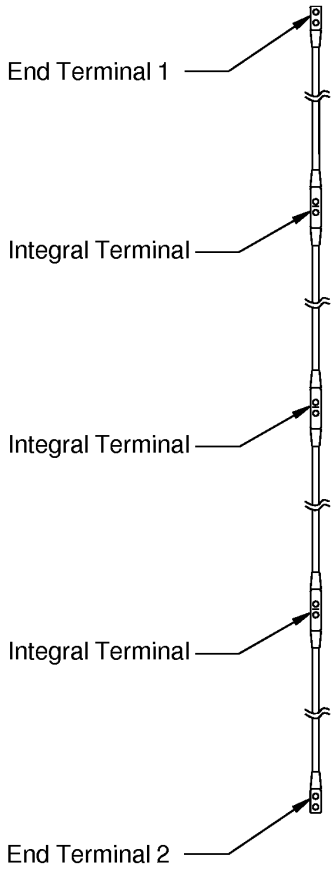
BACC13AU CURRENT RETURN NETWORK PART NUMBER STRUCTURE
Figure 1



BACC13AW CURRENT RETURN NETWORK PART NUMBER STRUCTURE
Figure 2



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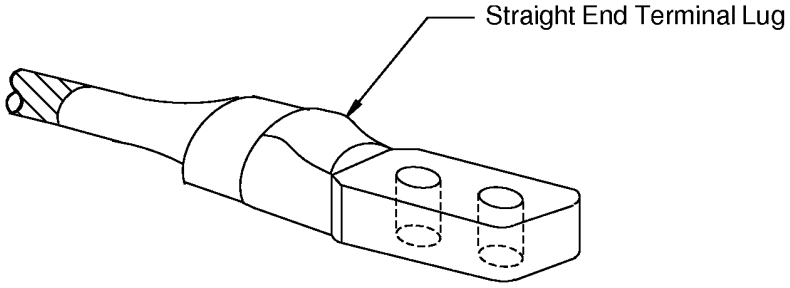
BACC13AU AND BACC13AW CURRENT RETURN NETWORK CABLE ASSEMBLY
Figure 3

B. Terminal Lugs Supplied on the BACC13AU Current Return Network Cable

This paragraph gives the description of the aluminum terminal lugs that are supplied on the BACC13AU Current Return Network Cable.

MAINTENANCE OF THE BACC13AU AND BACC13AW CURRENT RETURN NETWORK CABLES



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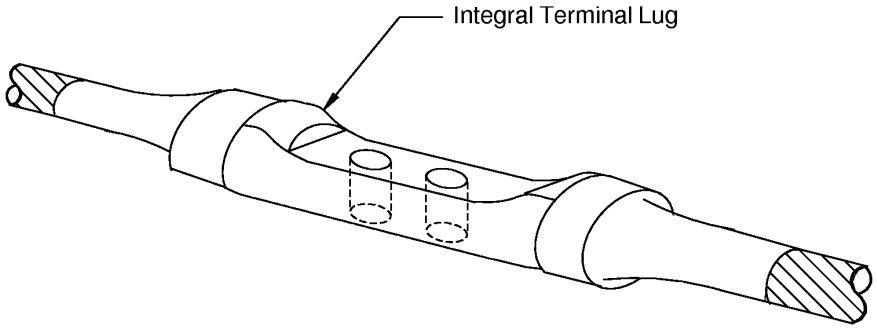
ALUMINUM STRAIGHT END TERMINAL LUG SUPPLIED ON THE BACC13AU CURRENT RETURN NETWORK CABLE
Figure 4

NOTE: The BACC13AU Current Return Network Cable is also supplied with tin plated copper end terminal lugs. Refer to Figure 8, and Figure 9.

NOTE: The Integral terminals for the BACC13AU Current Return Network cables cannot be replaced. If an integral terminal must be replaced, refer to Paragraph 2.C..



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ALUMINUM INTEGRAL TERMINAL LUG SUPPLIED ON THE BACC13AU CURRENT RETURN NETWORK CABLE
Figure 5

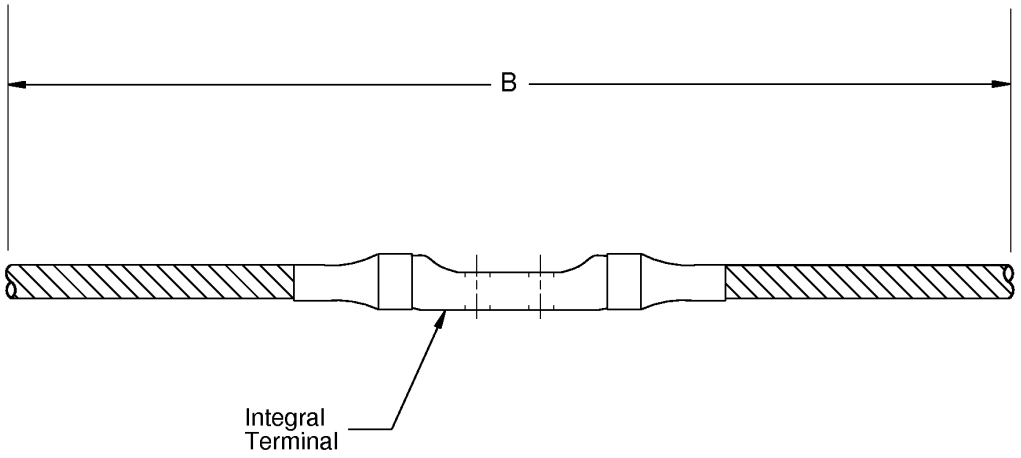
MAINTENANCE OF THE BACC13AU AND BACC13AW CURRENT RETURN NETWORK CABLES

C. Repair Cables for the BACC13AU Current Return Network

NOTE: The repair cables shown in Table 8, have one integral terminal and no end terminals. A BACC13AU Current Return Network that has more than one integral terminal can be made from two or more repair cables selected from Table 8 that are spliced together. New copper end terminals can be selected from Table 9. Refer to Paragraph 4.C. for the procedure to join the cables.

Table 8
BACC13AU REPAIR CABLE PART NUMBERS

Wire Size (AWG)	Length B (inch)	Part Number	Supplier
2/0	72	BACC13AU01NNC005	Boeing
	36	BACC13AU01NNC006	Boeing



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BACC13AU CURRENT RETURN NETWORK REPAIR CABLE ASSEMBLY
Figure 6

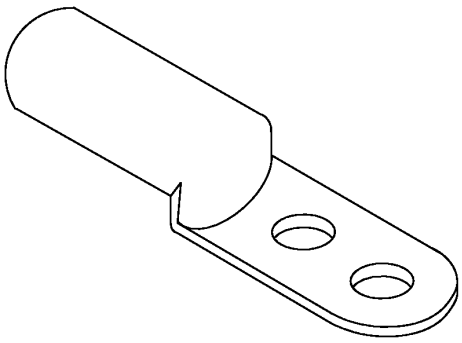
MAINTENANCE OF THE BACC13AU AND BACC13AW CURRENT RETURN NETWORK CABLES

D. Replacement Terminal Lugs for the BACC13AU Current Return Network

Refer to Paragraph 6.A. for the assembly and installation of the Copalum terminal lugs shown in Table 9.

Table 9
TIN PLATED COPPER REPLACEMENT TERMINAL LUGS FOR THE BACC13AU CURRENT RETURN NETWORK

Description	Material	Part Number	Supplier	Reference
Straight	Tin Plated Copper	BACT13L-()	Boeing	Figure 7
90 Degree	Tin Plated Copper	BACT12AW-()	Boeing	Figure 8
Flag	Tin Plated Copper	BACT12AY-()	Boeing	Figure 9



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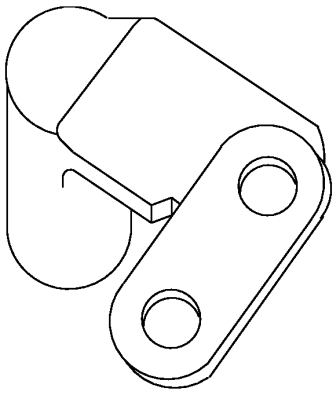
BACT13L-() TIN PLATED COPPER STRAIGHT END TERMINAL LUG
Figure 7

NOTE: The BACT13L-() Tin Plated Copper Straight End Terminal Lug is the replacement terminal lug for the aluminum straight end terminal lug that is supplied on the BACC13AU Current Return Network Cable. Refer to Figure 4.



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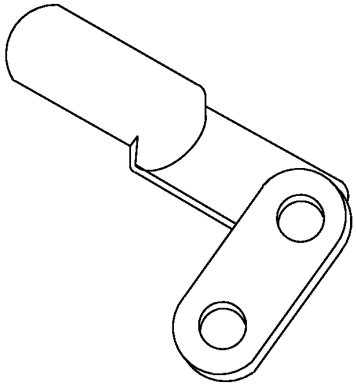
BACT12AW-() TIN PLATED COPPER 90 DEGREE END TERMINAL LUG
Figure 8



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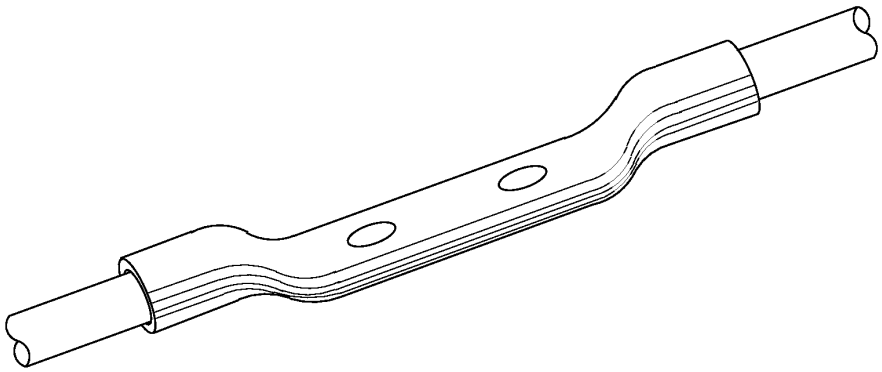
BACT12AY TIN PLATED COPPER FLAG END TERMINAL LUG
Figure 9

MAINTENANCE OF THE BACC13AU AND BACC13AW CURRENT RETURN NETWORK CABLES

E. Supplied and Replacement Terminal Lugs for the BACC13AW Current Return Network

This paragraph gives the description of the aluminum terminal lugs that are supplied on the BACC13AW Current Return Network (CRN) cables. The end terminals of the CRN can be replaced by the aluminum terminals shown in Figure 11 through Figure 15.

NOTE: The Integral terminals for the BACC13AW Current Return Network cables cannot be replaced. If an integral terminal must be replaced, refer to Paragraph 2.F..



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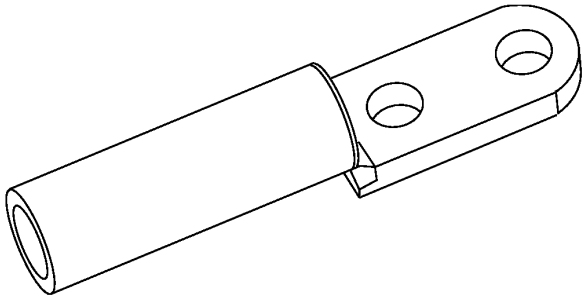
ALUMINUM INTEGRAL TERMINAL SUPPLIED ON THE BACC13AW CURRENT RETURN NETWORK CABLE
Figure 10

For the terminal lugs shown in Table 10, refer to:

- Subject 20-30-07 for terminal lug assembly with aluminum wire
- Paragraph 6.A. for terminal lug installation.

Table 10
ALUMINUM REPLACEMENT TERMINAL LUGS FOR THE BACC13AW CURRENT RETURN NETWORK

Description	Material	Part Number	Supplier	Reference
Straight	Aluminum	BACT12BC()	Boeing	Figure 11
90 Degree Flag	Aluminum	BACT12BD()	Boeing	Figure 12
Flag End	Aluminum	BACT12BE()	Boeing	Figure 13
Hammerhead	Aluminum	BACT12BF()	Boeing	Figure 14
90 Degree Hammerhead	Aluminum	BACT12BG()	Boeing	Figure 15



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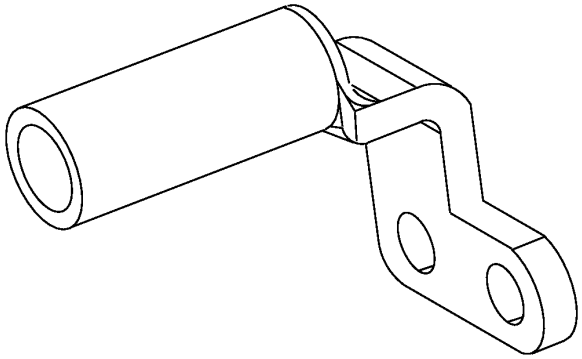
BACT12BC ALUMINUM STRAIGHT END TERMINAL LUG
Figure 11



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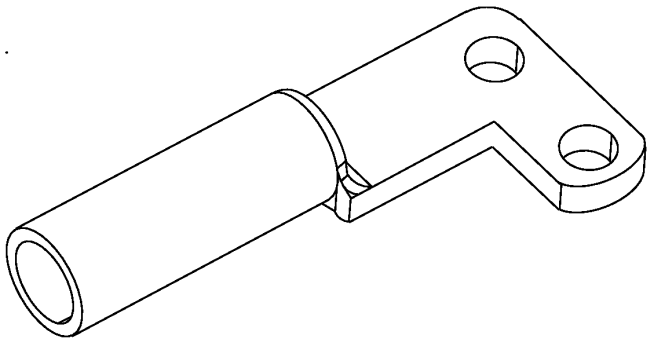
BACT12BD ALUMINUM 90 DEGREE FLAG TERMINAL
Figure 12



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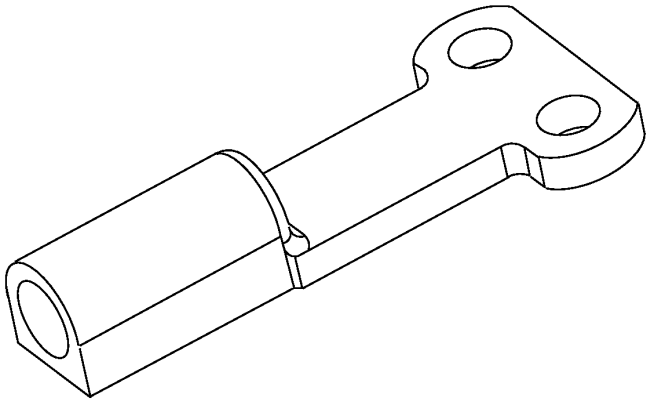
BACT12BE ALUMINUM FLAG END TERMINAL
Figure 13



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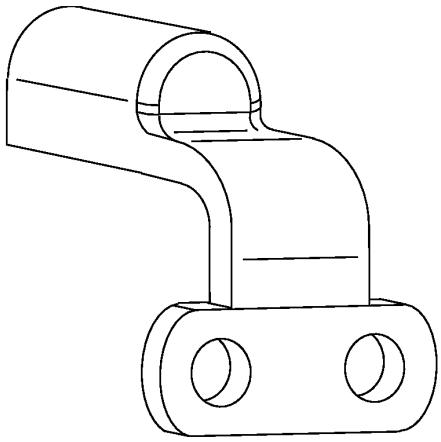
BACT12BF ALUMINUM HAMMERHEAD TERMINAL
Figure 14



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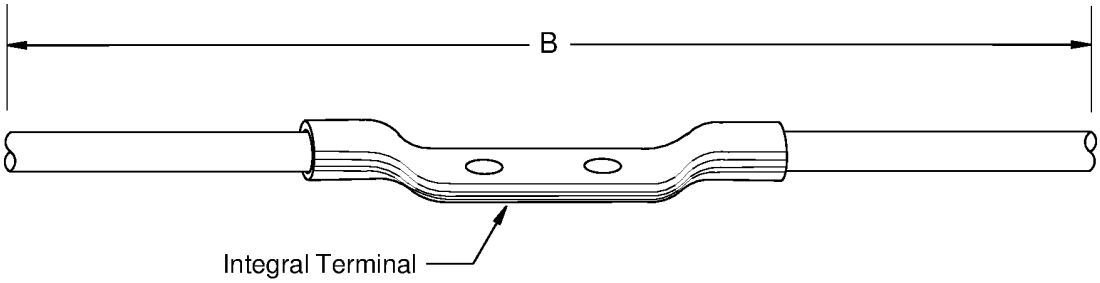
BACT12BG ALUMINUM 90 DEGREE HAMMERHEAD TERMINAL
Figure 15

F. Repair Cables for the BACC13AW Current Return Network

NOTE: The repair cables shown in Table 11, have one integral terminal and no end terminals. A BACC13AW Current Return Network that has more than one integral terminal can be made from two or more repair cables selected from Table 11 that are spliced together. New aluminum end terminals can be selected from Table 10. Refer to Paragraph 4.C. for the procedure to join the cables.

Table 11
BACC13AW REPAIR CABLE PART NUMBERS

Wire Size (AWG)	Length B (inch)	Part Number	Supplier
1/0	36	BACC13AW01NND1003	Boeing
	72	BACC13AW01NND1004	Boeing
2/0	36	BACC13AW01NNC1005	Boeing
	72	BACC13AW01NNC1006	Boeing
4/0	36	BACC13AW01NNA1007	Boeing
	72	BACC13AW01NNA1008	Boeing



BACC13AW CURRENT RETURN NETWORK REPAIR CABLE ASSEMBLY
Figure 16

G. Monel Terminal Lug Gaskets

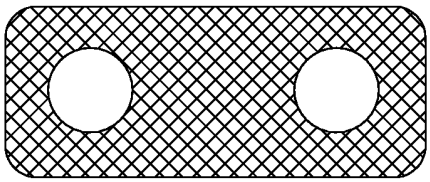
The monel terminal lug gaskets are only installed under these aluminum terminal lugs:

- The straight end terminal lug that is supplied on the BACC13AU Current Return Network (CRN) cable.
- The integral terminal lugs that are supplied on the BACC13AU and BACC13AW CRN cables
- The BACT12BC (Straight), BACT12BD (90 Degree Flag), BACT12BE (Flag), BACT12BF (Hammerhead) and BACT12BG (90 Degree Hammerhead) terminal lugs.

NOTE: Monel terminal lug gaskets are not used with the BACT13L-(), BACT12AW-(), BACT12AY-() tin plated copper terminal lugs.

Table 12
PART NUMBERS FOR MONEL GASKETS FOR CRN TERMINAL LUGS

Current Return Network	Application	Size (AWG)	Part Number	Supplier
BACC13AU	For the End Terminal Lug	-	X-1492-02	Tensolite
BACC13AU and BACC13AW	For the Integral Terminal Lug	-	X-1492-02-01	Tensolite
BACC13AW	For BACT12BC, BACC12BD, BACT12BE, BACT12BF, and BACT12BG Terminal Lugs	2	115-15074-01	Tensolite
		1/0		
		2/0	115-15067-01	Tensolite
		4/0		



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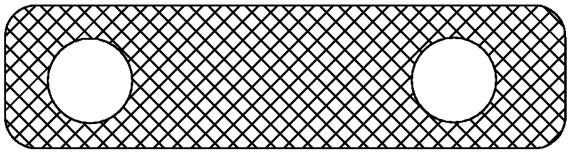
MONEL GASKET FOR AN END TERMINAL
Figure 17



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MONEL GASKET FOR AN INTEGRAL TERMINAL LUG
Figure 18

NOTE: The monel gaskets are only used for the installation of the aluminum end terminal lugs and aluminum integral terminal lugs.

3. CURRENT RETURN NETWORK REMOVAL

A. Necessary Tools and Materials

Table 13
NECESSARY TOOLS

Tool	Part Number	Description	Supplier
Shear Collar Removal Tool	MED50-()	Offset Handle	Alcoa Fastening Systems
	MED50-()S	Straight Handle	Alcoa Fastening Systems
	MED50-()CF	Square Drive	Alcoa Fastening Systems
Scraper	-	Wood	An available source
Scraper	-	Plastic	An available source
Wrench	-	Allen	An available source
Wrench	-	Open End	An available source
Wrench	-	Box End	An available source

Table 13 NECESSARY TOOLS (Continued)

Tool	Part Number	Description	Supplier
Wrench	-	Socket	An available source

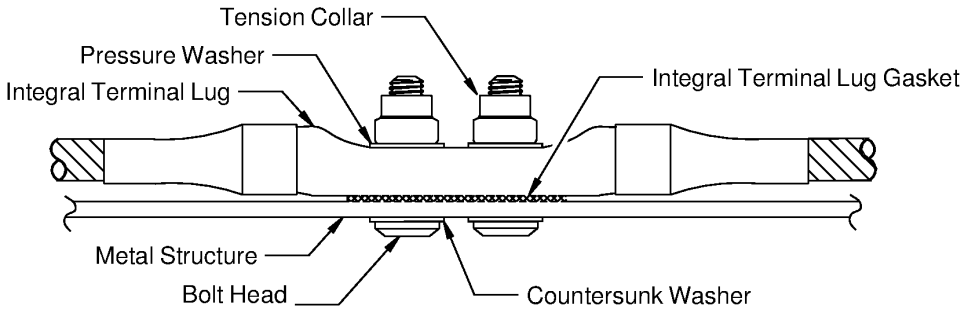
B. Terminal Lug Removal

(1) Carefully remove the sealant from on and around the fasteners and the terminal lug with the scraper.

Make sure that you use a wooden or plastic scraper.

CAUTION: DO NOT USE A METAL SCRAPER. A METAL SCRAPER CAN CAUSE DAMAGE TO THE TERMINAL LUG AND THE STRUCTURE.

(2) Identify the type of fasteners used for the terminal lug installation. Refer to Figure 19 and Figure 20.



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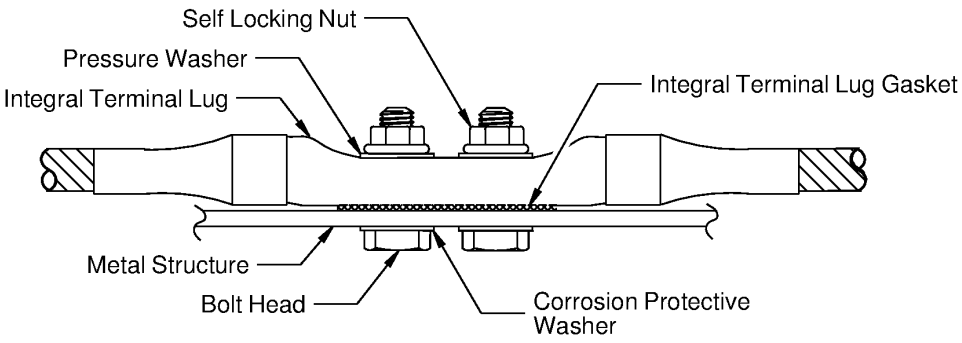
PERMANENT TERMINAL LUG INSTALLATION
Figure 19



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NON-PERMANENT TERMINAL LUG INSTALLATION
Figure 20

(3) If the terminal lug has permanent fasteners:

(a) Make a selection of these items from Table 13:

- An allen wrench
- A shear collar removal tool

(b) Hold the bolt with the hex wrench.

NOTE: The bolt is held at the threaded end with the allen wrench.

(c) Turn the shear collar counterclockwise with the removal tool until it is removed

NOTE: An equivalent shear collar removal tool is a satisfactory alternative.

(d) Discard the shear collar.

(e) Remove the pressure washer.

(f) Remove the bolt.

(g) Remove the corrosion protective washer.

(h) Remove the terminal lug from the structure.

(i) Remove the terminal lug gasket and discard it.

NOTE: It is recommended that the pressure washer, bolt, and corrosion protective washer be discarded and replaced with new parts.

(4) If the terminal lug has non-permanent fasteners:

(a) Make a selection of these items from Table 13:

- A wrench to hold the bolt head
- A wrench to turn the lock nut

(b) Hold the bolt head with a wrench.

(c) Turn the lock nut counterclockwise with a wrench until it is removed.

(d) Remove the pressure washer.

(e) Remove the bolt.

(f) Remove the corrosion protective washer.

(g) Remove the terminal lug from the structure.

(h) Remove the terminal lug gasket and discard it.

NOTE: It is recommended that the lock nut, pressure washer, bolt, and corrosion protective washer be discarded and replaced with new parts.

4. CURRENT RETURN NETWORK REPAIR

A. Damage and Repair Conditions for BACC13AU and BACC13AW Current Return Network Wire

For the general damage and repair conditions of the Current Return Network wire, refer to Subject 20-10-13.

These are the special damage and repair conditions for the Current Return Network wire:

- If the conductor has damage, it is necessary to repair the wire with a splice
- Only one splice is allowed between terminal lugs.

CAUTION: DO NOT PUT MORE THAN ONE SPLICE BETWEEN TERMINAL LUGS. UNSATISFACTORY PERFORMANCE OF THE CURRENT RETURN NETWORK CAN OCCUR.

B. Repair of the Wire Insulation

For the procedure to repair the wire insulation, refer to Subject 20-10-13.

C. Joining Two or More Cables Together With a Splice

Table 14
NECESSARY PARTS

Description	Size	Mark on Splice	Part Number	Supplier
Splice, CopAlum	1/0-1/0	AMP 1/0 AL - 2 CU	277160-1	AMP
	2/0-2/0	AMP 2/0 AL - 1/0 CU	277161-1	AMP

To make a new Current Return Network that has more than one integral terminal, two or more cables can be joined together with an AMP CopAlum splice.

Make sure that the angular positions of the end terminals and the integral terminals of the new replacement cable assembly are the same as the angular positions of the end terminals and the integral terminals of the initial installed current return network cable.

These conditions are applicable:

- Make a selection of a splice from Table 14
- Refer to Subject 20-30-13 for the procedure to install the splice

- The angular positions of the end terminals and the integral terminals of the new replacement cable assembly are the same as the angular positions of the end terminals and the integral terminals of the initial installed current return network cable.

5. ALUMINUM DUAL HOLE TERMINAL LUG INSTALLATION

A. General Conditions for BACC13AU and BACC13AW Dual Hole Terminal Lug Installation

These conditions are applicable:

- The aluminum integral terminals and the aluminum end terminals that are supplied on the BACC13AU and BACC13AW Current Return Network Cables must have a monel gasket installed between the terminal lug and the faying surface of the structure
- The installation of the aluminum terminals: BACT12BC (Straight), BACT12BD (90 Degree Flag), BACT12BE (Flag), BACT12BF (Hammerhead) and BACT12BG (90 Degree Hammerhead) must have a monel gasket
- The installation of the tin plated copper terminals: BACT13L (Straight), BACT12AW (90 Degree), and BACT12AY (Flag) does not use a monel gasket
- The terminal lug installation must be done within 24 hours of surface preparation
- If the terminal lug installation is not done within 24 hours, the surfaces must be cleaned again.

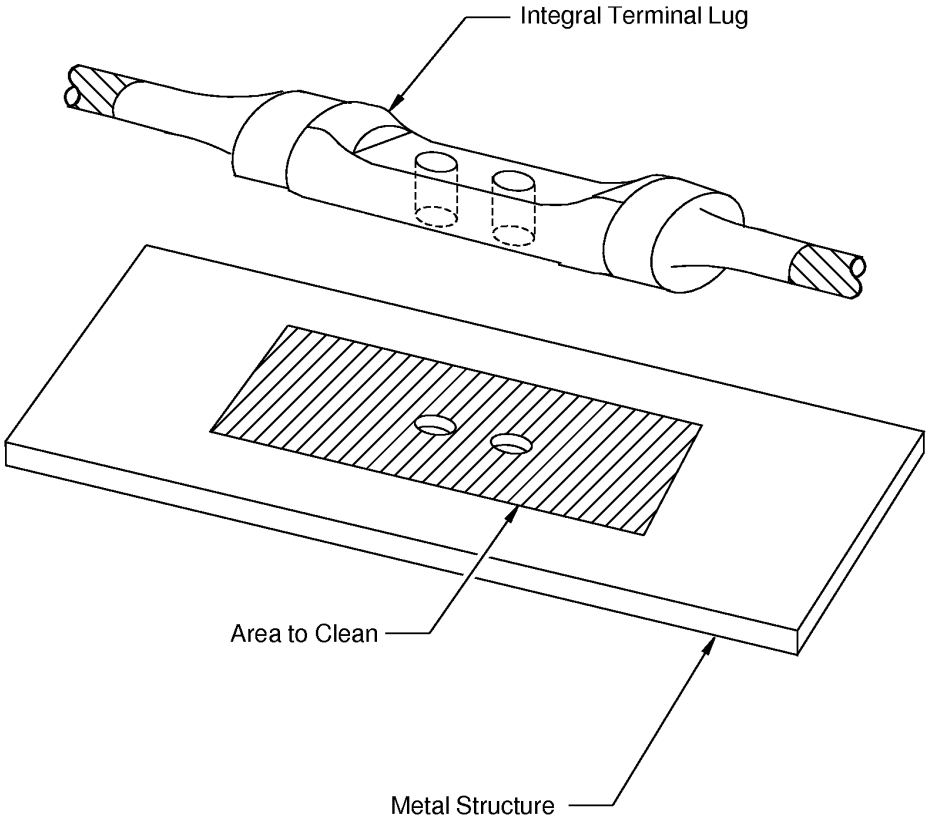
B. Permanent Category 2 Fay Sealed and Category 6 Fillet Sealed BACC13AU and BACC13AW Aluminum Dual Hole Terminal Direct Ground Stud Installation

(1) Clean the surface of the structure that the terminal lug touches.

Make sure that the full area of the structure under the dual hole terminal is clean.

Refer to:

- Figure 21 and Figure 22 for the area to be cleaned
- Table 7 for the cleaning procedure.



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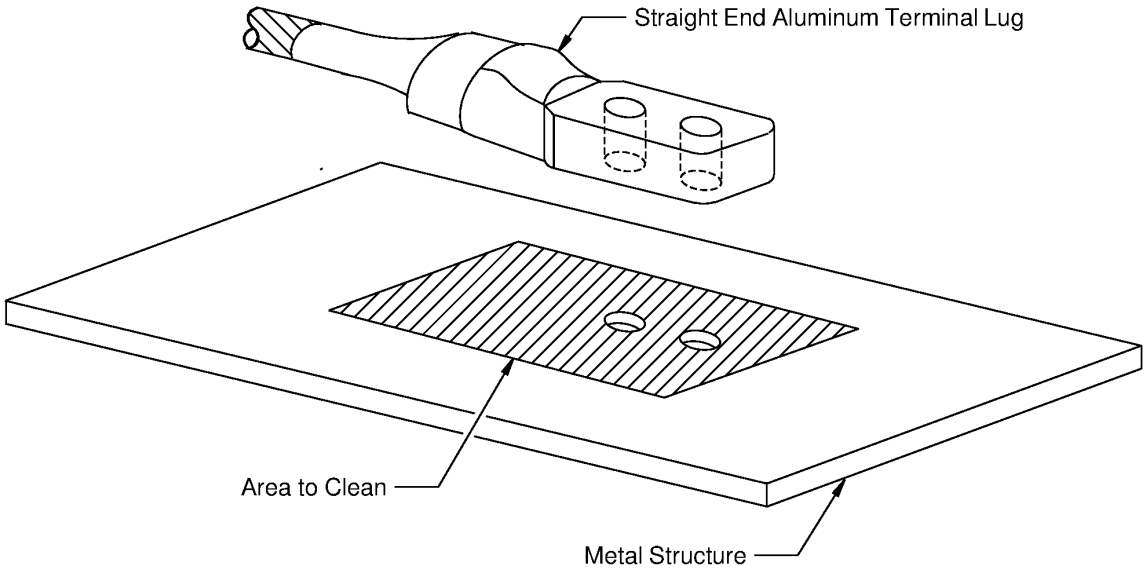
AREA TO CLEAN UNDER AN INTEGRAL TERMINAL LUG
Figure 21



AREA TO CLEAN UNDER A STRAIGHT END TERMINAL LUG
Figure 22

(2) Clean the terminal lug with solvent. Refer to Subject 20-20-00.

Make sure that the areas that touch and make the electrical bond are clean.

CAUTION: DO NOT USE AN ABRASIVE CLEANING METHOD TO CLEAN THE TERMINAL LUG. DAMAGE TO THE TERMINAL LUG PLATING CAN OCCUR AND CAUSE UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

CAUTION: THE TERMINAL LUG INSTALLATION AND RESISTANCE MEASUREMENT MUST BE DONE WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE TERMINAL LUG INSTALLATION AND RESISTANCE MEASUREMENT ARE NOT DONE WITHIN 24 HOURS, THE FAYING SURFACES MUST BE CLEANED AGAIN.

(3) Make a selection of a monel gasket from Table 12.

Make sure that you select an integral lug monel gasket for the installation of an integral terminal lug and an end lug monel gasket for the installation of and end terminal lug.

(4) Make a selection of a sealant. Refer to Table 4.

(5) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth, continuous layer of sealant
- Does not cause damage to the structure or the terminal lug when the sealant is applied.

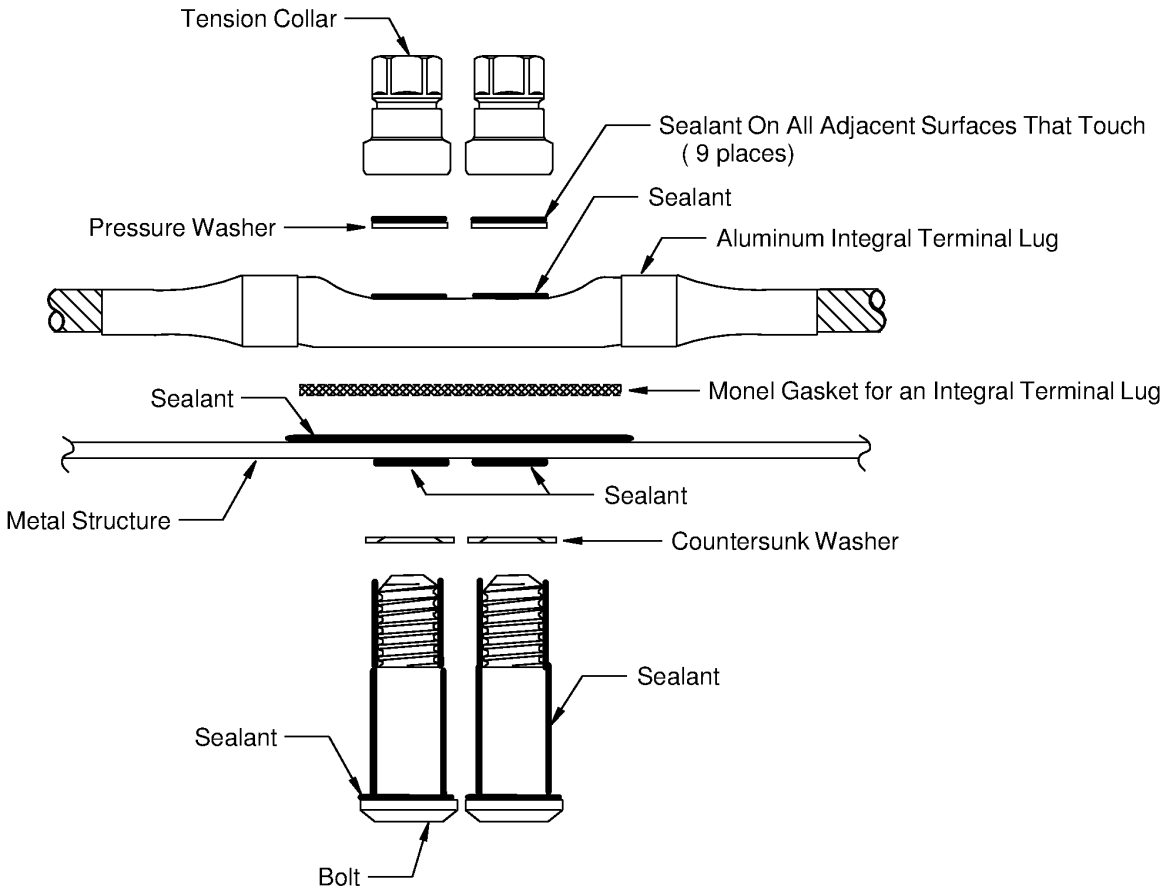
(6) Apply a continuous layer of sealant to these surfaces:

- The shank and thread areas of the 2 bolts
- The structure areas that touch the 2 countersunk washers
- The structure area that touches the terminal lug
- The terminal lug area that touches the 2 pressure washers
- The 2 Pressure Washers

Refer to Figure 23.

NOTE: It is necessary to apply the sealant on the surface of one component of two adjacent components.

NOTE: It is satisfactory to apply the sealant to the parts with a brush. Make sure that a uniform coat of sealant covers the mating surface.



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PERMANENT CATEGORY 2 FAY SEALED DUAL HOLE INTEGRAL TERMINAL DIRECT GROUND STUD INSTALLATION

Figure 23

(7) Put the 2 countersunk washers on the 2 bolts.

(8) Put the threads of the bolts through the mounting holes of the structure.

Make sure that the heads of the bolts are against the structure.

(9) Put these components on the 2 bolts in this order:

- The monel gasket
- The dual hole terminal lug
- The 2 pressure washers.

(10) Install the 2 tension collars:

(a) Engage the threads of the shear collar and the bolt.

(b) Hold the bolt with the allen wrench.

Make sure that the bolt does not turn in the hole during installation.

(c) Turn the hex head of the shear collar clockwise with a wrench until the hex head breaks off.

(d) Discard the hex head.

(11) Do a test of the electrical resistance.

Refer to:

- Paragraph 7.B. for the maximum permitted resistance
- Paragraph 7.C. for the procedure to perform the test.

NOTE: It is permitted to carefully pierce the surface finish of the structure with the test probes to make electrical contact with the structure.

(12) If the measured electrical resistance is more than the maximum permitted:

(a) Disassemble the ground stud assembly.

(b) Do Step 5.B.(1) through Step 5.B.(11) again.

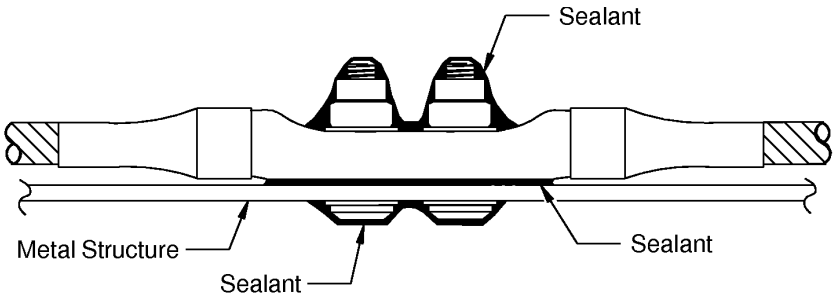
(13) Apply a bead of more sealant between the terminal lug and the structure to make a Category 6 fillet seal.

Make sure that:

- There are no gaps in the sealant
- There are no air bubbles in the sealant
- The area between the terminal lug and the structure is fully sealed.

(14) Smooth out the sealant with a clean wiper or a brush.

NOTE: It is satisfactory to encapsulate the ground stud head and the shear collar and bolt threads.



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COMPLETED PERMANENT CATEGORY 2 FAY SEALED DUAL HOLE INTEGRAL TERMINAL DIRECT GROUND STUD INSTALLATION
Figure 24

(15) If part of the structure surface finish was removed to make electrical contact, the finish must be applied again within 7 days of removal of the original the finish.

Refer to Subject 20-20-00.

C. Non-Permanent Category 2 Fay Sealed and Category 6 Fillet Sealed BACC13AU and BACC13AW Aluminum Dual Hole Terminal Direct Ground Stud Installation

(1) Clean the surface of the structure that the terminal lug touches.

Make sure that the full area of the structure that touches the terminal lug is clean.

Refer to:

- Figure 21 and Figure 22 for the area to be cleaned.
- Table 7 for the cleaning procedure.

CAUTION: THE TERMINAL LUG INSTALLATION AND RESISTANCE MEASUREMENT MUST BE DONE WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE TERMINAL LUG INSTALLATION AND RESISTANCE MEASUREMENT ARE NOT DONE WITHIN 24 HOURS, THE FAYING SURFACES MUST BE CLEANED AGAIN.

(2) Clean the terminal lug with solvent. Refer to Subject 20-20-00.

Make sure that the areas that touch and make the electrical bond are clean.

CAUTION: DO NOT USE AN ABRASIVE CLEANING METHOD TO CLEAN THE ALUMINUM TERMINAL LUG. DAMAGE TO THE TERMINAL LUG CAN OCCUR AND CAUSE UNSATISFACTORY PERFORMANCE OF THE ELECTRICAL BOND.

MAINTENANCE OF THE BACC13AU AND BACC13AW CURRENT RETURN NETWORK CABLES

CAUTION: THE TERMINAL LUG INSTALLATION AND RESISTANCE MEASUREMENT MUST BE DONE WITHIN 24 HOURS OF THE SURFACE CLEANING. IF THE TERMINAL LUG INSTALLATION AND RESISTANCE MEASUREMENT ARE NOT DONE WITHIN 24 HOURS, THE FAYING SURFACES MUST BE CLEANED AGAIN.

(3) Make a selection of a monel gasket. Refer to Table 12.

Make sure that you select an integral lug monel gasket for the installation of an integral terminal lug and a end terminal lug monel gasket for the installation of an end terminal lug.

(4) Make a selection of a sealant. Refer to Table 4.

(5) Make a selection of a tool to apply the sealant.

Make sure that the tool:

- Can make a small fillet
- Can make a smooth, continuous layer of sealant
- Does not cause damage to the structure or the finish when the sealant is applied.

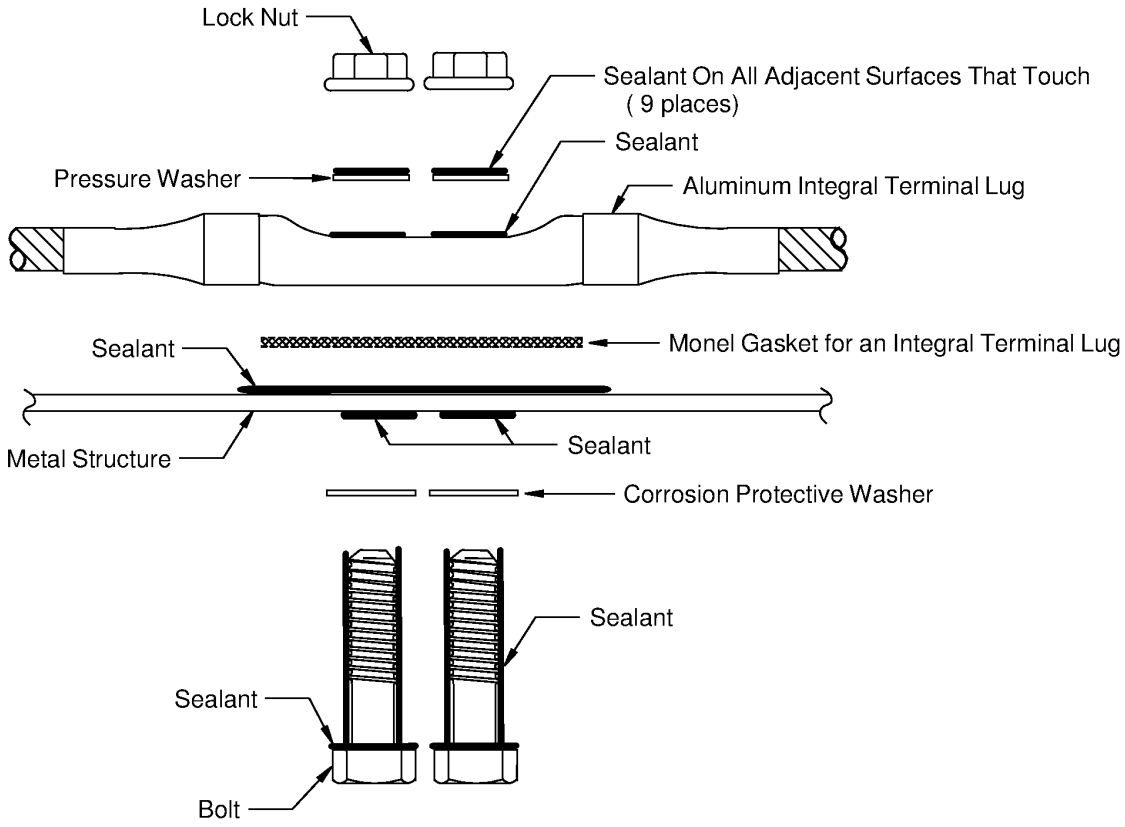
(6) Apply a continuous layer of sealant to these surfaces:

- The shank and threads of the 2 bolts
- The structure areas that touch the 2 corrosion protective washers
- The structure area that touches the terminal lug
- The terminal lug area that touches the 2 pressure washers
- The 2 pressure washers.

Refer to Figure 25.

NOTE: It is necessary to apply the sealant on the surface of one component of two adjacent components.

NOTE: It is satisfactory to apply the sealant with a brush. Make sure that a uniform coat of sealant covers the mating surfaces.



NON-PERMANENT CATEGORY 2 FAY SEALED DUAL HOLE INTEGRAL TERMINAL LUG DIRECT STUD INSTALLATION
Figure 25

(7) Assemble the terminal lug, the monel integral terminal lug gasket and the ground studs. Refer to Figure 25.

(a) Put the 2 corrosion protective washers on the fasteners.

(b) Put the fasteners through the mounting holes in the structure.

(c) Put the monel integral lug gasket on the fasteners.

(d) Put the terminal lug on the monel gasket.

(e) Put the pressure washers on the fasteners.

(8) Engage the threads of the bolts with the threads of the lock nuts.

(9) Torque the lock nuts.

Make sure that the bolt does not turn in the hole when the torque is applied to the lock nut.

(10) Do a test of the electrical resistance.

Refer to Paragraph 7. for the maximum permitted resistance and the procedure to perform the test.

NOTE: It is permitted to carefully pierce the surface finish of the structure with the test probes to make electrical contact with the structure.

(11) If the measured electrical resistance is more than the maximum permitted:

(a) Disassemble the ground stud assembly.

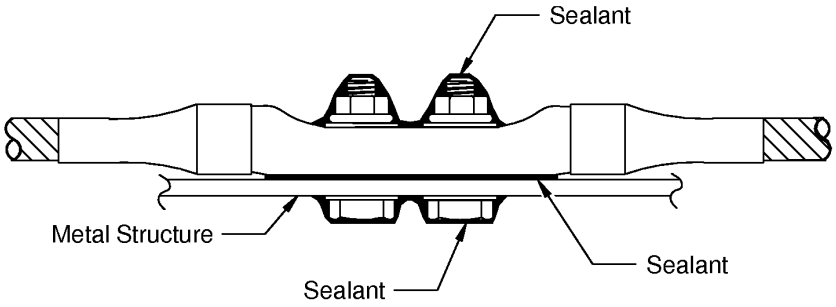
(b) Do Step 5.C.(1) through Step 5.C.(10) again.

(12) Apply a bead of more sealant between the terminal lug and the structure to make a Category 6 fillet seal.

Make sure that:

- There are no gaps in the sealant
- There are no air bubbles in the sealant
- The area between the terminal lug and the structure is fully sealed.

(13) Smooth out the sealant with a clean wiper or a brush.



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COMPLETED NON-PERMANENT CATEGORY 2 FAY SEALED AND CATEGORY 6 FILLET SEALED DUAL HOLE INTEGRAL TERMINAL LUG DIRECT GROUND STUD INSTALLATION
Figure 26

NOTE: It is satisfactory to encapsulate the ground stud head with the sealant.

(14) If part of the structure surface finish was removed to make electrical contact, the finish must be applied again within 7 days of removal of the original the finish.

Refer to Subject 20-20-00.

6. TIN PLATED COPPER AND ALUMINUM DUAL HOLE TERMINAL LUG INSTALLATION

A. Terminal Lug Termination and Fay Surface Installation

Refer to Subject 20-30-14 for the procedures for the termination of the Copalum terminal lugs shown in Table 9 to the cable of the BACC13AU Current Return Network.

Refer to Subject 20-30-07 for the procedures for the termination of the aluminum terminal lugs shown in Table 10 to the cable of the BACC13AW Current Return Network.

These conditions are applicable for the fay surface installation of the dual hole terminal lugs of the Current Return Network:

- The terminal lug installation must be done within 24 hours of surface preparation
- If the terminal lug installation is not done within 24 hours, the surfaces must be cleaned again

B. Permanent Category 2 Fay Sealed Tin Plated Copper and Aluminum Dual Hole Terminal Direct Ground Stud Installation

For the procedure to install a tin plated copper and aluminum dual hole terminal refer to:

- Subject 20-20-10 for the installation procedure
- Table 9 for the part numbers of the tin plated copper and aluminum dual hole terminals
- Table 4 for the type of sealant to use.

Make sure that:

- You use the procedure to install a Category 2 Permanent Fay Sealed dual hole direct ground stud in Subject 20-20-10.
- You use the BMS5-45 sealant. Refer to Table 4.

C. Non Permanent Category 2 Fay Sealed Tin Plated Copper and Aluminum Dual Hole Terminal Direct Ground Stud Installation

For the procedure to install a tin plated copper and aluminum dual hole terminal refer to:

- Subject 20-20-10 for the installation procedure
- Table 9 for the part numbers of the tin plated copper and aluminum dual hole terminals
- Table 4 for the type of sealant to use.

Make sure that:

- You use the procedure to install a Category 2 Non Permanent Fay Sealed Dual Hole Direct Ground Stud in Subject 20-20-10.
- You use the BMS5-45 sealant. Refer to Table 4.

MAINTENANCE OF THE BACC13AU AND BACC13AW CURRENT RETURN NETWORK CABLES

7. MAXIMUM PERMITTED RESISTANCE AND TEST PROCEDURES FOR DUAL HOLE TERMINAL LUGS

A. Approved Bond Meters for the BACC13AU and BACC13AW Current Return Network Bond Resistance Tests

Refer to Table 15 for the approved bond resistance meters.

Table 15
APPROVED BOND RESISTANCE METERS

Part Number	Display Resolution (Milliohms)	Serial Number	Supplier
Model M1	0.01 to 19,999	A(XXXXXXX)	BCD Electronics
		B(XXXXXXX)	BCD Electronics

WARNING: BEFORE A METER IS USED IN AN EXPLOSION HAZARD AREA, MAKE SURE THAT FUEL VAPORS ARE NOT PRESENT. INJURY CAN OCCUR.

WARNING: THE TERMINALS OF THE METER MUST NOT BE PUT DIRECTLY ON:

- THE TERMINAL OF AN EXPLOSIVE SQUIB
- A PART OF THE CIRCUIT THAT IS CONNECTED TO AN EXPLOSIVE SQUIB.

INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR.

B. Maximum Resistance of BACC13AU and BACC13AW Current Return Network Bonds

The maximum bond resistance of a BACC13AU and BACC13AW dual hole terminal lug and the structure for a new installation or a repair where the faying surfaces are prepared for a bond again is 0.000025 ohms (0.025 milliohms).

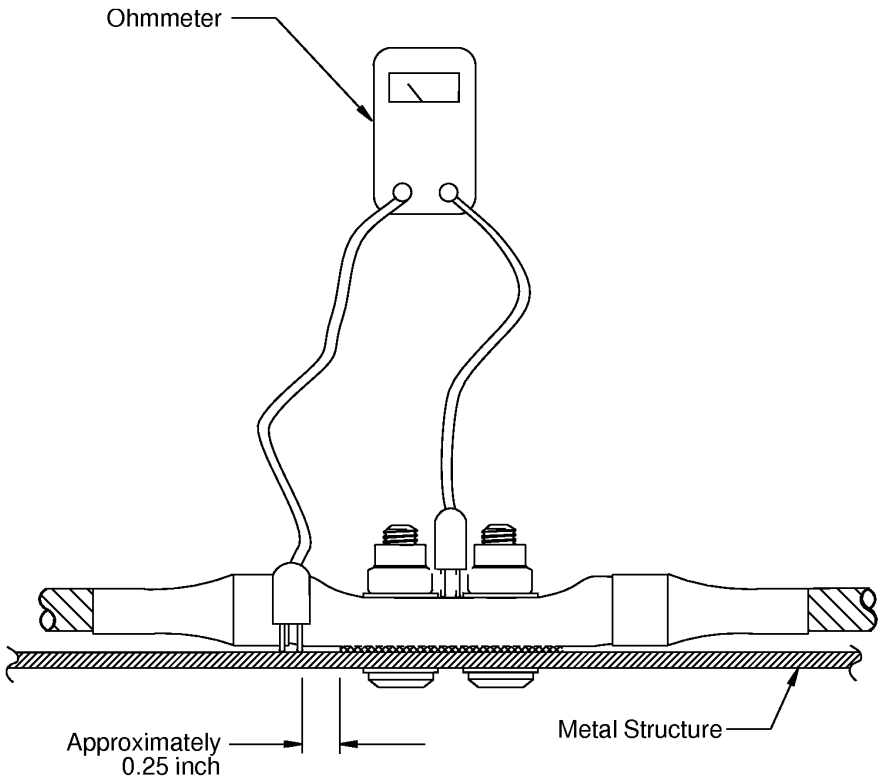
NOTE: Up to 0.00003 ohms (0.030 milliohms) is acceptable when using M1 Bond Meter that has a Serial Number of AXXXXXX.

C. Bond Test of a BACC13AU and BACC13AW Current Return Network Bond

Refer to:

- Paragraph 7.A. for the approved bond meters
- Paragraph 7.B. for the maximum permitted resistance of the bond.

The location of the test points for the bond test of a Current Return Network terminal lug is shown in Figure 27



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TEST POINTS FOR A BACC13AU AND BACC13AW CURRENT RETURN NETWORK BOND
Figure 27